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A Quantitative Analysis of the Relationship Between Collective Teacher Efficacy and its Enabling Conditions with Student Achievement in Colorado's Elementary and Middle Schools

Amelia Baldwin
University of Northern Colorado

UNIVERSITY OF NORTHERN COLORADO

Greeley, Colorado

The Graduate School

A QUANTITATIVE ANALYSIS OF THE RELATIONSHIP BETWEEN COLLECTIVE TEACHER EFFICACY AND ITS ENABLING CONDITIONS WITH STUDENT ACHIEVEMENT IN COLORADO'S ELEMENTARY AND MIDDLE SCHOOLS

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Amelia Baldwin

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Department of Leadership, Policy and Development:
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Accepted by the Doctoral Committee

_____
Dr. Amie Cieminski, Ed.D., Research Advisor

_____
Dr. Jonathan Cooney, Ed.D., Committee Member

_____
Dr. Randy Larkins, Ph.D., Committee Member

_____
Dr. Jenni Harding Middleton, Ed.D., Faculty Representative

Date of Dissertation Defense _____

Accepted by the Graduate School

_____
Jeri-Anne Lyons, Ph.D.
Dean of the Graduate School
Associate Vice President for Research

ABSTRACT

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This quantitative, correlational study aimed to investigate the relationships between collective teacher efficacy (CTE), its enabling conditions (EC-CTE), and student achievement in third through eighth grades in Colorado. Leveraging the theoretical foundations established by Rotter (1954), Bandura (1977) and expanded by Tschannen-Moran et al. (1998) and Adams and Forsyth (2006), a newly formed construct of CTE was created by using questions from the Teaching and Learning Conditions Colorado (TLCC) Survey. The following research questions guided the study:

Q1 Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by selected TLCC Survey questions, and student achievement scores?

Q1a Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the SES of the school?

Q2 Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy, as measured by selected TLCC Survey questions, and student achievement scores?

The research design utilized structured equation modeling to examine the association between a school-wide CTE construct and student achievement scores, as represented by the school's English language arts and mathematics scores on the Colorado Measures of Academic Success (CMAS) assessment. Additionally, this study addressed a gap in the existing literature by focusing on the enabling conditions that facilitate CTE and examining their correlation with

student achievement. Finally, this study explored whether CTE and EC-CTE independently contributed to student achievement after controlling for socioeconomic status (SES).

This secondary analysis used data from public schools in Colorado that completed the TLCC Survey and CMAS in 2022. Data were used from 353 schools in Colorado that met the threshold for publicly reportable TLCC survey data and CMAS assessment data. TLCC Survey questions were used to create a CTE construct and an EC-CTE construct that were then both used for future calculations. The results showed that CTE had a significant positive relationship with student achievement in both mathematics and English language arts (ELA), meaning that schools with higher levels of CTE tended to have students who performed better academically. In contrast, EC-CTE did not exhibit a direct significant effect on student achievement. Additionally, the study highlighted the persistent influence of SES on student achievement. SES showed a significant negative relationship with both math and ELA scores. This study aimed to provide insights that could guide school leaders and policymakers in school improvement approaches and strategies. Precise wording and comprehensive question inclusion were concluded as a necessity when measuring CTE and EC-CTE.

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CHAPTER I

INTRODUCTION

Collective teacher efficacy (CTE) has emerged as a foundational concept with notable influence on student achievement (see Bandura, 2000; Donohoo, 2018; Goddard, 2001; Pewee-Childs, 2023; Tschannen-Moran & Barr, 2004). Collective teacher efficacy refers to the collective belief of educators within a school and the belief that, through their combined efforts, they can positively influence student outcomes (Bandura, 1977). This belief is central to influencing student success and fostering a supportive and collaborative teaching environment.

The influence of CTE extends beyond individual teacher interactions; it encompasses the entire school culture (Goddard et al., 2004; Tschannen-Moran et al., 1998) and is heavily influenced by leadership practices (Akan, 2013; Armstrong-Coppins, 2003; Cansoy, 2020; Donohoo, 2018; Leithwood & Jantzi, 2008). Effective principals play an important role in shaping the school's collective belief by promoting collaboration, facilitating professional development, and ensuring a supportive environment that empowers teachers (Akan, 2013; Armstrong-Coppins, 2003; Donohoo, 2018). The cyclical interaction between leadership and teachers emphasizes the importance of understanding how principals can effectively foster CTE in support of teachers with the ultimate goal of enhancing student learning outcomes.

In today's evolving educational landscape, principals are pivotal in shaping teaching and learning environments. A principal's role extends beyond mere school management but also involves maintaining a positive environment that supports academic success and personal growth

(Grissom et al., 2021). As educational leaders, principals are responsible for ensuring the smooth operation of the school and are instrumental in delivering exceptional educational experiences. Their comprehensive approach significantly impacts school aspects such as teacher satisfaction (Baptiste, 2019), motivation (Sirait et al., 2022), and student achievement (Bluestein & Goldschmidt, 2021; Grissom et al., 2021). In a time of ongoing educational changes and increasing challenges, understanding the complex link between effective principal leadership and these key school factors is essential.

Since 2000, there have been monumental changes in federal education policy in the United States, which have impacted the duties of school principals (Grissom et al., 2021; Mulford, 2003). Significant policies include the No Child Left Behind Act (NCLB) of 2001 and the Every Student Succeeds Act (ESSA) of 2015. The NCLB era brought in standardized testing from third grade through high school. This addition of standardized testing changed how data were collected and disaggregated, thus increasing accountability pressure. With the introduction of ESSA, there was a move towards encouraging innovation and reforms at the state and local levels while maintaining a strong focus on accountability in education (Grissom et al., 2021). These policy changes have led to a shift in what was expected of school leaders, resulting in more job-related stress and a higher rate of principals leaving their positions (Mitani, 2018). The changes in federal policies have also influenced policy developments at the state and local levels, further affecting the environment in which principals work (Grissom et al., 2021).

With a newfound focus on the accountability of student achievement, researchers and practitioners have needed more knowledge relating to factors that impact student achievement. John Hattie (2008) synthesized over 800 meta-analyses related to achievement. In 2023, he revisited his seminal study, expanding the research base for the project significantly. The study

included over 2,100 meta-analyses from over 130,000 studies involving more than 400 million students worldwide (Hattie, 2023). Hattie developed a distinctive method for synthesizing influences from these studies in a manner that ranked factors that affected learning outcomes based on their effect size. Effect size is "a way of reporting the strength of a relationship between two or more variables" (Kneer, 2017 para. 1), where a 0.4 effect size signifies a year's growth per year of schooling (Corwin Visible Learning Plus, 2019).

In his updated findings, Hattie (2023) highlighted CTE as having the most significant effect size on student achievement, with a level of 1.36. By definition, this suggested that CTE could produce over three years of academic growth per year of schooling. Hattie categorized CTE under the heading of *Leadership* rather than other potential categories such as *Teacher* or *Other School Factors*. This classification emphasized and recognized the crucial role of leadership in cultivating CTE within schools.

Bandura's (2000) earlier perspectives provided depth to the understanding of CTE with recognition of the shift from individual efficacy to collective efficacy. Bandura (2000) explained, "The growing interdependence of human functioning is placing a premium on the exercise of collective agency through shared beliefs in the power to produce effects by collective action" (p. 75). His statement suggested the idea of how when, together, people believe that they can make a difference through their joint efforts, they are more likely to engage in actions that can bring about significant changes or effects. He further detailed that collective efficacy was not "simply the sum of the efficacy beliefs of individual members. Rather, it is an emergent group-level property" (p. 76). These insights from Bandura recognized the multifaceted nature of collective efficacy and highlighted the need for ongoing research into its powerful impact on educational outcomes.

Collective Teacher Efficacy

Collective teacher efficacy has gained notability in educational research due to its strong correlation with student achievement (Hattie, 2023). Defined as the collective belief of a group of educators in their ability to positively influence student outcomes (Bandura, 1977), CTE extends beyond individual teacher self-efficacy to encompass a shared sense of purpose and capability. The concept of CTE is rooted in Bandura's (1977) social cognitive theory and Rotter's (1966) locus of control theory, which, together, emphasize the role of collective beliefs in shaping group behavior and outcomes.

Decades of research on CTE began with Bandura's (1977) pioneering work in self-efficacy. In his seminal study on self and collective efficacy, Bandura (1993) investigated the academic environment, exploring students' beliefs in their academic abilities, teachers' belief in their ability to impact learning, and the collective beliefs of groups of educators in their instructional efficacy. Bandura's (1993) research demonstrated that when a group of teachers collectively believed in their ability to teach effectively, it positively contributed to the overall academic success of the institution. Conversely, when staff members collectively felt powerless, Bandura (1993) found that it led to a sense of academic futility within the school. He emphasized that "teachers operate collectively within an interactive social system rather than as isolates" (Bandura, 1993, p. 141), highlighting teachers' interconnectedness with fellow teachers.

Furthermore, Bandura (1993) found that the positive influence of CTE on students' academic performance outweighed the adverse effects of low socioeconomic status (SES). He noted that adverse student characteristics affected academic achievement "more strongly by altering faculties' beliefs about their collective efficacy to motivate and educate their students than through direct effects on school achievement" (Bandura, 1993, p. 143). Bandura's

pioneering work of the complex integration between collective efficacy and student achievement laid the groundwork for subsequent researchers (see Adams & Forsyth, 2006; Donohoo et al., 2020; Goddard et al., 2000, 2004; Hoy et al., 2002; Tschannen-Moran & Barr, 2004; Tschannen-Moran et al., 1998) to build upon by developing CTE measurement tools.

In developing their measurement tools, Tschannen-Moran et al. (1998) and Goddard et al. (2004) examined teacher self-efficacy and its connection to collective efficacy. Although connected, teacher self-efficacy and CTE were determined to be two different domains. Focusing on how these two domains were linked, Tschannen-Moran et al. (1998) discovered that schools with teachers who worked together to address educational challenges often experienced increased collective efficacy. In contrast, schools that concentrated their discussions primarily on the challenges and obstacles faced by individual teachers experienced a decline in collective efficacy. Additionally, research by Tschannen-Moran et al. (1998) and Goddard et al. (2004) demonstrated that strong school leadership, a cohesive culture, and a focus on academic achievement correlated with higher levels of collective efficacy among teachers. Subsequent studies, including those by Adams and Forsyth (2006), Donohoo et al. (2020), and Hoy et al. (2002), along with earlier works by Bandura (1993) and Goddard et al. (2000), have consistently supported these findings, confirming a significant relationship between student achievement and teachers' perceptions of CTE.

Goddard et al. (2000) studied the relationship between CTE and student achievement, controlling for SES, race, and gender. They introduced a model of collective efficacy with two components: task analysis and group competence. The study's results indicated that task analysis and group competence contributed to the development of CTE in schools, revealing that a one-unit increase in CTE was associated with an average gain of 8.62 points in student math

achievement and 8.49 points in reading achievement. Collective teacher efficacy emerged as a significant predictor of student achievement, surpassing the impact of the demographic control variables. Hoy et al. (2002), in a comparison with SES and academic press, also affirmed collective efficacy as the most significant variable affecting school achievement. Goddard et al. (2004) found that the positive strength of collective efficacy enhanced teachers' self-efficacy, while weak collective efficacy undermined it.

Following the seminal works of inquiry on CTE, research further expanded into studies analyzing the connection of CTE with job satisfaction (e.g., Buonomo et al., 2020; Ferlise, 2022; Klassen et al., 2010), leadership approaches (e.g., Bozkurt et al., 2021; Echiverri, 2021; Fathi & Savadi Rostami, 2018; Grissom et al., 2021; Leithwood et al., 2020), areas outside of the education field (e.g., Jung, 2023; Luo & Lin, 2022; Thaker et al., 2019; Yesberg et al., 2023), and antecedents for CTE (e.g., Cansoy, 2020; Donohoo et al., 2020; Ross & Hogaboam-Gray, 2003; Tschannen-Moran & Gareis, 2007).

Enabling Conditions for Collective Teacher Efficacy

Researchers (e.g., Abedini et al., 2018; Adams & Forsyth, 2006; Donohoo, 2017; Donohoo et al., 2020; Ross et al., 2004) have been seeking answers about malleable contextual factors that foster an environment that can produce CTE, focusing primarily on the contextual environment of the schools, centering around the idea of the locus of control theory. Elements that create a climate conducive to CTE are the antecedents of CTE, known as the enabling conditions of collective teacher efficacy. Donohoo et al. (2020) stated:

> To properly support school leaders in nurturing CTE then, knowledge of the status of the enabling conditions for CTE within their schools is necessary to identify areas of strength and opportunities for improvement. Armed with such knowledge, school leaders and

administrators can then begin the journey of cultivating CTE within their schools. (p. 158)

Through Donohoo et al.'s (2020) literature review, the researchers found only 14 studies that examined the antecedents of collective teacher efficacy. These studies highlighted the specific, malleable contextual areas that were found to have a relationship with CTE. Donohoo et al. (2020) developed the “Enabling Conditions” that included supportive leadership, empowered teachers, goal consensus, embedded reflective practices, and cohesive teacher knowledge. Understanding these conditions is essential for educational leaders who strive to create environments that support the enhancement of collective teacher efficacy.

Research has focused on the relationship between CTE, student achievement, and various environmental factors. However, researchers identified a lacking component. Adams and Forsyth (2006), Klassen et al. (2010, 2011), Ross et al. (2004), and Tschannen-Moran and Barr (2004) stated an additional need for consistent measurement tools for CTE and that there existed an inadequate initial assessment of the conditions that enable CTE. Furthermore, these researchers noted that previous studies offered limited guidance on how school leaders could effectively foster high levels of collective teacher efficacy.

Principal Influence

Addressing these gaps in research and practice, it becomes necessary to examine the specific role that school leaders play in enhancing CTE and influencing student outcomes. Research has shown that principals have emerged as pivotal in fostering environments conducive to student achievement, showcasing principals' profound impact on the various components of school success, from instructional quality to the collective efficacy of the teaching staff (Leithwood et al., 2004). Leithwood et al. (2004) discovered that leadership was the second most

significant contributor to student learning. Expanding on this, Grissom et al. (2021) quantified the impact of leadership quality by suggesting that replacing a below-average principal with an above-average one could enhance a typical student's learning by nearly three months annually in math and reading. This influence extended beyond academic outcomes to also include teacher satisfaction, working conditions, and teacher retention, which was influenced by principals engaging in instructional-oriented interactions, fostering a productive school climate, encouraging collaboration, and managing resources strategically (Grissom et al., 2021). Furthermore, researchers such as S.M. Johnson et al. (2012) and Guin (2004) emphasized the principal's role in shaping teacher work conditions and school culture, which were both determined as foundational to reducing teacher turnover and enhancing school performance.

The influence of principals on CTE is particularly noteworthy. Armstrong-Coppins (2003) and Leithwood and Jantzi (2008) have found that principal leadership practices support and actively shape organizational conditions conducive to fostering collective teacher efficacy. These organizational conditions include the aspect of principals inspiring group purpose, providing support, modeling behaviors, and nurturing positive school cultures. This link between leadership style and CTE was further supported by studies from researchers like Akan (2013) and Çalik et al. (2012), who observed that principals' leadership styles directly enhanced collective teacher efficacy. Nordick et al. (2019) pointed out that principals could develop CTE by providing teachers with supportive relationships, opportunities for collaboration, and avenues to advance their expertise. Goddard et al. (2015) found a significant influence on the throughline of principals to teachers and student achievement. Based on their results, Goddard et al. (2015) concluded, "The manner in which leaders and teachers work together to improve instruction and collective efficacy beliefs deserves more attention" (p. 526).

Problem Statement

Donohoo (2018) stated, “Policy makers, system and school leaders, and staff developers’ efforts toward successful education reforms might be better served by strategically and intentionally considering how to foster collective efficacy throughout the conceptualization, design, delivery, and assessment of change initiatives” (p. 340). Despite the recognized importance of CTE, there is little research on the specific enabling conditions that contribute to the development of CTE and the enabling conditions’ correlation with student achievement (Donohoo, 2018). Additionally, the education field lacks standardized measures for CTE or enabling conditions. This gap in the literature hinders the ability of educational leaders to implement targeted strategies for fostering CTE and improving academic outcomes.

Additional knowledge of how CTE is formed and its relationship with student achievement in Colorado would contribute to the current literature, thus providing educational leaders and policymakers with more information supporting decision-making strategies, implementation approaches, and change efforts. This proposed study intended to add to this knowledge by exploring the relationship between CTE and its enabling conditions with student achievement in Colorado elementary and middle schools.

Rationale

Despite its widespread recognition, CTE still needs to be explored in its practical application and implementation. Much of the current understanding of CTE has been shaped by theoretical research, which has the potential to limit its direct applicability in everyday educational settings (Klassen et al., 2011). Researchers have stated that there has been limited guidance on how school leaders could effectively foster high levels of CTE (Adams & Forsyth, 2006; Donohoo, 2017), a need for consistent measurement tools for CTE (Donohoo, 2018;

Goddard et al., 2000; Tschannen-Moran & Barr, 2004), and a desire for answers about malleable factors that foster an environment that can produce CTE (Abedini et al., 2018; Adams & Forsyth, 2006; Donohoo et al., 2020). This gap highlights the need to consider the steps schools and leaders could take to thoughtfully measure and strategically determine factors to focus on for improving CTE and, ultimately, student outcomes.

The significance of this study lies in its potential to inform educational practices and policies. Rooted in social learning theory informed by Rotter (1954) and Bandura (1977) and built upon by Tschannen-Moran et al. (1998) and Adams and Forsyth (2006), CTE has a solid theoretical basis. Donohoo (2017, 2018) initially examined the practical applications of collective teacher efficacy. Later, Donohoo et al. (2020) expanded upon this research by investigating effective practices and the key factors leaders could target to enhance CTE in schools, ultimately aiming to increase student academic success.

In Colorado, student academic success is measured using the Colorado Measures of Academic Success (CMAS) assessment. This assessment is given annually to students in third through eighth grade and assesses academic growth and achievement. According to the Colorado Department of Education (2022a), between 2015 and 2019 the state showed an average yearly increase of about one percentage point. In 2019, a sharp decrease of three and a half percent occurred, translating to a total average of 63% of students who did not meet expectations. The results continued to trend downward into 2022 (Colorado Department of Education, 2022a). The CMAS results have historically remained relatively stable, except for a decline in the past five years. Amidst these concerning student performance trends, it is essential to consider how to significantly influence learning outcomes.

This study desires to bridge that gap by integrating the theory of CTE with its contextual malleable factors within a school and investigating their correlation with student achievement. The hope of this study is that it will contribute to school leaders' strategic planning by prompting the consideration of consistent CTE measurement with the acknowledgment of its influence on student achievement. Practically, the shift in focus would have the potential to provide educational leaders with evidence-based insights for creating environments that nurture collective efficacy and enhance student learning. Due to its high correlation and effect size on student achievement, CTE is positioned as a nucleus for forming structures for student achievement. Based on theory, the practical assessment of conditions that enable CTE would provide practitioners with actionable guidance for developing conditions that support enhancing CTE, thus positively influencing student academic success.

Purpose of the Study

This quantitative, correlational study aimed to investigate the relationships between collective teacher efficacy (CTE), its enabling conditions (EC-CTE), and student achievement in third through eighth grades in Colorado. Specifically, the research was directed at identifying the contexts that best supported CTE and EC-CTE, and subsequently examining their relationship with student achievement.

Feasibility of the Study

Relevant data, established methodologies for assessing CTE and student achievement, and public access to the applicable data supported the feasibility of this study. The Teaching and Learning Conditions Colorado (TLCC) Survey data and Colorado Measures of Academic Success (CMAS) assessment data from 2022 were evaluated. The data necessary for analysis was available publicly from the Colorado Department of Education. The quantitative approach

allowed for a systematic investigation of the relationship between CTE and student achievement as well as its enabling conditions and student achievement, making this study both viable and valuable.

Research Questions

The following questions guided this study:

Q1 Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by selected TLCC Survey questions, and student achievement scores?

Q2 Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy, as measured by selected TLCC Survey questions, and student achievement scores?

Research has shown that CTE outweighs the effects of SES status on student achievement (Bandura, 1993; Goddard et al., 2000; Hoy et al., 2002). This interconnected element was considered in this study. Therefore, the addition of a sub-question for Research Question 1 is also included:

Q1a Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the SES of the school?

Hypotheses

Researchers may make a "prediction about the expected outcome, basing this prediction on prior literature and studies on the topic that suggest a potential outcome" (Creswell, 2014, pp. 144–145). Based on prior literature relating to CTE and its relationship with student achievement, the following directional hypotheses were tested in this study:

H1 A positive relationship exists between the collective teacher efficacy scores from the TLCC Survey and CMAS student achievement scores, suggesting that higher collective teacher efficacy is associated with higher student achievement.

H1a Collective teacher efficacy independently contributes to explaining the variance in student achievement scores, even when controlling for the socioeconomic status

(SES) of students, demonstrating that the influence of collective teacher efficacy on student achievement is significant beyond the effects of SES.

H2 A positive relationship exists between the scores of enabling conditions of collective teacher efficacy from the TLCC Survey and CMAS student achievement scores, indicating that better enabling conditions are associated with higher student achievement.

Based on the literature, it was predicted that there would be a positive relationship between CTE and the EC-CTE and student achievement. Additionally, CTE and the EC-CTE were expected to contribute to student achievement independently of SES.

Definition of Terms

This study used the following definitions of terms:

Collective Teacher Efficacy (CTE). The shared belief or collective self-perception that teachers in a specific school can collaboratively execute actions necessary to positively impact their students' education beyond the influence of their homes and communities (Bandura, 1997; Tschannen-Moran & Barr, 2004).

Enabling Conditions of Collective Teacher Efficacy (EC-CTE). Factors or conditions within a school environment that facilitates the development of CTE, as defined as supportive leadership, empowered teachers, goal consensus, embedded reflective practices, and cohesive teacher knowledge (Donohoo et al., 2020).

Student Achievement. This achievement indicator "reflects the extent to which students have met the learning objectives described in the relevant academic content standards for a given content area and grade level" (Colorado Department of Education, 2023a, para. 1).

Acronyms

This study used the following acronyms:

CTE. Collective teacher efficacy

EC-CTE. Enabling conditions of collective teacher efficacy

TLCC Survey. Teaching and Learning Conditions Colorado Survey

CMAS Assessment. Colorado Measures of Academic Success Assessment

CTE-Scale. Collective Teacher Efficacy Scale, developed by Goddard et al. (2000)

CE-Short form. Collective Efficacy Scale Short Form, developed by Goddard (2002)

CTBS. Collective Teacher Beliefs Scale, developed by Tschannen-Moran and Barr (2004)

EC-CTES. Enabling Conditions of Collective Teacher Efficacy Scale, developed by Donohoo et al. (2020)

Researcher Background

As a doctoral student specializing in educational leadership, the desire to uncover strategies that school and district leaders could utilize to promote effective teaching and learning drove my research. Over the past six years, my leadership roles have included overseeing a complete transformation of a high school and leading a high-achieving elementary school through COVID-19 challenges and a district reconfiguration plan. This reconfiguration involved relocating the school building and transforming the school into a kindergarten through eighth-grade institution. My guiding framework for change in both contexts was grounded in collective teacher efficacy. Through the use of CTE surveys as influenced by Bandura (1993), our staff strategically targeted our lowest-ranking areas and focused our efforts on increasing our capacity in those areas.

These extensive experiences in educational settings shaped my positionality, where I have witnessed the transformative power of CTE in driving school success. These transformations included one school's state recognition for its innovative approach, leading to hosting the first-ever state conference for alternative education outside the state capital. Another

school was recognized multiple years in a row for high achievement and became the first middle school in the district ever to receive such acknowledgment. Both schools were subsequently awarded significant financial awards from the state for their growth and achievement.

These experiences have reinforced my belief in the power of collaboration and synergistic actions and mindsets among educators to achieve common goals. Collective teacher efficacy, teacher efficacy, and self-efficacy are theories of interest to me because of my experience witnessing these components and a school leader's influence on the malleability, facilitation, and group growth in these areas. This perspective shaped my approach to investigating the dynamics of CTE and its relationship with student achievement.

The significance of principal leadership in relation to student achievement and CTE is profound. Effective principals do not merely lead schools; they transform them. They create environments where teachers are empowered to excel, which, in turn, significantly impacts student outcomes. The throughline from principal to teacher to student is clear, with each role interconnected in a dynamic of support, growth, and achievement that ultimately leads to the success of entire school communities.

Conclusion

The pressures and expectations on principals have intensified, requiring a deeper understanding of how leadership practices can strategically foster CTE (Donohoo, 2018). This chapter highlighted the profound influence that collective beliefs and leadership have on educational outcomes. This dissertation further explores these dynamics by analyzing the enabling conditions that enhance collective teacher efficacy, CTE itself, and student achievement.

The potential implications for policymaking, leadership development, and educational practice ground the importance of this study. This research aspired to contribute to educational leadership by integrating theoretical insights with practical applications. Ultimately, the goal is to empower school leaders with the knowledge and tools necessary to create optimal learning environments that meet educational standards and foster every student's growth and success.

Organization of Dissertation

This dissertation is structured to comprehensively explore the concept of CTE, EC-CTE, and their relationship with student achievement. The first chapter introduces the study's topic, provides the background, and outlines the research problem, the study’s significance, and the research questions. The second chapter thoroughly reviews the literature on CTE, its theoretical formation, and the enabling conditions that foster its development. The third chapter describes the research design, data collection methods, and analytical procedures employed to explore the research questions. The fourth chapter details the study's results, and the fifth chapter discusses the findings and considerations for future research.

CHAPTER II

REVIEW OF THE LITERATURE

Over the past two decades, collective teacher efficacy (CTE) has emerged as a pivotal area of interest within educational research, attributed to its significant influence on student achievement and academic outcomes. This relationship has been consistently validated across diverse settings and through various research methodologies (e.g., Bandura, 1993; Eells, 2011; Goddard, 2001, 2002; Goddard et al., 2004; Hattie, 2023; Kurz & Knight, 2004; Tschannen-Moran & Barr, 2004). Bandura's (1997) foundational definition described collective efficacy as "the shared belief that actions by a group will influence the future they seek" (p.1). Defining CTE is essential to understanding its significance. Collective teacher efficacy is not merely the sum of individual teacher self-efficacy; instead, it encompasses the collective belief of a group of educators in their ability to influence student success (Bandura, 2000).

Shaped by teacher efficacy and contextual factors, CTE significantly impacts student achievement (Adams & Forsyth, 2006; Bandura, 2000; Tschannen-Moran & Barr, 2004; Tschannen-Moran et al., 1998). Although known for its effect, there still exists a gap in the literature, particularly concerning U.S.-based studies, that examine CTE within the framework of principal decision-making and strategic educational planning (Donohoo, 2018; Echiverri, 2021). Previous research has laid a conceptual foundation; however, the research lacks in providing principals with concrete, actionable strategies for implementation.

This literature review lays the groundwork for understanding CTE by highlighting current knowledge gaps and justifying further research into the conditions that enable it. The following sections explore the concept of CTE, beginning with CTE's theoretical roots in social cognitive theory and locus of control theory. Then, the delineation of self-efficacy and teacher efficacy is established, forming the foundational growth to the differentiation of CTE as its own distinct construct, including its formation, measurement, and theoretical implications. The review concludes by exploring Donohoo et al.'s (2020) theoretical framework for the enabling conditions that stimulate collective teacher efficacy.

Social Learning Theory

Understanding the sources of CTE is central to exploring its implications. The sources of CTE originated from Social Learning Theory, which was first introduced by Rotter (1954) and later expanded by Bandura (1977). Social Learning Theory postulates that people learn behaviors by watching others and interacting with their surroundings. Rotter's (1954) theory focused on the idea of locus of control, which suggested that an individual's belief about the extent to which they can control events in their life influenced their behavior. Bandura (1977) further developed this theory by considering the role of cognitive processing in learning, emphasizing that actions were influenced not only by external behaviors but also by internal thought processing.

Social Cognitive Theory

CTE is grounded in social cognitive theory. According to Bandura (1977, 2001), social cognitive theory is a framework for comprehending how people learn and develop their behavior through observational learning. Bandura (1977) theorized that learning is not solely a product of direct personal experience but is significantly influenced by observing others' behaviors, the consequences they encounter, and an individual's capacity to self-regulate. The theory highlights

the interaction between individual agency and collective agency. Bandura (2001) believed that collective agency was becoming more important in controlling individual destinies and one's life.

Locus of Control

The locus of control theory is related to the belief of whether actions can affect outcomes, whereas self-efficacy is the belief that one can produce those actions (Rotter, 1966). Integrating the locus of control theory into CTE meant that Bandura's inclusion of efficacy sources was merged with school contextual conditions that affected the teaching task and assessment of teaching competence (Adams & Forsyth, 2006). Adams and Forsyth (2006) stated:

> Efficacy perceptions are confined to judgments of future actions and not the potential outcomes of such actions. While the difference…might seem subtle or trivial, it is indeed a fundamental difference between social cognitive theory and locus of control theory and one that ultimately shapes our understanding of efficacy. (p. 627)

Efficacy beliefs are about how capable people feel about future actions and do not involve the actual outcomes. This distinction between believing in one's abilities and predicting outcomes is a fundamental difference between social cognitive theory and locus of control theory.

Efficacy and Outcome Expectations

Efficacy and outcome expectations are concepts central to the theories that inform studies on teacher efficacy, aligning with the idea that expectations influence behavior. Rotter (1966) highlighted the importance of locus of control, suggesting that behavior is driven by expectations and the perceived ability to influence the outcomes. Bandura's (1977) social learning theory presented behavior as a complex interaction between cognition and the processing of sources from past experiences, which helped determine future success.

Rotter (1966) and Bandura (1977) Theory Examples

While Rotter's and Bandura's theories developed along different lines, they were not entirely incompatible. According to Rotter (1966), outcome expectations are influenced by an individual's locus of control. In contrast, Bandura (1977) believed that outcome expectations were just one aspect of a broader cognitive process influenced by self-efficacy beliefs. Believing in one's ability to plan and execute actions (self-efficacy) differs from believing that those actions will affect outcomes (outcome expectations). While the perception of control can influence self-efficacy beliefs, it does not determine those beliefs (Bandura, 1977).

Rotter (1966) Example

Imagine a teacher named Mr. Smith who believed that the success of his students was primarily within his control (outcome expectations/locus of control). He expected that he could significantly improve their performance by using innovative teaching methods and providing extra support to struggling students. This belief caused him to actively engage in professional development, experiment with new instructional strategies, and closely monitor his students' progress. Mr. Smith's choices, behavior, and teaching approach were shaped by his expectation that he would have the ability to influence the outcomes of his students' learning.

Bandura (1977) Example

Consider a teacher named Mrs. Johnson, who had past experiences of successfully implementing project-based learning in her math classroom. These past experiences then contributed to her strong belief in her ability to execute this teaching method effectively (social cognitive theory/self-efficacy). As she planned for a new school year, her behavior was influenced by this cognitive process. She confidently integrated project-based learning into her curriculum, predicting that it would lead to future success based on her past achievements. Mrs.

Johnson's approach to teaching resulted from the complex interaction between her cognition and the processing of her previous successful experiences.

Self-Efficacy

The capability to understand CTE begins with self-efficacy, as introduced by Bandura (1977, 1993, 1997), and is a central component of his social cognitive theory. Self-efficacy refers to an individual's belief in their ability to execute behaviors necessary to produce specific actions. It is a foundational component of Bandura's social cognitive theory, emphasizing the role of cognitive, behavioral, and environmental influences in human functioning. Bandura (1977) stated:

> Not only can perceived self-efficacy have directive influence on choice of activities and settings, but, through expectations of eventual success, it can affect coping efforts once they are initiated. Efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences. (p. 194)

This idea of personal efficacy plays a key role in shaping one’s actions, motivations, and resilience in the face of challenges. Four primary sources of past experiences formed the construction of self-efficacy: mastery experiences, vicarious experiences, social persuasion, and affective states (Bandura, 1977, 1993, 1997). Next, these sources are briefly defined in relation to self-efficacy and later examined in more detail concerning collective teacher efficacy.

Four Sources of Self-Efficacy

Defined as the most influential source of self-efficacy (Bandura, 1997; Bandura & Cervone, 1986; Goddard, 2001; Goddard et al., 2004), mastery experience refers to personal experiences of success or mastery and provides direct evidence of one’s capability (Bandura, 1977). Mastery experience relates to one’s interpretation of one's own experience.

Vicarious experiences involve evaluating one's capabilities based on observing the success of one's peers (Bandura, 1997). Credited as the second most influential source of self-efficacy, Bandura (1977) explained, "Seeing others perform threatening activities without adverse consequences can generate expectations in observers that they too will improve if they intensify and persist in their efforts" (p. 197). An essential element in correctly forming vicarious experiences is that the observed situation must be similar in circumstance and perceived similarity to the observer. If the observed person or situation is notably different, the observer will not be influenced as greatly (Anderson et al., 2023). This source is important when considering how some individuals may have limited personal experience with a task.

Social persuasion involves verbal encouragement and expressed confidence from others (Adams & Forsyth, 2006; Bandura, 1977; Goddard et al., 2004), suggesting that one has the skills needed to succeed. This persuasion is often offered in the form of feedback. With social persuasion, "people are led, through suggestion, into believing they can cope successfully with what has overwhelmed them in the past" (Bandura, 1997, p. 198). For social persuasion to effectively impact self-efficacy, Bandura (1997) noted that the persuasion must be authentic and not simply empty praise. The integration of this practice is an essential component in the forming of self-efficacy.

Affective states refer to the physical and emotional reactions to stress or success (Bandura, 1997; Goddard et al., 2000). Positive moods and emotions can enhance self-efficacy by making individuals feel more confident in their abilities, whereas stress, anxiety, and negative emotional states can undermine self-efficacy (Adams & Forsyth, 2006; Bandura & Cervone, 1986; Goddard et al., 2004). Self-efficacy can decrease if these states are interpreted as debilitating to the individual (Bandura, 1977).

The interaction of mastery experiences, vicarious experiences, social persuasion, and affective states shapes and influences the evolution of one's self-efficacy over time. These four sources of self-efficacy motivate an individual's behavior and performance. Self-efficacy is not the same in all situations. Depending on the context, task, circumstance, and overall competence, an individual's cognitive process can vary, thus impacting self-efficacy and enacting its variability (Bandura, 1977, 1997). Given the importance of these four sources in shaping self-efficacy, it is essential to explore how they influence teacher efficacy in educational settings.

Assessing Teacher Efficacy

This study examined self-efficacy in the educational context, where it is labeled as *teacher efficacy* (Armor et al., 1976; Webb & Ashton, 1986). Teacher efficacy evolved from Rotter's (1966) locus of control theory in linear conjunction with Bandura's (1977) social cognitive theory. Developed by Armor et al. (1976), the RAND organization conducted a survey on teacher efficacy, which included two questions regarding teachers' beliefs about their ability to influence student achievement and motivation. Armor et al. (1976) designed the survey to assess reading programs and their interventions, and it explored whether teachers felt their impact on students came from their abilities or their environment. The teacher efficacy questions on this survey were separated into two questions, under the categories of general teacher efficacy and personal teacher efficacy, respectively:

> RAND Item 1. When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment.
>
> RAND Item 2. If I really try hard, I can get through to even the most difficult or unmotivated students. (Armor et al., 1976, p. 31)

The scores relating to the teachers' level of agreement with these questions were added and called *teacher efficacy*, which was defined as "a construct that purported to reveal the extent to which a teacher believed that the consequences of teaching student motivation and learning were in the hands of the teacher, that is, internally controlled" (Tschannen-Moran et al., 1998, p. 205). Other researchers found that conditions relating to these questions accounted for variance in math and reading achievement scores (Webb & Ashton, 1986), the amount of time teachers dedicated to interactive instruction (Smylie, 1988), and decreased stress (Parkay et al., 1988).

With concern about only a two-item scale, researchers began to develop broader-ranging teacher efficacy scales. Rose and Medway (1981) developed the Teacher Locus of Control (TLC) measure, consisting of 28 items. These researchers found their scale to better predict teacher behaviors than previous surveys (Rose & Medway, 1981). Parkay et al. (1988) divided teacher efficacy into four sections relating to self and group, with positive and negative connotations. These researchers found that teachers who scored highly in all measures had a more internally focused orientation in relation to locus of control.

Going one step further with consideration to the outcome of student achievement, Guskey (1981) developed the 30-item instrument Responsibility for Student Achievement (RSA). This survey assessed teacher's analysis that an event was caused either by their own doing or was outside of the teacher's control. These researchers concluded that the four causes for success or failure were specific teaching abilities, the effort put into teaching, task difficulty, or luck. Guskey (1982, 1988) then later compared these results with the RAND teacher efficacy scores and found a significant positive correlation between teacher efficacy and concluded that efficacy was responsible for student success and failure.

Teacher Efficacy and Self-Efficacy

Gibson and Dembo (1984) developed a 30-item measure combining the conceptual ideas of Bandura's (1977) self-efficacy and the RAND (Armor et al., 1976) items relating to teacher efficacy. These researchers viewed the two RAND items as self-efficacy and outcome efficacy. The initial 30-item instrument failed to show instrument questions loading sufficiently in each categorized factor. Due to these results, multiple researchers (e.g., Hoy & Woolfolk, 1993; Soodak & Podell, 1993) completed edited item number iterations of the original instrument.

Ultimately, research supported the predictions that teachers who scored higher on the measurement were more efficacious in their classrooms, therefore positively impacting classroom behaviors (Emmer & Hickman, 1991), innovative teaching (Berman & McLaughlin, 1977; Smylie, 1988), attitudes toward teaching (Parkay et al., 1988), student achievement (Armor et al., 1976; Berman & McLaughlin, 1977; Webb & Ashton, 1986), and teacher efficacy in special education (Coladarci & Breton, 1997; Emmer & Hickman, 1991).

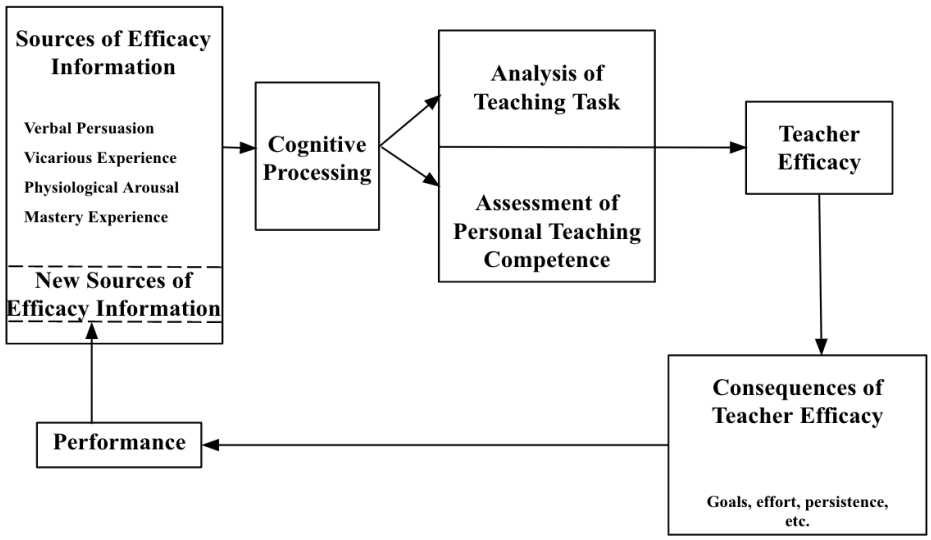
To clarify the teacher efficacy construct and improve its measurement, Tschannen-Moran et al. (1998) explored the theory and ideas that formed the basis of teacher efficacy as a concept and evaluated different instruments used to measure it. Tschannen-Moran et al. (1998) referenced the theoretical work of Rotter (1966) and Bandura (1977). The seminal measurement tools reviewed were Armor et al.'s (1976), Gibson and Dembo's (1984), Hoy and Woolfolk's (1993), and Guskey and Passaro's (1994). In their analysis, Tschannen-Moran et al. (1998) noted correlations between the different instruments.

After synthesizing their research, Tschannen-Moran et al. (1998) proposed a teacher efficacy model (see Figure 2.1). Building upon Bandura's (1977, 1997) identification of the four sources of self-efficacy—mastery experiences, vicarious experiences, verbal (social) persuasion,

and physiological arousal (affective states)—the model displayed Tschannen-Moran et al.'s (1998) theory that teachers' sense of efficacy would vary significantly across different teaching contexts. For example, a teacher may feel highly efficacious teaching mathematics in a rural middle school but feel less confident in an urban high school setting. The researchers argued that this variability could even occur within the same day.

Figure 2.1

The Cyclical Nature of Teacher Efficacy



Note. This figure by Tschannen-Moran et al. (1998) represents the researchers' integrated model of Bandura's (1977, 1997) four sources of self-efficacy with Tschannen-Moran et al.'s included context-specific dimensions.

Tschannen-Moran et al. (1998) explained that when considering their efficacy, teachers must consider both the task and its context, assessing their strengths and weaknesses relative to the circumstance. Their model delineated two key dimensions influencing these judgments: the Analysis of Teaching Task and the Assessment of Personal Teaching Competence. The researchers explained that, in their model, "the judgment a teacher makes about his or her

capabilities and deficits is self-perception of teaching competence, while the judgment concerning the resources and constraints in a particular teaching context is the analysis of the teaching task" (Tschannen-Moran et al., 1998, p. 231). They further detailed that the teaching task and its context were the factors that "make teaching difficult or act as constraints [then] weighed against an assessment of the resources available that facilitate learning" (p. 228). Teaching competence was related to the personal judgment of capabilities such as "skills, knowledge, strategies, or personality traits balanced against personal weaknesses or liabilities in [the] particular teaching context" (Tschannen-Moran et al., 1998, p. 228). The elements of teaching task and teaching competence are detailed in the following sections.

A teacher's formation is based on their foundational components. Before a teacher analyzes the teaching task or assesses their teaching competence, cognitive processing determines the evaluation and prioritization of Bandura's four sources of self-efficacy (Tschannen-Moran et al., 1998). Bandura's (1997) four sources of self-efficacy are attributed as contributors to the analysis of teaching task and assessment of personal teaching competence (Tschannen-Moran et al., 1998). The researchers found that the "differential impact of each of these sources depends on cognitive processing–what is attended to, what is remembered, and how the teacher thinks about each of the experiences" (Tschannen-Moran et al., 1998, p. 229). This evaluation and assessment process impacts the development of teacher efficacy by integrating the analysis of teaching responsibilities (teaching task and teaching competence) with an understanding of one's abilities (self-efficacy sources).

All four dimensions of Bandura's (1977) sources impact the assessment of personal teaching competence. However, Tschannen-Moran et al. (1998) argued that mastery experiences

and affective states were the primary influencers of teaching competence. The researchers explained:

> Only in a situation of actual teaching can an individual assess the capabilities she or he brings to the task and experience the consequence of those capabilities. In situations of actual teaching, teachers gain information about how their strengths and weaknesses play out in managing, instructing, and evaluating a group of students…The level of emotional and physiological arousal a person experiences in a teaching situation adds to self-perceptions of teaching competence. (Tschannen-Moran et al., 1998, p. 229)

Concerning vicarious experiences, Tschannen-Moran et al. (1998) outlined how watching others teach, reading professional literature, and teachers' lounge conversation can help or hinder the observer's teaching competence, depending on the positive or negative circumstance of the observation. Similar to the resource of professional literature, professional development workshops support teacher education about the teaching task. Tschannen-Moran et al. (1998) noted that social persuasion could enhance performance by motivating individuals to adopt new approaches or exert greater effort to achieve success. However, Gist and Mitchell (1992) found that encouraging someone to work harder may worsen their self-efficacy if they lack the necessary skills for a specific task. These findings indicate that while positive encouragement can be beneficial, it needs to be paired with developing relevant skills and providing feedback that supports the necessary demands of the teaching task to be truly effective. Additionally, "social persuasion may lower self-perceptions of personal teaching competence if the feedback is overly harsh and global rather than focused and constructive" (Tschannen-Moran et al., 1998, p. 230).

Tschannen-Moran et al. (1998) defined teacher efficacy as "the teacher's belief in his or her capability to organize and execute courses of action required to successfully accomplish a specific teaching task in a particular context" (p. 233). Tschannen-Moran et al. (1998) highlighted that researchers continued to find "two separate dimensions or factors" (p. 223) of teacher efficacy. There was general agreement about personal teacher efficacy; however, confusion and disagreement existed about the meaning of the second factor, general teaching efficacy. Guskey and Passaro (1994), Emmer and Hickman (1991), and Woolfolk and Hoy (1990) aligned in that general teacher efficacy could be more specifically defined as external influences.

Contextual Influences of Efficacy

Bandura and Cervone (1986) identified that social experiences evoke information, which is then transferred to efficacy beliefs. In the context of schools, these sources are typically measured as how well the school and students perform compared to norms (Adams & Forsyth, 2006). While not discounting Bandura's efficacy sources, Adams and Forsyth (2006) argued that these sources related solely to past experiences and that contextual variables relating to teaching conditions also needed to be considered sources of collective efficacy.

Therefore, Adams and Forsyth (2006) classified the past experiences relating to the social cognitive theory and self-efficacy as *remote.* The contextual conditions (i.e., task, context, and competence) relating to the locus of control theory of the "here and now" (Adams & Forsyth, 2006, p. 630) of teaching were classified as *proximate.* The researchers found that these two constructs, *remote* (self-efficacy) and *proximate* (contextual variables), were independent. The authors suggested future research of practices that worked to incite perceptions of collective efficacy as well as other contextual variables that could impact collective efficacy.

Several past studies found contextual factors, such as past academic performance (Gist & Mitchell, 1992), the academic expectations placed on students (Gibson & Dembo, 1984; Hoy & Woolfolk, 1993), school climate and teaching decision-making (Moore & Esselman, 1992), leadership (Hoy & Woolfolk, 1993), student socioeconomic status (Gibson & Dembo, 1984), student achievement (Armor et al., 1976), school level and school structure (Webb & Ashton, 1986), classroom management strategies (Tschannen-Moran et al., 1998; Webb & Ashton, 1986), and type of class taught (Tschannen-Moran et al., 1998) had significant variability in how teachers perceived their ability to teach. Based on these topics, researchers identified two categories of contextual factors: analysis of teaching task (Adams & Forsyth, 2006; Gist & Mitchell, 1992; Goddard et al., 2004; Tschannen-Moran et al., 1998) and assessment of teaching competence (Adams & Forsyth, 2006; Bandura, 1997; Goddard et al., 2004; Tschannen-Moran et al., 1998). These factors are essential because they shape teachers' beliefs and opinions about their teaching skills.

Analysis of Teaching Task

The analysis of teaching tasks was defined by Tschannen-Moran et al. (1998) as the examination and understanding of the complexities involved in teaching, including student abilities, student motivation, instructional strategies, availability and quality of materials, managerial concerns, access to technology, the physical environment of the classroom/teaching space, the leadership of the principal, the climate of the school, and the supportiveness of other teachers. This component would entail a teacher analyzing and understanding the challenges and requirements of their expected teaching task while considering the difficulty of the teaching task and the necessary factors to be successful given the circumstances. In the teaching task analysis, Gist and Mitchell (1992) found that teachers would likely rely on memories of past teaching

experiences to gauge their capacity with the task at hand. Tschannen-Moran et al. (1998) aligned the analysis of teaching task in similarity with Gibson and Dembo's (1984) general teaching efficacy.

Assessment of Personal Teaching Competence

The assessment of personal teaching competence involves an individual assessment of one's current knowledge, skills, and practices that educators bring to their teaching. Tschannen-Moran et al. (1998) explained that "teacher efficacy will be determined, in part, by the individual's comparative judgment of whether his or her current abilities and strategies are adequate [assessment of personal teaching competence] for the teaching task in question" (p. 231). Educators could gain insights into their strengths and weaknesses through reflective practices, peer evaluations, and professional development assessments. This perception can vary significantly across different teaching contexts, and beliefs about the malleability of one's abilities and strategies fundamentally affect a teacher's efficacy beliefs (Bandura, 1993). For example, a teacher who is aware of their current limitations but confident in their ability to improve those areas would likely maintain a resilient sense of teacher efficacy (Tschannen-Moran et al., 1998). In consideration for future research, Tschannen-Moran et al. (1998) highlighted that teaching is performed in a group context and that teachers work together to collectively impact students' school experiences. In addition to self-efficacy, collective efficacy gained traction and was found to influence student achievement (Bandura, 1977, 1997). From this, Tschannen-Moran et al. (1998) acknowledged the need for further study into collective teacher efficacy.

Collective Teacher Efficacy

The delineation of concepts of self-efficacy and collective efficacy is evident in the social cognitive theory. Bandura (1997) defined the difference between these two concepts: "...self-efficacy is the belief in one's ability to act to produce desired results, and collective efficacy is the shared belief that actions by a group will influence the future they seek" (p. 1). Collective teacher efficacy is not merely the sum of individual teacher self-efficacy; instead, it encompasses the collective belief of a group of educators in their ability to influence student success. Bandura (2000) stated it was not uncommon "for groups with members who are talented individually to perform poorly collectively because the members cannot work well together as a unit. Therefore, perceived collective efficacy is not simply the sum of the efficacy beliefs of individual members" (p. 76). This explanation highlighted the idea that teachers are not isolated individuals working in silos; they are part of a broader collaborative network working towards a common goal. While CTE and teacher self-efficacy share similarities, they differ in their scope. Teacher self-efficacy pertains to an individual teacher's belief in their ability to impact students, whereas CTE emphasizes the shared belief among a group of teachers. Collective teacher efficacy recognizes that when educators collectively believe in their effectiveness, it substantially affects the institution's academic success.

Though collective efficacy is not a summation of all individuals' self-efficacy, self-efficacy can generate behaviors that impact perceptions and experiences. Goddard et al. (2021) found that schools whose teachers experienced principals with a high sense of self-efficacy resulted in increased collective efficacy, mainly that "a one standard deviation increase in principal efficacy beliefs was associated with a .20 standard deviation increase in teachers' collective efficacy beliefs" (Goddard et al., 2021, p. 488). Furthermore, Goddard et al. (2021)

discovered that collective efficacy beliefs had a stronger correlation with student achievement than all student demographic variables, including gender, ethnicity, and free/reduced lunch status, leading the researchers to conclude that “through a complex chain of influence” (Goddard et al., 2021, p. 488), leaders also impact student achievement.

Construction of Collective Teacher Efficacy

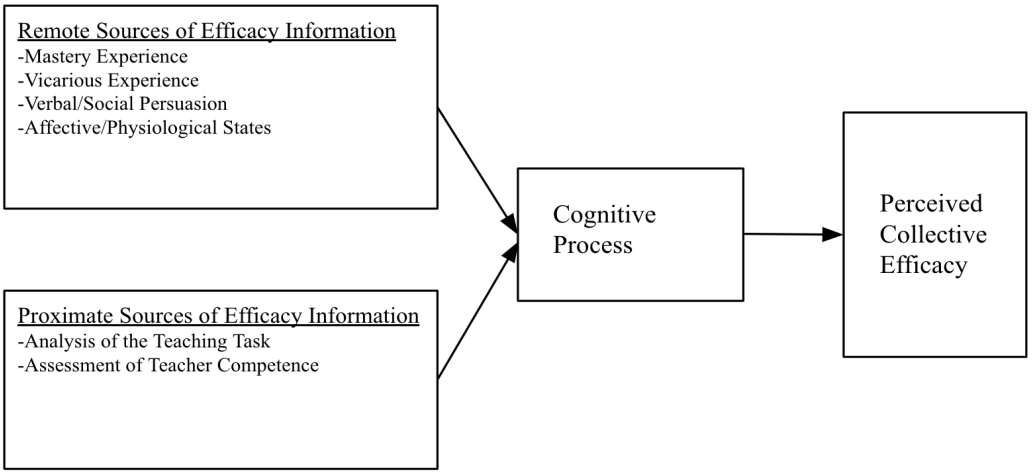
CTE is a concept rooted in social cognitive theory. Social cognitive theory focuses on the importance of observational learning, self-control, and the interaction between individual and collective agency in shaping behavior (Bandura, 1977). It is essential to consider how these theoretical components inform the construction of CTE and its impact on education.

Adams and Forsyth (2006) examined how the contextual variables of socioeconomic status (SES), school level, and enabling school structure impacted teachers' perceptions of CTE. The researchers used the CTE scale developed by Goddard et al. (2000) and collected data from 79 schools from different districts across a Midwestern state. The school levels were 22 elementary schools, 30 middle schools, and 27 high schools. The sample of teachers was from fifth, seventh, or eleventh grade at each school site. In total, 545 teachers returned usable instruments. The state department’s education database was referenced for SES, school level, and academic achievement. After accounting for the effects of prior academic performance, the study employed hierarchical multiple regression analysis at the school level to assess the incremental variance in CTE beliefs that could be attributed to these contextual variables.

Their hypothesis was affirmed that contextual variables significantly contributed to CTE. Notably, enabling school structure (the school's rules, regulations, and procedures) independently accounted for the most significant variability. In response to their findings, these researchers developed a model of perceived CTE (see Figure 2.2).

Figure 2.2

Model of Perceived Collective Teacher Efficacy



Note. Adams and Forsyth's (2006) research findings indicated that contextual factors affected teachers' views of their faculty's collective capability to achieve desired results under environmental limitations. This model proposed that sources of efficacy, both remote and proximate, were integrated into the cognitive process. As a result, Adams and Forsyth (2006) determined that judgments about abilities were partly based on anticipated outcomes.

Adams and Forsyth (2006) categorized the sources of efficacy in relation to the "proximity of occurrence to present teaching realities by which efficacy sources exist" (p. 430). These sources were defined as *remote* and *proximate—remote* experiences linked to social cognitive theory and past experiences, and *proximate* experiences related to the current teaching conditions under the locus of control theory (Adams & Forsyth, 2006). These researchers discovered that these two constructs were independent of each other.

Remote Sources

The four sources of self-efficacy (Bandura, 1977, 1993) form an individual's foundation in CTE, rooted in the social cognitive theory. Social cognitive theory emphasizes self-control

and the ability to self-regulate and make good choices shaped by thoughts, feelings, and the environment. It identifies three modes of agency: personal (acting independently), proxy (relying on others), and collective (working together). Bandura (2001) highlighted the growing importance of collective agency in controlling individual destinies. The four sources of self-efficacy are core components in the construction of collective teacher efficacy.

Mastery Experiences. Bandura's (1977) social cognitive theory suggested that people's confidence in their abilities comes from their personal wins and losses. This idea extends to groups of teachers in schools, where the collective achievements of teachers boost their joint confidence. In testing the relationship between mastery experience and collective efficacy, Goddard (2001) found that "mastery experience explained nearly two-thirds of the variance between schools in collective efficacy" (p. 474) and concluded that mastery experiences were "an important way to build collective efficacy in schools" (p. 474). These findings highlight the significant role that shared successes play in enhancing the collective confidence and efficacy of teaching staff within a school environment.

Research findings highlight the significance of mastery experiences in shaping collective teacher efficacy. Bandura (1977) credited mastery experiences as the most influential source of self-efficacy, a concept echoed by Donohoo et al. (2020) and Loughland and Ryan (2022). In their research relating to CTE, Goddard et al. (2000) stated that collective efficacy "requires experience in overcoming difficulties through persistent effort" (p. 484). Goddard (2001) later emphasized the positive impact of collective efficacy on student achievement, with mastery experiences playing a crucial role in developing this collective belief. Adams and Forsyth (2006), Hoy and Woolfolk (1993), and Tschannen-Moran and Barr (2004) further reinforced the idea that teachers' perceptions of their success in teaching contributed to their sense of self-

efficacy, thus impacting the collective. Altogether, these studies stressed the importance of successful teaching experiences in fostering a strong sense of efficacy among educators as a unit.

Vicarious Experiences. Goddard (2001) found that, along with mastery experience, "additional factors systematically associated with schools may explain variation among schools in collective efficacy. These factors…include the other sources of efficacy-shaping information postulated by social cognitive theory (vicarious experience, social persuasion, and affective states)" (p. 472).

Bandura (1977) established that vicarious experiences were a central source of self-efficacy. Goddard et al. (2000) asserted that teachers' only source of collective efficacy was not just through relying on direct experience. Following, researchers (e.g., Donohoo et al., 2020) determined vicarious experiences as the "second most potent source of collective efficacy" (p. 160). Observing effective teaching practices and hearing and reflecting on the successes and failures of others can influence teachers' beliefs in their capabilities (Adams & Forsyth, 2006; Goddard, 2001; V. E. Lee et al., 1991; Ross & Hogaboam-Gray, 2003). Loughland and Ryan (2022) concluded that vicarious learning was essential for leaders to consider in relation to recognizing effective practices in other schools and encompassing vicarious learning for teachers.

Social Persuasion. Bandura (1977) defined social persuasion as the impact of verbal encouragement and feedback from colleagues and administrators in enhancing teachers' beliefs in their capabilities. These capabilities included areas such as their teaching strategies or their impact on student learning. Although "verbal persuasion alone is not likely to be a powerful change agent" (Goddard et al., 2000, p. 484), researchers have consistently validated its necessary integration into the collective efficacy construct and its influence on student

achievement (Adams & Forsyth, 2006; Goddard, 2002; Goddard et al., 2000). At the collective level, social persuasion "depends on establishing norms of openness, collaboration, and cooperation" (Adams & Forsyth, 2006, p. 631), creating "cohesion" (Donohoo et al., 2020, p. 153; Ross et al., 2004, p. 409) within the school. Verbal and non-verbal feedback from credible, trustworthy sources can influence teachers' beliefs in their collective capabilities.

Affective States. Bandura (1997) explained affective states in its expression that "people rely partly on their state of physiological arousal in judging their anxiety and vulnerability to stress" (p. 198). Therefore, affective states, also referred to as emotional arousal (Goddard et al., 2000), was noted as a key factor affecting self-efficacy, with positive emotions enhancing efficacy beliefs. Goddard et al. (2000) went on further to identify that affective states were not just housed in individuals alone, but rather stated, "Organizations have affective states. Just as individuals react to stress, so do organizations" (p. 484), and this reaction has a lot to do with how "challenges are interpreted by the organization" (p. 484). Adams and Forsyth (2006) emphasized the link between teachers' emotional well-being and their sense of efficacy, suggesting that positive attitudes and beliefs can enhance teachers' beliefs in their abilities and can influence the formation of judgments in a given contextual circumstance. Hoy and Woolfolk (1993) and Ross et al. (2004) found that teachers' stress levels and job satisfaction were related to their efficacy beliefs. Ross et al. (2004) and Donohoo et al. (2020) further stressed the importance of supportive school environments in fostering positive affective states and, in turn, more substantial teacher efficacy. Loughland and Ryan (2022) found affective states as essential as the other three constructs.

Proximate Sources

Adams and Forsyth (2006) stated, “Mastery experiences, vicarious experiences, social persuasion, and affective states occurred at some time in the past, and they are called to mind in the present to influence beliefs about future performance. Contextual conditions [proximate sources], on the other hand, have a day in and day out influence on the teaching tasks” (p. 630). These contextual conditions (proximate sources) were categorized as: analysis of the teaching task and assessment of teaching competence (Goddard et al., 2004).

According to Goddard et al. (2004), assessing teaching competence and analyzing the teaching task is key in shaping collective efficacy beliefs. These beliefs are influenced by a teacher's evaluation of current contextual factors that impact their teaching ability and students' ability to learn (Tschannen-Moran & Hoy, 2001). Contextual variables can either support or hinder teachers' perceptions of teaching conditions in the school and include factors like available resources, student characteristics, school conditions, size, level, and administrative structures. Some of these variables can be changed, while others cannot. The argument was that these contextual variables, through the teaching task analysis, significantly impacted collective efficacy beliefs (Adams & Forsyth, 2006). Adams and Forsyth (2006) found that the contextual variables of school (proximate sources) accounted for a substantial amount of variability in the teachers’ perceptions of collective efficacy. The contextual predictors of school structure, student characteristics, and school level were environmental conditions that influenced teachers' perceptions of their control and then influenced collective efficacy perceptions. The proximate experiences of teaching task and competence, as initially defined by Tschannen-Moran et al. (1998) were found to be influential in the context of teacher efficacy and collective teacher efficacy.

Analysis of Teaching Task. Tschannen-Moran et al. (1998) defined the analysis of teaching tasks as the process of exploring and comprehending the various intricacies involved in teaching. These intricacies included factors such as the abilities and motivation of students, the strategies used for instruction, the quality and availability of teaching materials, management issues, access to technology, the physical setup of the teaching space, the leadership provided by the principal, the school's overall climate, and the support provided by fellow teachers. The teaching task analysis requires a teacher to assess and understand the challenges and demands of their specific teaching assignment, taking into account the complexity of the task and the essential elements needed for success under the given circumstances. Research (e.g., Bandura, 1977; Goddard et al., 2000, 2004; Hoy et al., 2002; Tschannen-Moran et al., 1998) has highlighted the significance of task analysis in education, demonstrating that when teachers collaboratively engage in this process, they develop a more nuanced understanding of their professional challenges and opportunities. For example, Donohoo (2018) and J. C. Lee et al. (2011) found that professional learning communities where teachers regularly analyze teaching tasks together reported higher levels of collective efficacy. As teachers pool their knowledge and resources, they build a synergistic collective intelligence greater than the sum of its parts (Jankowska, 2017), enabling them to tackle complex educational challenges more effectively.

Collective Contextual Variables. The teaching task analysis references the context in which teachers engage in their teaching practice. Several components of the analysis of the teaching task, such as past academic performance (Goddard et al., 2000), how the school operates (Ross & Hogaboam-Gray, 2003), the academic expectations placed on students (Hoy et al., 2002), school climate (Moore & Esselman, 1992), sense of community (V. E. Lee et al., 1991), leadership (Hoy & Woolfolk, 1993), and student socioeconomic status, school level,

school structure, and type of class taught (Webb & Ashton, 1986) had significant variability in how teachers perceived their teaching ability. These factors are essential because they shape teachers' beliefs and opinions about their teaching skills. Efficacy beliefs are about how capable people feel about future actions and do not involve the actual outcomes (Bandura, 1977).

The research findings related to the teaching task analysis highlight the importance of contextual factors in shaping collective teacher efficacy. Multiple studies (see Goddard, 2002; Goddard et al., 2000, 2004) have emphasized the role of cognitive processes in evaluating the teaching task, including assessing student abilities and motivations, the availability of instructional materials, community resources and constraints, and the appropriateness of school facilities. Adams and Forsyth (2006) and Tschannen-Moran and Hoy (2001) further validated that these contextual variables, along with the availability of teaching resources and the enabling school structure, significantly influenced teachers' beliefs in their collective ability to teach effectively. Donohoo et al. (2020) and Anderson et al. (2023) highlighted the integration between empowered teachers, supportive leadership, and goal consensus in fostering a positive perception of the teaching task and, consequently, enhancing collective efficacy, with Anderson et al. (2023) noting the overarching significance of supportive leadership over all of the contextual factors. In definition, Anderson et al. (2023) stated:

> As measured, task analysis refers to participants’ views that students come to school ready to learn, the community supports student learning, and the home environment supports learning. Concerning the results of this study, this means that as teachers feel more empowered and supported by their leaders, they are more likely to view students as well as community and parental support [or lack thereof] in a positive light. (p. 11)

Overall, these findings point to the importance of considering teaching context and available resources when analyzing the task of teaching and its impact on collective teacher efficacy. Loughland and Ryan (2022) argued that it was the school leader's responsibility to ensure these steps were taken.

Assessment of Teaching Competence. Teacher competence can be assessed in various ways (i.e., self-assessment, peer observation, student feedback, administrative evaluations). Tschannen-Moran et al. (1998) explained that the actual domain of assessment of teaching competence lies in the teacher's individual "level of perceived competence to meet the demands of a particular teaching task" (p. 233). Furthermore, the assessment of teaching competence "has to do with self-perception of competence rather than actual level of competence" (Tschannen-Moran et al., 1998, p. 211). Engaging in reflective practices and receiving feedback enhances individual teacher efficacy and strengthens the teaching staff's collective efficacy (Tschannen-Moran & McMaster, 2009). Pajares (1996) explained how assessments perceived as punitive or overly critical could undermine teachers' confidence and cohesion. Instead, the school environment should view assessment as a tool for development rather than judgment (Pajares, 1996; Tschannen-Moran et al., 1998).

Collective Contextual Variables. Research around the assessment of teaching competence has shown the significance of professional development and reflective practices in shaping collective teacher efficacy. Tschannen-Moran and McMaster (2009) demonstrated that professional development programs, especially those providing explicit feedback on teaching performance, effectively increased both individual efficacy and collective efficacy. Goddard et al. (2000) emphasized that to enhance efficacy, the actions of assessing faculty teaching skills, methods, training, and expertise, as well as fostering positive beliefs in the ability of all children

to succeed, was necessary. Donohoo et al. (2020) further noted the role of cohesive teacher knowledge and embedded reflective practices in strengthening efficacy. Together, these findings suggested that a comprehensive assessment of teaching competence, targeted professional development, and reflective practices were vital for fostering a sense of efficacy among teachers.

The analysis of teaching task and assessment of teaching competence are two interlinked sources of efficacy. Tschannen-Moran et al. (1998) noted that by teachers engaging in reflective practices, teachers are then able to "attribute their success or failure to factors outside of themselves, or they can assess the personal factors they brought to the task, including assets or liabilities" (p. 231). In this reflection, teachers are self-categorizing the influence of teaching competence or teaching task, allowing correct assessment and determining action for future improvement.

Findings Associated with Collective Teacher Efficacy

CTE has significantly evolved since its initial conceptualization. The evolution of understanding CTE began with the shift from being viewed as a mere aggregation of individual teachers' self-efficacy to being recognized as the collective belief of a school's teaching staff in their ability to positively influence student achievement. With the inclusion of contextual variables, categorized as analysis of teaching task and teaching competence, the sources of self-efficacy, such as mastery experience, vicarious experience, verbal persuasion, and physiological states, were believed to be applicable when transitioning from individual to collective efficacy (Adams & Forsyth, 2006). This shift was marked by the development of new measurement tools (see Goddard, 2001; Tschannen-Moran et al., 1998), which emphasized the collective capacity of teachers rather than individual capabilities.

One of the foundational aspects of CTE is related to its association with teacher behavior and instructional practices. Research by Hoy et al. (2002) and Tschannen-Moran and Barr (2004) highlighted the role of CTE in enhancing teacher collaboration, trust, and classroom management. Moreover, studies by Klassen et al. (2011) and Hulpia et al. (2009) found that teachers in schools with strong collective efficacy were more likely to be satisfied with their jobs, committed to their roles, and less likely to leave the profession. This is particularly important in the context of teacher turnover and the need for school leaders to maintain employment of stable, experienced teaching staff.

The relationship between CTE and school leadership has emerged as a significant area of interest within educational research. Hallinger and Heck (2010) and Louis et al. (2010) found that effective leadership practices (setting a clear vision, fostering collaboration, and providing instructional support) contributed to developing a strong sense of collective efficacy among teachers. These practices, in turn, led to improved school outcomes. Moreover, Supovitz (2002) and Çalik et al. (2012) highlighted the role of leadership in facilitating teacher collaboration and instructional improvement, which are key components of collective teacher efficacy.

Another noteworthy aspect of CTE is its association with inclusive teaching practices and support for diverse student populations. Research by Gibbs and Powell (2012), Lyons et al. (2016), and Tschannen-Moran and Hoy (2001) indicated that schools with high CTE were more likely to implement inclusive practices for students with behavioral struggles, special education needs, and English language supports. Since 2020, the research on CTE has expanded to include its relationship with school innovation and professional development. Schwabsky et al. (2020) found a positive relationship between CTE and school innovation, suggesting that collective efficacy could drive schools toward adopting new and effective educational practices. Studies by

Moolenaar et al. (2012), Cantrell and Callaway (2008), and Donohoo (2018) noted the importance of CTE in fostering professional development and teacher collaboration. Table 2.1 provides a non-comprehensive summary of studies on collective teacher efficacy.

Research on CTE has shown promising results concerning its positive impact on educational outcomes. Prior studies (see Table 2.1) in this field primarily focused on identifying the presence of CTE, its correlation with student achievement, and its interaction with various environmental factors. These investigations have provided valuable insights into the relationship between CTE and student success. However, a gap exists in the literature regarding practical guidance for educational leaders. Specifically, there is limited information on strategies that school administrators can use to cultivate and then maintain high levels of CTE within their institutions (Adams & Forsyth, 2006; Klassen et al., 2011; Ross et al., 2004; Tschannen-Moran & Barr, 2004). This lack of actionable guidance leaves school leaders with limited direction on how to effectively foster an environment where teachers collectively believe in their ability to positively influence student learning.

Furthermore, minimal research has explored the specific conditions that foster or promote collective teacher efficacy. Understanding these enabling conditions is fundamental for developing targeted interventions and strategies that can support the growth of CTE in schools. By identifying and implementing these conditions, educational leaders can create a more collaborative and supportive teaching environment, ultimately improving student outcomes.

Table 2.1

Non-Comprehensive Summary of Findings Associated with Collective Teacher Efficacy

Findings	Researcher(s)
Associated with group-level norms surrounding teachers' beliefs about impacting student learning	(Klassen et al., 2008; J. C. Lee et al., 2011)
Associated with PLC implementation	(Voelkel & Chrispeels, 2017)
Associates with enabling school structures; Positive association with student engagement	(Adams & Forsyth, 2006)
Associates with teacher ownership over school processes; Increased teacher leadership	(Derrington & Angelle, 2013; Goddard, 2002)
Better qualities of academic goals, expectations, and learning opportunities for students	(Bandura, 1977; Goddard et al., 2004; Hoy et al., 2002; Kurz & Knight, 2004; Tschannen-Moran & Barr, 2004)
Decreased teacher stress	(Ware & Kitsantas, 2007)
Educators promote higher levels of student emotional engagement	(Boberg & Bourgeois, 2016)
Enhanced teacher motivation and commitment, Increased feelings of teacher competence, Enhanced teacher performance	(Goddard et al., 2000, 2004; Goddard & Goddard, 2001; Hoy et al., 2002; Klassen et al., 2008; Skaalvik & Skaalvik, 2007)
Increased student achievement in mathematics, improved teacher collective problem-solving	(Ross et al., 2004)
Increased teacher collaboration	(Ross et al., 2004; Tschannen-Moran & Barr, 2004)
Increased teacher trust, improved classroom management	(Tschannen-Moran & Barr, 2004)
Influenced by leadership style	(Akan, 2013; Çalik et al., 2012; Cansoy, 2020; Nordick et al., 2019; Ramazan & Hanifi, 2018)
Novice teacher retention	(Tiplic et al., 2016)
Positive association with school climate and culture	(Hoy et al., 2002; Klassen et al., 2008; J. C. Lee et al., 2011)
Positive association with teacher self-efficacy	(Bandura, 1993; Caprara et al., 2006; J. C. Lee et al., 2011)
Positive impact on school leadership practices and decision-making	(Hallinger & Heck, 2010)
Positive impact on teacher retention	(Klassen et al., 2011; Ware & Kitsantas, 2007)
Predictor of student achievement	(Goddard, 2001; Goddard et al., 2000; Hoy et al., 2002; Kurz & Knight, 2004; Moolenaar et al., 2012; Tschannen-Moran & Barr, 2004)
Reduced teacher feelings of burnout	(Caprara et al., 2006; Skaalvik & Skaalvik, 2007)
Teachers are more likely to engage in inclusive teaching practices	(Gibbs & Powell, 2012; Lyons et al., 2016; Tschannen-Moran & Hoy, 2001; Urton et al., 2014)
Teachers express greater job satisfaction	(Adams & Forsyth, 2006; Caprara et al., 2006; Hoy et al., 2002; Klassen et al., 2011; J. C. Lee et al., 2011; Skaalvik & Skaalvik, 2007, 2021; Ware & Kitsantas, 2007)
Teachers held more positive attitudes toward professional development	(Cantrell & Callaway, 2008; Rauf et al., 2012)
Teachers hold higher expectations and greater academic press	(Bandura, 1993; Hoy et al., 2002; Tschannen-Moran & Barr, 2004)
Teachers reward behaviors conducive to intellectual development	(Bandura, 1993; Tschannen-Moran & Barr, 2004)
Teachers show greater commitment to students	(J. C. Lee et al., 2011)

Empirical Studies of Student Achievement and Collective Teacher Efficacy

The relationship between CTE and student achievement has been a focus of educational research for decades. Bandura's (1993) seminal work on collective efficacy in socioeconomically disadvantaged schools set the stage by demonstrating that strong collective beliefs among teachers could lead to higher student achievement, even in challenging environments. This finding relating to CTE's interaction with socioeconomic status (SES) was echoed in subsequent studies across various educational settings. This section expands on studies that focused solely on the interaction of CTE with student achievement and studies that also controlled for SES.

Building on the foundational research that links CTE and SES with student achievement, differing methodological approaches allow for a deeper understanding of these relationships. Meta-analysis is a "quantitative set of techniques for analyzing results from two or more studies on the same or similar issues" (Creswell & Guetterman, 2019, p. 357). In this process, the results from multiple studies on a particular topic are synthesized, providing a comprehensive understanding of the overall effect size and the strength of the relationship between variables. Meta-analyses assist in surveying the field of education to investigate studies of interest. In the context of CTE and its impact on student achievement, meta-analysis quantifies the magnitude of CTE's effect across different settings and populations.

Eells (2011) and Hattie (2008, 2012, 2023) conducted two notable meta-analyses in this field. Eells (2011) conducted a meta-analysis of 26 studies and found a strong positive relationship between CTE and student achievement, with an average effect size of 1.57. Effect size is defined as "a way of reporting the strength of a relationship between two or more variables" (Kneer, 2017, para. 1), and a 0.4 effect size represents a year's growth per year of schooling (Corwin Visible Learning Plus, 2019).

Using varying measurement tools, many researchers have investigated the relationship between CTE and student achievement, primarily by quantitative, correlational analysis (see Table 2.2). Though similar in purpose, these studies offered varied conclusions through different processes. For the CTE construct, most of the reviewed studies either used one of Goddard's CTE measurement instruments (see Goddard, 2002; Goddard et al., 2000) or Tschannen-Moran and Barr's (2004) CTE measurement tool. Additionally, most of the researchers used state assessment data to measure student achievement. A consistent finding that higher levels of CTE were positively correlated with higher student achievement was evident in most of the studies. Last, many of the studies focused on elementary schools, particularly in the subjects of English language arts and math.

In difference, many of the studies occurred in the early 2000s, with only a few taking place after the COVID-19 pandemic. When investigating the relationship of CTE with student achievement, several studies controlled for SES, finding that, while CTE was a significant predictor of student achievement when controlling for SES, the degree to which SES influenced outcomes varied across the studies. For example, although CTE was determined to support ELA student achievement in sixth-grade students, Moolenaar et al. (2012) found SES to be a strong predictor of student achievement in ELA. In elementary schools, Pennycuff (2010) concluded that SES explained more of the variance in student achievement than CTE, whereas, in elementary and middle schools, Parker et al. (2006) found that neither CTE nor SES accounted for a significant portion of the total variance.

Table 2.2

Non-Comprehensive Summary of Studies Utilizing Seminal CTE Measurement Instruments

Researcher(s)	Purpose	Participants	CTE Survey	Student Achievement Assessment Tool	Results
Eells (2011)	Quantify the effect size between CTE and achievement	26 studies reviewed in total	5 studies used Goddard et al. (2000) 15 studies used Goddard (2002) 4 studies used Tschannen-Moran and Barr (2004) (one shortened it) 1 study used experimenter made 1 study used other	15 studies used state assessment data 11 studies used either another standardized assessment measure, content learning standards or proficiency tests	CTE was found to be strongly and positively correlated with student achievement. Moderator analysis revealed that both university affiliation and instrument used to measure CTE were able to explain the variance found among studies.
Hoy et al. (2002)	Investigate if CTE had a positive effect on school mathematics achievement	97 Ohio high schools	Goddard (2002) short form	12th grade standardized test scores	Significant positive relationship between CTE and math ($r = .65$, $p < .01$) and when controlling for SES ($r = .61$, $p < .01$)
Moolenaar et al. (2012)	Investigate if teachers' perceptions positively influenced student achievement	53 Dutch elementary schools	Goddard (2002) short form	6th grade state standardized test scores	CTE supported student achievement in ELA but not math. SES was stronger predictor of student achievement in ELA but not math.
Pewee-Childs (2023)	Investigate the relationship of principals' leadership qualities on CTE and student achievement	14 schools comprised of elementary, middle, K-8, and high school	Goddard et al. (2000)	3rd-8th state standardized test scores, 10th grade college assessment test, divided into 4 levels	Elementary teachers reported the highest CTE, high school teachers reported the lowest Significant relationship between CTE and elementary ELA and math. Weak, non-significant relationship between CTE and middle school ELA and math. Moderate correlation between high school CTE and ELA and math.
Bozkurt et al. (2021)	Investigate how leadership, school culture, CTE, and SES affect student achievement	30 schools comprised of 194 teachers and 948 students	Goddard et al. (2000)	8th grade Course grades	SES, academic self-efficacy, and collective efficacy of teachers each individually had a significant effect on the students' average academic achievement scores.
Ross et al. (2004)	Investigate the relationship between student achievement, school processes, and CTE	141 elementary schools comprised of 2,710 teachers	Abbreviated Goddard et al. (2000), highest loading factors	6th grade National standardized mathematics assessment scores	There is a reciprocal relationship between CTE and student achievement. Staff cohesion fosters a collective purpose, enhancing agency in areas where the school has the discretion to act.

Table 2.2, continued

Researcher(s)	Purpose	Participants	CTE Survey	Student Achievement Assessment Tool	Results
Jackson (2009)	Analyze the relationship of CTE and student achievement when controlling for SES.	35 Virginia elementary schools	Used an abbreviated form of their Teacher Climate Survey and Tschannen-Moran and Barr (2004) CTBS	3rd and 5th grade state standardized test scores	When controlling for SES, CTE was a significant positive predictor of student achievement in 3rd grade reading and 5th grade reading and math.
Pennycuff (2010)	Investigate the impacts of CTE and additional specific components (trust, RTI) with student achievement	35 Virginia elementary schools	Used their Teacher Climate Survey, Inclusion Teacher Survey with integrated Tschannen-Moran and Barr (2004) CTBS	3rd - 5th grade state standardized test scores	SES explained 49% of variance of student achievement and CTE and its components explained 27% of the variance.
Parker et al. (2006)	Explored relationship between CTE, SES and achievement in reading, writing and math in primary schools	15 primary schools with free/reduced lunch% ranges from 3% to above 54%	Tschannen-Moran and Barr (2004) CTBS	3rd, 4th, 6th, 7th grade national test scores	Significant positive relationships between SES and reading and math (not writing) Significant positive relationships between CTE and reading and writing (not math) Neither CTE or SES accounted for significant portion of total variance; however, CTE had stronger impact that SES in writing and modest in reading
Qadach et al. (2020)	Investigate the direct and mediating effects of principal and teacher interaction through CTE with student achievement on math and science tests.	130 elementary schools comprised of 1,700 teachers, minimum of 30% of the teaching staff at each school	Tschannen-Moran and Barr (2004) CTBS	National standardized assessment	CTE was significantly directly related to students' math and science achievements. Organizational learning mechanisms promoted student math and science achievement through CTE. CTE showed the strongest direct relationship to students' achievements in science and math, compared with the other teachers' variables

Note. CTE = collective teacher efficacy; SES = socioeconomic status, ELA = English language arts; CTBS = Collective Teacher Beliefs Scale.

The impact of CTE appeared to vary by the educational level and the subject. Jackson (2009) noted that CTE was a significant positive predictor of student achievement in third-grade reading and fifth-grade reading and math but not third-grade math. In their study, Qadach et al. (2020) concluded that CTE was directly related to math and science in the elementary grades. Furthermore, Pewee-Childs (2023) found a significant relationship between CTE and elementary ELA and math. In elementary schools that included sixth grade, Ross et al. (2004) identified a reciprocal relationship between teacher ownership over school processes, CTE, and student achievement, stating that in order for teachers to develop their collective sense of purpose, they had to have discretion over the school process actions.

Though predominately elementary schools were studied, varying secondary results were found. Pewee-Childs (2023) noticed a weaker relationship between CTE and achievement at the middle school level than in elementary and high schools. On the contrary, Hoy et al. (2002) reported a significant positive relationship between CTE and twelfth-grade math achievement. Bozkurt et al. (2021) determined that CTE significantly affected eighth-grade achievement in all subject areas. Additionally, Parker et al. (2006) found a significant positive relationship between CTE and elementary and middle school reading and writing, but not math. In Parker et al.'s study, neither CTE nor SES accounted for a significant portion of the variance; however, CTE did have a more substantial impact on writing scores than SES and a modest impact on reading scores.

The variations in study participants, survey measurement tools, and results highlight the nuanced way in which CTE can influence different aspects of student achievement. These studies' results lend to the importance of context, measurement tools, and demographic elements in interpreting the effects of collective teacher efficacy. The measurement tools (see Goddard,

2002; Goddard et al., 2000; Tschannen-Moran & Barr, 2004) referenced in Table 2.2 are covered in more detail in a subsequent section.

Principal Interaction with Teachers, Collective Teacher Efficacy, and Student Achievement

School principals play a pivotal role in the dynamic ecosystem of education. Their leadership influences a school's daily operations and the teachers' and students' overall educational experiences. Effective principal leadership is, therefore, a critical factor in shaping the quality of education and student outcomes. The principal's role has not always been viewed with such a high impact. The principal's influence was not communicated in its cruciality until the Wallace Foundation began more profound research into leadership impacts, commissioning multiple reports.

The first report, from Leithwood et al. (2004), found that leadership was the second largest contributor to student learning. Later, in a thorough review of six studies, Grissom et al. (2021) found the principal effect to be "nearly as large as estimates of individual teacher effects on student learning" (p. 39). These researchers found that when a principal moved from a rating in the 25 percentile of effectiveness to the 75th percentile, students learning increased by an average of 2.8 months in reading and math. These principal effects were not separated from the teachers'; Grissom et al. (2021) explained, "Principals' effects on student achievement are mostly indirect, coming largely through their efforts to recruit, develop, support, and retain a talented teaching staff and create conditions for them to deliver strong instruction" (p. 40). Grissom et al. (2021) concluded that "the impact of an effective principal has likely been understated, with impacts being both greater and broader than previously believed: greater in the impact on student achievement and broader in affecting other important outcomes" (p. viv), such as student attendance, teacher satisfaction, teacher retention, reduced disciplinary actions.

Effective principals are instrumental in constructing teacher work conditions (Johnson et al., 2012), school culture and climate (Guin, 2004; Sebastian & Allensworth, 2012), and reducing teacher turnover (Grissom et al., 2021). Principal leadership is more than just creating value directly; it also enables others to achieve more. Principals work in tandem with their teacher teams. Researchers have concluded that it is difficult to separate the leader's contributions from the teachers' due to the leader's influence in fostering teacher self-efficacy (Kelley & Finnigan, 2003), building trust (K. Louis & Murphy, 2017; Sebastian & Allensworth, 2012; Tschannen-Moran & Gareis, 2015), promoting collaboration (Berebitsky et al., 2014; Goddard et al., 2015), and providing meaningful professional development learning opportunities (Brown & Militello, 2016; Donohoo, 2017; Dutta & Sahney, 2022). Therefore, rather than thinking in silos of teacher impact and principal impact, there is a need for a consideration of the throughline of impact from principal to teacher, leading then directly to the student (Grissom et al., 2021). Great principals enable teachers to thrive (Ikemoto et al., 2012).

The principal's influence is not left to these impacts alone. Researchers have validated that principals influence collective teacher efficacy. In an investigation of 235 principals and what they did to increase CTE in high schools, Armstrong-Coppins (2003) found that principals' leadership practices were related to organizational conditions and CTE by inspiring the group purpose, providing individual support, modeling behaviors, and fostering positive school cultures. Furthermore, using Goddard et al.'s (2000) measurement tool integrated into a 134-item principal survey, Leithwood and Jantzi (2008) investigated K-12 principals' impact on CTE and student achievement. These researchers concluded that the collective efficacy of K-12 school leaders was linked to school conditions and student achievement. Not only the principals themselves but also their leadership style had a direct and positive impact on CTE (see Akan,

2013; Çalik et al., 2012; Cansoy, 2020; Fathi & Savadi Rostami, 2018; Nordick et al., 2019; Ramazan & Hanifi, 2018). Nordick et al. (2019) found that principals could develop CTE by providing teachers with supportive relationships, scaffolded collaboration, and opportunities to advance their expertise.

The principal's impact cannot be ignored. The field of education must formulate how principals can harness this influence to promote success among students and teachers. Not only do principals impact student achievement in general, but principal impact has also been shown to have a significant positive effect on reducing achievement gaps (see Dhuey & Smith, 2014). Sun and Leithwood (2012) found that principals who built collaborative school structures and provided individualized support to teachers greatly contributed to student achievement. Although principals may not interact primarily with student content learning, a "chain of variables linking leadership practices to student learning" (Leithwood et al., 2004, p. 13) exists. The researchers defined these variables as the principal's interaction with teachers, setting clear school goals, fostering positive school culture, and allowing teachers to participate in decision-making. If school principals prioritized the skills, expertise, behavior, and leadership practices found in the literature, they could appropriately allocate time to support teacher effectiveness and, in turn, student achievement. However, precise formation and strategic planning for all these intricate components can be challenging. This challenge comes from how "leaders contribute to student learning indirectly, through their influence on other people" (Leithwood et al., 2004, p. 13); therefore, a significant part of principal influence is enacted through others. Student achievement will be negatively impacted if principals cannot create positive influence.

School principals' leadership approach and ability to foster CTE among teachers are paramount (Bandura, 2000; Echiverri, 2021; Fathi & Savadi Rostami, 2018). Adams and Forsyth

(2006) stated, “Our findings illustrate the importance for collective efficacy studies to operationalize efficacy sources derived from both locus of control and social cognitive theories” (p. 638). Researchers have developed various instruments to operationalize and quantify CTE (see Donohoo et al., 2020; Goddard, 2002; Tschannen-Moran et al., 1998).

Socioeconomic Status and Its Influence on Collective Teacher Efficacy

In exploring the factors influencing educational outcomes, SES and CTE are significant variables for consideration. SES, as defined by the American Psychological Association (2023), “encompasses not only income but also…subjective perceptions of social status and social class. SES reflects quality-of-life attributes and opportunities afforded to people within society and is a consistent predictor of a vast array of psychological outcomes” (para. 1). The concept of CTE, which reflects the collective belief of teachers in their ability to positively affect students, has been shown to interact with SES in determining educational outcomes. Although SES has an independent effect on student achievement, Bandura (1993) and Goddard et al. (2000) discovered that student achievement significantly correlated with CTE when reviewed at the school level. Collective teacher efficacy was also found to have a more substantial impact on enhancing student achievement than the aggregated effects of SES (Bandura, 1993; Goddard et al., 2000).

Adams and Forsyth (2006) specifically examined how SES impacted the task of teaching and found that SES, along with school structure and school level, independently explained significant variability in collective teacher efficacy. Their findings suggested an inverse relationship between SES and CTE, indicating that higher poverty levels in schools might negatively impact the development of collective efficacy among teachers. This relationship highlighted the challenges faced by schools in high-poverty areas.

Further research by Goddard et al. (2004) and Tschannen-Moran and Barr (2004) supported the notion that while SES was a strong predictor of student success, CTE could have a more substantial influence on student achievement. This notion became particularly evident in studies that controlled for SES, revealing that CTE significantly enhanced student outcomes in mathematics and writing across various grade levels (Barr, 2002; Pearce, 2007). Tschannen-Moran and Barr (2004) concluded that the effect of CTE on student academic achievement was more than that of a student's SES level variable. These findings suggest that fostering a strong sense of collective efficacy among teachers could be an effective strategy to increase academic performance, even in contexts where SES might pose considerable challenges.

Goddard and Goddard (2001) further explained that CTE influenced student achievement directly and enhanced teacher self-efficacy. Their analysis indicated that CTE predicted variations in teacher efficacy beyond what could be explained by SES and other school contextual factors. This relationship showcased the potential of CTE to empower teachers, enabling them to overcome SES constraints and other barriers to student success.

While SES remains a strong determinant of educational achievement, CTE's role is meaningful and vital. Research has illustrated that CTE can mitigate some of the adverse effects of low SES on student outcomes. Barr (2002) stated, “Teachers in schools with high collective efficacy make no excuses for low student achievement such as ability, low socioeconomic status, or family background” (p. 35). By focusing on CTE, educators are not only addressing the disparities occurring from SES but also leveraging the transformative potential of CTE to foster greater academic success.

Collective Efficacy Frameworks and Measurement Instruments

Bandura's pioneering work of the complex integration between collective efficacy and student achievement laid the groundwork for subsequent researchers to build upon through their development of CTE measurement tools (e.g., Adams & Forsyth, 2006; Donohoo et al., 2020; Goddard et al., 2000, 2004; Hoy et al., 2002; Tschannen-Moran & Barr, 2004; Tschannen-Moran et al., 1998). Tschannen-Moran et al. (1998) and Goddard et al. (2004) examined teacher self-efficacy and its connection to collective efficacy. Although connected, teacher self-efficacy and CTE were determined to be two different domains. Focusing on how these two domains were linked, Tschannen-Moran et al. (1998) discovered that schools where teachers collaborated to tackle educational challenges tended to strengthen their collective efficacy. In contrast, schools where conversations primarily centered on difficulties eroded their collective efficacy. Additionally, Tschannen-Moran et al.'s (1998) research findings indicated that strong school leadership, a cohesive culture, and a focus on academic achievement were correlated with higher levels of collective efficacy among teachers.

Historically, CTE has been primarily studied through quantitative, self-reported surveys grounded in theories of locus of control (Rotter, 1966) and social cognitive theory (Bandura, 1977). Bandura's (1993) seminal work highlighted CTE's strong influence on student achievement, suggesting that it could be measured either by aggregating individual teachers' beliefs in their own abilities or by considering teachers' collective beliefs in their school's capability, depending on the level of task interdependence. Subsequent research has primarily focused on the latter approach of considering collective beliefs, with correlational methods being the primary way to understand the relationships and predictive values of variables associated with collective teacher efficacy.

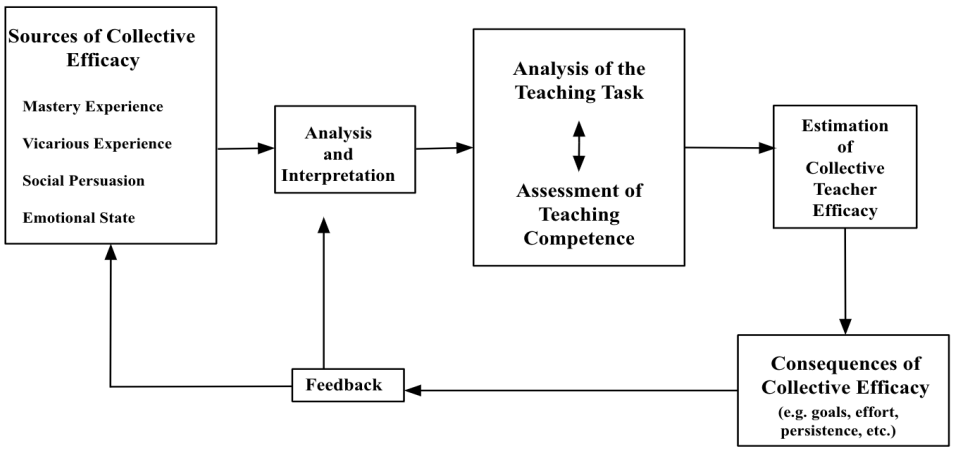
Various tools have been developed to assess this construct, each with its own approach to capturing the teaching staff's collective beliefs and capabilities. This section explores the seminal measurement tools of CTE, including their theoretical influences, methodological approaches, and the implications of their findings.

Collective Teacher Efficacy Scale

CTE diverged from individual teacher efficacy when studies began to show that these two elements were distinct variables impacting student achievement. Goddard et al. (2000) suggested that task complexity and teaching competence interacted at the organizational level and, together with self-efficacy, shaped the teachers' individual perceptions of their school's capacity for student success. Informed by Tschannen-Moran et al.'s (1998) model of teacher efficacy, the researchers introduced a simplified model of collective teacher efficacy, as illustrated in Figure 2.3, to display the formation of this concept.

Figure 2.3

A Simplified Model of Collective Teacher Efficacy



Note. Goddard et al. (2000) postulated that the "perceptions of collective efficacy are formed only after teachers weigh these elements in relation to one another" (p. 485).

Goddard et al. (2000) developed the Collective Teacher Efficacy Scale (CTES) (displayed in Table 2.3), arguing that CTE was a group-level attribute resulting from the interactive dynamics of group members completing joint work. The CTES, a 21-item instrument, measured teachers' perceptions of group competence and task analysis. Its development was guided by modification of the items from Tschannen-Moran et al.'s (1998) Teacher Sense of Efficacy Scale to be focused more strictly on referencing group beliefs. When tested, the measure proved to have a high internal reliability of .96 (Cronbach's alpha).

Using their scale, with 46 teacher participants, each from a different elementary school in five different states, Goddard et al.'s (2000) results provided evidence that CTE was a single construct that united teacher task analysis and teacher competence. Next, the researchers investigated the relationship of CTE with student achievement with participants in one district comprised of 47 elementary schools and 452 teachers. State assessment data for second, third, and fifth grades was used. Goddard et al. (2000) found that CTE significantly predicted student achievement in mathematics and reading above socioeconomic status and minority demographics, meaning that elementary schools with higher levels of CTE had significantly better performance in mathematics and reading. Notably, teacher efficacy indirectly impacted student achievement, and CTE directly impacted student achievement (Goddard et al., 2000). Subsequent studies (e.g., Goddard, 2001; Kurz & Knight, 2004) further confirmed that teacher efficacy and CTE were statistically distinct in their relationship to student achievement.

Table 2.3

Collective Teacher Efficacy Scale (CTE-Scale)

Item Number	Item	Subscale
CTE 1	Teachers in this school have what it takes to get the children to learn.	Group Competence
CTE 2	Teachers in this school are able to get through to difficult students.	
CTE 3	If a child doesn't learn something the first time teachers will try another way.	
CTE 4	Teachers here are confident they will be able to motivate their students.	
CTE 5	Teachers in this school really believe every child can learn.	
CTE 6	If a child doesn't want to learn, teachers here give up.	
CTE 7	Teachers here need more training to know how to deal with these students.	
CTE 8	Teachers in this school think there are some students that no one can reach.	
CTE 9	Teachers here don't have the skills needed to produce meaningful student learning.	
CTE 10	Teachers here fail to reach some students because of poor teaching methods.	
CTE 17	Teachers here are well prepared to teach the subjects they are assigned to teach.	
CTE 18	Teachers in this school are skilled in various methods of teaching.	
CTE 11	These students come to school ready to learn.	Task Analysis
CTE 12	Home life provides so many advantages they are bound to learn.	
CTE 13	The lack of instructional materials and supplies makes teaching very difficult.	
CTE 14	Students here just aren't motivated to learn.	
CTE 15	The quality of school facilities here really facilitates the teaching and learning process.	
CTE 16	The opportunities in this community help ensure that these students will learn.	
CTE 19	Learning is more difficult at this school because students are worried about their safety.	
CTE 20	Drug and alcohol abuse in the community make learning difficult for students here.	
CTE 21	Teachers in this school do not have the skills to deal with student disciplinary problems.	

(Goddard et al., 2000)

Collective Efficacy Short Form

Informed by the same simplified model of CTE (see Figure 2.3), Goddard (2002) created the Collective Efficacy Short Form (CE-Short Form) to better align with theory by giving equal weight to task complexity and teaching competence. This shortened version of the form can be seen in Table 2.4. When tested with 452 teachers from 47 elementary schools, Goddard (2002) concluded that the instrument was more "theoretically pure" (p.97) than its previous version and found it yielded scores of internal consistency with a Cronbach's alpha of .94. Furthermore, the researchers found that short form was a positive predictor of between-school variability in mathematics achievement (Goddard, 2002).

Table 2.4

Collective Efficacy Scale Short Form (CE-Short form)

Item Number	Item	Subscale
CTE 2	Teachers in this school are able to get through to difficult students.	Group Competence
CTE 4	Teachers here are confident they will be able to motivate their students.	
CTE 5	Teachers in this school really believe every child can learn.	
CTE 6	If a child doesn't want to learn, teachers here give up.	
CTE 9	Teachers here don't have the skills needed to produce meaningful student learning.	
CTE 21	Teachers in this school do not have the skills to deal with student disciplinary problems.	
CTE 11	These students come to school ready to learn.	Task Analysis
CTE 12	Home life provides so many advantages they are bound to learn.	
CTE 14	Students here just aren't motivated to learn.	
CTE 16	The opportunities in this community help ensure that these students will learn.	
CTE 20	Drug and alcohol abuse in the community make learning difficult for students here.	

(Goddard, 2002)

Despite its widespread use, the CE-Short Form faced criticism (see Klassen et al., 2011; Tschannen-Moran & Barr, 2004). Klassen et al. (2011) cited Goddard et al.'s (2000) and Goddard's (2002) extended and short-form scales as having a "lack of congruence with theory" (p. 35) and incorrectly focusing on teachers' current abilities rather than future-oriented capabilities, as aligned by self-efficacy theory. Klassen et al. recommended using "can" instead of "will" in item wording to address conceptual issues that would confuse outcome expectations with efficacy beliefs.

Collective Teacher Beliefs Scale

Tschannen-Moran and Barr (2004) argued that Goddard's (2002) scale required refinement because they were concerned that the measure might reduce the collective efficacy scores of schools in challenging environments. Tschannen-Moran and Barr (2004) believed the existing measure directly assessed task difficulty, which would negatively impact the perceived collective efficacy in those schools.

Therefore, Tschannen-Moran and Barr (2004) developed the Collective Teacher Beliefs Scale (CTBS) (see Table 2.5). The CTBS focused on teachers' perceptions of efficacy in instructional strategies and student discipline. Tschannen-Moran and Barr (2004) considered it to be aligned more closely with Bandura's self-efficacy theory by distinguishing capability from outcome expectations using the word "can" instead of "will" in item wording. Klassen (2010) highlighted the benefits of using this instrument to measure CTE in concluding that the Tschannen-Moran and Barr's (2004) instrument provided a conceptually sound approach by focusing on teachers' beliefs about their collective ability to influence student achievement through evaluating individual teachers' perceptions of CTE. Schechter and Tschannen-Moran (2006) also found the instrument reliable and valid.

Table 2.5

Collective Teacher Beliefs Scale (CTBS)

Item Number	Item	Subscale
CTBS 1	How much can teachers in your school do to produce meaningful student learning?	Instructional Strategies
CTBS 2	How much can your school do to get students to believe they can do well in schoolwork?	
CTBS 5	How much can teachers in your school do to help students master complex content?	
CTBS 6	How much can teachers in your school do to promote deep understanding of academic concepts?	
CTBS 9	How much can teachers in your school do to help students think critically?	
CTBS 11	How much can your school do to foster student creativity?	
CTBS 3	To what extent can teachers in your school make expectations clear about appropriate student behavior?	Student Discipline
CTBS 4	To what extent can school personnel in your school establish rules and procedures that facilitate learning?	
CTBS 7	How well can teachers in your school respond to defiant students?	
CTBS 8	How much can school personnel in your school do to control disruptive behavior?	
CTBS 10	How well can adults in your school get students to follow school rules?	
CTBS 12	How much can your school do to help students feel safe while they are at school?	

(Barr, 2002; Tschannen-Moran & Barr, 2004)

Tschannen-Moran and Barr (2004) stated that few studies had "sought to understand the relationship between collective teacher efficacy as a school characteristic and student achievement" (p. 190). These researchers analyzed the relationship between CTE and middle school student achievement using the Virginia Standards of Learning (SOL) state standardized test and the researchers' Collective Teacher Belief Scale (CTBS). This tool assessed CTE through 12 items, divided into two categories: Instructional Strategies and Student Discipline. The scale asked for opinions on the faculty's belief about its "collective capability" (Tschannen-Moran & Barr, 2004, p. 198) to influence student achievement by implementing effective

teaching methods and student behavior management. Responses were scored on a nine-point Likert scale, from "none at all" to "a great deal."

In Tschannen-Moran and Barr's (2004) study of 66 schools, the 12-item CTBS demonstrated a reliability of .97 (Cronbach's alpha). The instructional strategies and discipline subscales had reliability of .96 and .94, respectively. Correlational analysis indicated strong positive correlations between teachers' perceptions of CTE and student performance in math, writing, and English, particularly in eighth grade. Additionally, the subscales of instructional strategies and student discipline both showed significant relationships with student achievement on all three academic tests. Moreover, when controlling for SES, CTE was noted as making an independent contribution to writing, aligning with the theoretical expectations of the construct, as defined by Bandura (1993).

Moreover, the researchers found significant positive relationships between eighth-grade math, writing, and English test scores and CTE. Additionally, CTE explained 18%, 28%, and 14% of the variation in middle school math, writing, and English scores, respectively, although this variance did decrease when school SES was considered. Tschannen-Moran and Barr (2004) observed that elementary schools with strong CTE demonstrated higher student achievement, acknowledging positive instructional practices, a collaborative school culture, and effective leadership as critical factors in this impact.

Klassen et al. (2011) reviewed the literature on teacher efficacy and CTE from 1998 to 2009, summarized key findings, and suggested directions for future research. They highlighted the challenge of measuring the concept of CTE due to its integration of two separate social learning theories: locus of control and social cognitive theory. The researchers pointed out that the most common measurement tools, the CTE-Scale (Goddard et al., 2000) and the CE-Short

Form (Goddard, 2002), showed some overlap with Bandura's (1997) social cognitive theory and Rotter's (1966) locus of control, but did not align adequately. Klassen et al. (2011) observed that research on teacher efficacy was predominantly quantitative and usually captured a single point in time rather than being longitudinal. Additionally, Klassen et al. (2011) criticized the lack of diversity in research samples, as most studies were associated with Midwestern universities, relying on local districts for convenience samples. Last, Klassen et al. (2011) concluded that "insufficient attention" (p. 39) had been given to the sources of CTE, particularly in how CTE sources "form, develop, and change over time" (p.39).

Enabling Conditions of Collective Teacher Efficacy

Additional researchers (e.g., Donohoo, 2018; Goddard, 2002) stated similar conclusions to those of Klassen et al. (2011), suggesting that educators should uncover specific practices and organizational variables for increasing collective teacher efficacy. Donohoo et al. (2020) shifted the focus from the construct of CTE itself to the antecedents of CTE. In their pivotal work, Donohoo et al. (2020) emphasized the significance of CTE in achieving optimal student outcomes through exploring the enabling conditions that foster collective teacher efficacy. Donohoo et al. (2020) stated, "Previous research focused on the remote sources of CTE, [and] very few studies have examined the proximate sources" (p. 161). To address this gap, these researchers considered the proximate sources of CTE through investigation into the antecedents of CTE. Donohoo et al.'s (2020) investigation focused on identifying malleable contextual factors that fostered the development of CTE in schools.

Enabling Conditions for Collective Teacher Efficacy Scale

Informed by eleven peer-reviewed articles, with most published since 2000, Donohoo et al.'s (2020) initial work identified six key enabling conditions of collective teacher efficacy.

Based on these conditions, Donohoo et al. (2020) developed and validated the Enabling Conditions for Collective Teacher Efficacy Scale (EC-CTES), a teacher perception questionnaire designed to identify and measure these contextual antecedents. The researchers considered these areas pivotal for school leaders aiming to enhance CTE among their staff.

The scale underwent two refinement phases. In the first phase, when tested with 136 teachers, the 18-item instrument resulted in a Confirmatory Factor Analysis (CFA) indicating that the proposed model was not an acceptable fit. Phase two updated the instrument to 31 statements, and the results of the CFA indicated that the model was still not acceptable. Potential model specification issues were reviewed, resulting in rewording one question and removing 11 items from the survey. These adjustments resulted in a 20-item instrument covering five key enabling conditions: Empowered Teachers, Embedded Reflective Practices, Cohesive Teacher Knowledge, Goal Consensus, and Supportive Leadership, with the CFA indicating an acceptable fit and notably strong correlations between Empowered Teachers and Supportive Leadership. The composite reliabilities for each of the factors were each of the factors were Empowered Teachers (0.91), Embedded Reflective Practices (0.84), Cohesive Teacher Knowledge (0.86), Goal Consensus (0.88), and Supportive Leadership (0.93).

Donohoo et al.'s (2020) EC-CTES instrument is protected under copyright. Formal requests may be submitted to First Educational Resources for permission to access and use the survey. Permission for use and reference has been granted for this study under the condition that the survey questions are not published (see Appendix).

Though intertwined to form the complete enabling construct, the five categories of the EC-CTES were unique. Embedded reflective practices involved an assessment of the systematic processes where teachers collaboratively examined evidence of student learning, adjusted their

instructional practices based on feedback, and engaged in ongoing reflection to improve student outcomes. Cohesive teacher knowledge, referring to teachers' shared understanding and agreement on effective instructional practices, was determined to be fostered through collaboration, professional development, and peer support, leading to a unified approach to teaching and learning. Goal consensus was the shared understanding and agreement on the goals of the school and the processes in which to achieve them, which focused on aligning individual and organizational efforts. Empowered teachers were determined to have the agency and influence to make decisions about important school processes, contributing to a sense of ownership and investment in school outcomes. Supportive leadership involved actions by school leaders that focused on instruction, buffered teachers from distractions, and recognized individual and team accomplishments. Importantly, supportive leadership was credited as being responsible for creating an environment that supported the other four conditions for collective teacher efficacy.

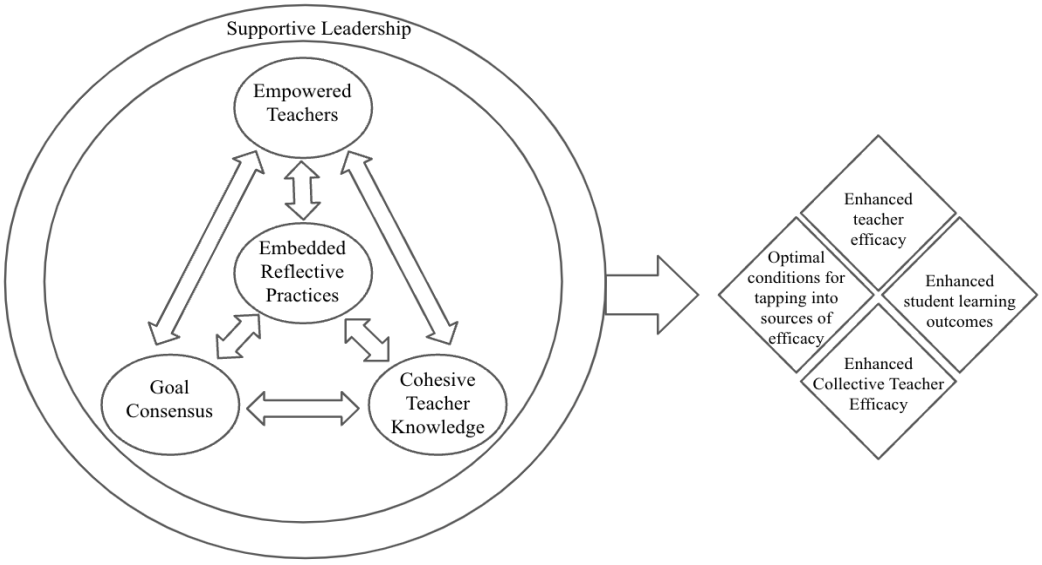
Donohoo et al. (2020) acknowledged the need for future work that included additional items to make a more apparent distinction between the factors. Additionally, the researchers noted that it would be helpful to pursue studies that focused on other aspects of validity, including potential consequences for the measurement and interpretability of the scores. Limitations regarding the study's sample indicated a need for broader participant inclusion in future research. Lastly, Donohoo et al. (2020) suggested future studies that examined how the elements validated in this study related to student learning outcomes.

Donohoo et al. (2020) developed a conceptual framework model (see Figure 2.4) that emphasized that school leaders were crucial in nurturing collective teacher efficacy. They concluded that school leaders do this by 1) setting normative expectations for teacher

collaboration, 2) establishing empowering processes and procedures, and 3) creating conditions that increase teachers' knowledge of each other's work, enhance staff cohesion, and facilitate consensus on school goals. Their model suggested that effective leadership enhances teacher efficacy and CTE, ultimately improving student learning outcomes.

Figure 2.4

Conceptual Framework: Leading for Collective Teacher Efficacy



Note. This model from Donohoo et al. (2020) highlights the influence of supportive leadership on all other enabling conditions, which leads to improved student learning outcomes.

In a quantitative study, Anderson (2021) investigated the validity of Donohoo et al.'s 20-item EC-CTES instrument. The study included 411 participants and examined the EC-CTES' relationship with measures of collective teacher efficacy using CFA, correlation matrices, and multiple regression models. The results of Anderson's (2021) study showed the factor variable and correlations ($R^2 > .5$) as strong, and all unstandardized path coefficients were significant at $p < .001$. The subscales' reliability scores were high as measured by Cronbach's alpha: Empowered Teachers (.89), Goal Consensus (.87), Cohesive Teacher Knowledge (.86),

Embedded Reflective Practice (.84), and Supportive Leadership (.83). The correlation between the Supportive Leadership and Empowered Teachers displayed a very strong, positive relationship (.97). Additionally, Anderson (2021) determined the factor-variable relationships to be strong in the CFA.

Anderson (2021) found that the theoretical frameworks for the enabling conditions of collective teacher efficacy and CTE itself were related but distinct. The enabling conditions described the contextual factors that preceded CTE, whereas CTE focused on teachers' beliefs in their collective ability to influence student learning beyond the school's fixed characteristics. Within this distinction and through an analysis with seminal CTE measurement scales (see Goddard, 2002; Tschannen-Moran & Barr, 2004), Anderson (2021) concluded that the five subscales of the EC-CTES had explanatory value for every subscale measurement of collective teacher efficacy. Therefore, Anderson (2021) concluded the instrument to be a valid and reliable tool, with subscales that showed positive associations with CTE measures, thus reinforcing the importance of these enabling conditions in promoting collective teacher efficacy.

While Anderson (2021) recognized the framework proposed by Donohoo et al. (2020) as being theoretically sound, Anderson (2021) acknowledged its complexity and the necessity for:

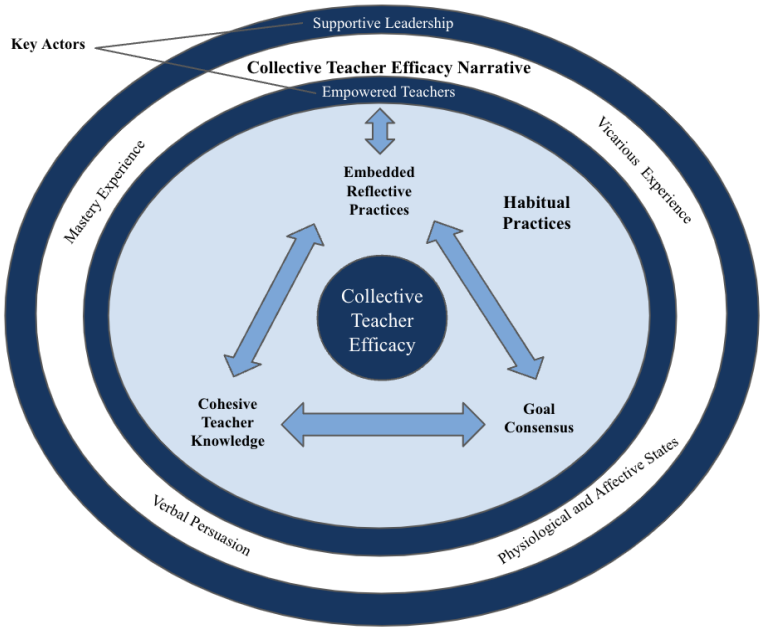
> Agile leadership to impact collective teacher efficacy by simultaneously considering multiple variables (supportive leadership, empowered teachers, embedded reflective practices, goal consensus, and cohesive teacher knowledge) in conjunction with Bandura’s (1993) four sources of efficacy (mastery experience, vicarious experience, persuasion, and physiological and affective states). (p. 95-96)

Thus, Anderson (2021) suggested refinements to enhance the scale's practical application and congruence with collective efficacy theory, proposing a simplified framework (see Figure 2.5) to

make “the theory clearer and more accessible to practitioners” (p. 114), with the intention of providing a framework that more schools would apply with fidelity to improve student learning and outcomes.

Figure 2.5

Adjusted Conceptual Framework for the Enabling Conditions for Collective Teacher Efficacy



Note. The purpose of this conceptual framework constructed by Anderson (2021) was to condense and refine the subscales relating to the enabling conditions of CTE to make it more easily applicable to practitioner use.

As confirmed by Donohoo et al. (2020) and further emphasized by Anderson (2021), supportive leadership continued to hold the spotlight in fostering CTE by establishing the key practices of embedded reflection practices, goal consensus, and cohesive teacher knowledge. Because these practices become routine over time, Anderson (2021) named them *Habitual Practices*, with the idea that viewing them in this manner cultivated a culture of continuous improvement and shared responsibility. Additionally, Anderson (2021) introduced *Key Actors* in

reference to Supportive Leadership and Empowered Teachers. Their purpose was to reinforce the role of supportive leadership and position teachers as central figures surrounding the routine practices of CTE and "establish and facilitate the collective efficacy narrative in the school" (Anderson, 2021, p. 12). Anderson (2021) concluded that *Key Actors* also shaped the narrative of collective teacher efficacy by emphasizing successful outcomes achieved by leveraging sources of self-efficacy, including Bandura's (1977) four sources of mastery experience, vicarious experience, verbal persuasion, and physiological and affective states.

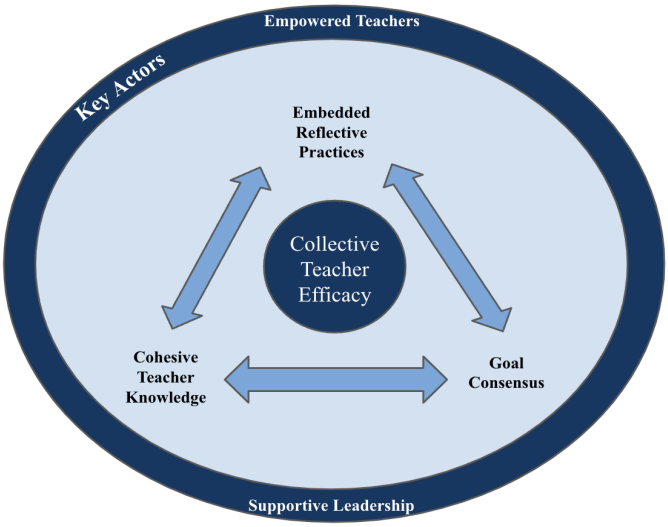
In reference to leaders and teachers, Anderson et al. (2023) later stated that the focus needed to shift to "the relationship between leaders and teachers because neither can exist as a mutually discrete variable in support of collective teacher efficacy" (p. 9). Anderson (2021) stated that "supportive leadership is critical in establishing tone as well as providing voice and inspiring agency in teachers" (p. 114).

Due to a few weak to moderate associations found in the data, Anderson (2021) stated that it was a possibility that some of the subconstructs of the enabling conditions had "not yet fully encapsulated all the environmental variables that lead to efficacious schools" (p. 116) and that "additional factor-analysis studies should be carried out to further refine the EC-CTES construct and to bring greater congruence between the theory supporting the EC-CTES and its measurement." (p. 122). Specifically, Anderson (2021) acknowledged, "The measures of collective teacher efficacy have an established research record of being linked to student achievement while the new EC-CTES has yet to be tested widely…It makes sense to continue refining the EC-CTES because it represents an emerging theory" (p. 116). Anderson et al. (2023) published a revision to Anderson's (2021) original conceptual framework. The revised framework focused on "making the enabling conditions theory more accessible to practitioners"

(Anderson et al., 2023, p. 1). With this focus, influencing variables such as the four sources of self-efficacy and supplementary categorical titles such as *Habitual Practices* were removed from the framework. The revised framework is displayed in Figure 2.6.

Figure 2.6

Practitioners Framework for Enabling Conditions for Collective Teacher Efficacy Scale



Note. The purpose of Anderson et al.'s (2023) adjusted framework was to provide practitioners with an approach that could be more easily applied in the school setting and be more likely to impact student achievement.

School leadership has the potential to foster and cultivate collective teacher efficacy. Anderson (2021) explained, "School leaders seeking to augment student learning through bolstering collective teacher efficacy can dependably use the enabling conditions for collective teacher efficacy as a pathway to realizing their goal" (p. 118). Moreover, the researchers further declared, "School leaders should remember that effective leadership is truly ubiquitous in the school. Supportive leadership is the antecedent by which all the other antecedents are systematically possible" (Anderson et al., 2023, p. 13). Therefore, the EC-CTES measurement

tool is a necessary starting point for examining these foundational antecedents in developing collective teacher efficacy.

Conclusion

Building on the understanding that the EC-CTE and CTE are related yet distinct constructs, researchers have delved deeper into how these elements interact within the educational landscape. Literature has recognized the importance of assessing CTE's impact on student achievement and understanding how CTE functions as a characteristic of schools. This research investigates the correlation between a state-assessed construct of CTE and student achievement and the EC-CTE and student achievement. Collective teacher efficacy and its enabling conditions have been theorized. Klassen et al. (2010) emphasized that while the literature often focused on the impacts of CTE on student achievement, there was a need to understand the applicable interaction of CTE as a school characteristic for impacting student outcomes. While researchers have validated the enabling conditions of CTE, these conditional elements have yet to be analyzed for correlation to student achievement as associated with the correlational relationship with CTE itself.

CHAPTER III

METHODOLOGY

This quantitative, correlational study aimed to investigate the relationships between collective teacher efficacy (CTE), its enabling conditions (EC-CTE), and student achievement in third through eighth grades in Colorado. The results of this research have the potential to help principals identify an approach for determining the factors in their schools that can facilitate increased student achievement and provide possible actionable ideas for school improvement through collective teacher efficacy.

Research Design

A well-crafted research design is essential for accumulating knowledge and understanding complex phenomena. As emphasized by Briggs et al. (2012), "The critical issue for researchers is to choose the approach that best addresses the question asked" (p. 26). A correlational design involves "procedures in quantitative research in which investigators measure the degree of association (or relation) between two or more variables" (Creswell & Guetterman, 2019, p. 21). In preparation for this study, Creswell and Guetterman's (2019) quantitative data collection and analysis components were referenced.

Research Questions

The following questions guided this study:

Q1 Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by selected TLCC Survey questions, and student achievement scores?

Q2 Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy, as measured by selected TLCC Survey questions, and student achievement scores?

Research has shown that CTE outweighs the effects of socioeconomic status (SES) on student achievement (e.g., Bandura, 1993; Eells, 2011; Goddard et al., 2000, 2015; Hoy et al., 2002). This interconnected element was considered in this study. Therefore, the addition of a sub-question for Research Question 1 is also included:

Q1a Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the SES of the school?

Hypotheses

Researchers may make a "prediction about the expected outcome, basing this prediction on prior literature and studies on the topic that suggest a potential outcome" (Creswell, 2014, pp. 144–145). Based on prior literature relating to CTE and its relationship with student achievement, the following directional hypotheses were tested in this study:

H1 A positive relationship exists between the collective teacher efficacy scores from the TLCC Survey and CMAS student achievement scores, suggesting that higher collective teacher efficacy is associated with higher student achievement.

H1a Collective teacher efficacy independently contributes to explaining the variance in student achievement scores, even when controlling for the socioeconomic status (SES) of students, demonstrating that the influence of collective teacher efficacy on student achievement is significant beyond the effects of SES.

H2 A positive relationship exists between the scores of enabling conditions of collective teacher efficacy from the TLCC Survey and CMAS student achievement scores, indicating that better enabling conditions are associated with higher student achievement.

Based on the literature, it was predicted that there would be a positive relationship between CTE and the EC-CTE and student achievement. Additionally, CTE and the EC-CTE were expected to contribute to student achievement independently of SES.

Data

The examined data consisted of cross-sectional data collected over a year, during which the Teaching and Learning Conditions Colorado (TLCC) Survey and the Colorado Measures of Academic Success (CMAS) assessment were administered. Additionally, school-level SES data were utilized. The TLCC Survey, CMAS data, and school-level SES data are publicly available on the Colorado Department of Education's website. According to Lisa Steffen, the Strategy and Operations Manager from the Office of Accountability and Continuous Improvement for the Colorado Department of Education (CDE), the TLCC and CMAS data are declared as Non-Personally Identifiable Information (Non-PII) and available for public access on the CDE website (personal communication, January 17, 2024). Therefore, IRB approval was not deemed necessary for the secondary data analysis involved in this study.

Description of School Sample

The school participants in this study were distributed throughout the state of Colorado. The total number of schools in the study's sample was 353. To be considered for data analysis, the schools needed to have a qualifying TLCC score and qualifying CMAS mathematics and English language arts scores. A qualifying TLCC school-level score requires a minimum of five responses and at least 50% of the staff completing the survey for the 2021-22 school year. A qualifying CMAS score requires a school to have 16 or more students with a valid score administered in the spring of 2022. The school is the unit of analysis for this study. The data collected and analyzed reflects the collective efficacy and achievement at the school level rather than individual or classroom levels. Therefore, using the school as the unit of analysis, the total number of Colorado schools with qualifying CMAS Math and ELA mean scores and public

TLCC scores was 353. For clarity of school level, the following categories were assigned to school levels representative of the outlined grade levels:

Elementary. These are schools potentially containing grades preschool through fifth grade. For example, some schools may be configured as kindergarten through fifth grade, while others may be second through fifth.

Elementary/Middle. These are schools potentially containing grades preschool through eighth grade. For example, some schools may be configured in kindergarten through seventh grade, while others may be fourth through eighth grade.

Middle. These are schools potentially containing grades sixth through eighth grade. For example, some schools may be configured as sixth through eighth grade, while others may be sixth through seventh grade.

Secondary. These are schools potentially containing grades sixth through twelfth grade. For example, some schools may be configured as sixth through tenth grade, while others may be sixth through twelfth grade.

Elementary/Middle/High. These are schools potentially containing preschool through twelfth grade. For example, some schools may be configured kindergarten through twelfth grade, while others may be third through twelfth grade.

Sample by Level

For elementary schools, the sample included 264 schools out of 954 TLCC responses (28%). This is compared to the state's 38% of elementary school responses. The FRL% was 46.8% for the sample, compared to 45.7% for the state, a difference of 1.1%. For elementary/middle schools, the sample included 27 schools out of 195 TLCC responses (14%), compared to the state's 24% response rate. The sample's FRL% was 50.5%, compared to the

state's 41%, a difference of 9.4%. For middle schools, the sample included 44 schools out of 267 TLCC responses (16%), compared to the state's 22% response rate. The sample's FRL% was 51.4%, compared to the state's 44.7%, a difference of 6.7%. For secondary schools, the sample included ten schools out of 117 TLCC responses (9%), compared to the state's 12% response rate.

The sample's FRL% was 55.1%, compared to the state's 47.7%, a difference of 7.4%. For combined elementary/middle/high schools, the sample included eight schools out of 114 TLCC responses (7%), compared to the state's 15% response rate. The sample's FRL% was 34.4%, compared to the state's 32.9%, a difference of 1.4%.

There were 1,647 schools that completed the TLCC survey and would have completed the CMAS assessment. The total number of schools in the study's sample was 353. The 353 schools represented 21% of the elementary through middle schools that completed the TLCC survey. The study's sample size represented 31% of the state's total TLCC staff responses.

Socioeconomic Status

This study represented SES by each school's free/reduced lunch percentage (FRL%). As a whole, the sample FRL% was representative of the state's FRL%. According to the Colorado Department of Education (2024b), the state average for elementary through middle schools was 42.4%. In comparison, the study's sample FRL% was 47.6%, which was 5.2% higher than the state average, with each school level specifically being higher.

Summary of Participants

School staff, including leaders, teachers, and support staff, completed the TLCC Survey administered by the Colorado Department of Education. Table 3.1 presents the descriptive data

and participation rates of schools and staff responses from the 2022 TLCC survey, the number of schools in each grade level sample, and the school's SES.

Table 3.1

Descriptive Statistics of Schools and Staff Responses by School Level

	School Level Response			Staff Response			SES [a]		
School Level	Sample n=	TLCC	% Represented	Sample n=	TLCC	% Represented	Sample %	CDE %	Difference %
All Schools	353	1,647	21	10,974	35,202	31	47.6	42.4	5.2
Elementary	264	9,54	28	8,149	21,342	38	46.8	45.7	1.1
Elementary/Middle	27	1,95	14	894	3,747	24	50.5	41	9.4
Middle	44	2,67	16	1,543	7,164	22	51.4	44.7	6.7
Secondary	10	1,17	9	160	1,389	12	55.1	47.7	7.4
Elementary/Middle/ High	8	1,14	7	228	1,560	15	34.4	32.9	1.4

Note. TLCC = Teaching and Learning Conditions Survey. TLCC represents the number of Colorado schools that had qualifying TLCC responses. The Sample represents the number of schools involved in this study. % Represented = the percent of Colorado schools with qualifying TLCC reports involved in this study. SES = socioeconomic status. The Sample of SES represents the sample's FRL%. CDE = Colorado Department of Education. The CDE percent represents the Colorado FRL% at that sample's level. The Difference represents the difference in the percentage of the sample and the state percentage.

[a] Socioeconomic status (SES) is represented by the school's free/reduced lunch percentage (FRL%) (Colorado Department of Education, 2024b).

Data Sources

The following section describes the instruments used in this study to define and measure the independent and dependent variables. In this study, the independent variable was represented

by the Teaching and Learning Conditions Colorado (TLCC) Survey, and the dependent variable was represented by the Colorado Measures of Academic Success (CMAS).

Teaching and Learning Conditions Colorado Survey

In Colorado, the Teaching and Learning Conditions Colorado (TLCC) Survey, developed by the Colorado Department of Education (Colorado Department of Education, 2022b), is the tool used to assess teacher satisfaction. The Colorado House Bill 08-1384 stated, “The teaching and learning conditions under which teachers practice their profession, though often overlooked, are essential elements to student achievement and teacher retention” (HB 08-1384, 2008, para. b). At its inception, the TLCC Survey was categorized into 11 constructs (listed with their respective number of questions): Instructional Practices and Support (7), Facilities and Resources (4), General Reflection (3), Community Support and Involvement (4), School Leadership (11), District Supports (9), Staff Leadership, Managing Student Conduct (5), New Staff Questions (3), Professional Development (12), and Time (7). Following the COVID-19 pandemic, seven new constructs were added: Roles and Responsibilities (7), Student Challenges (8), Support for Student Wellbeing (7), School Supports (4), Pandemic Impact on Teaching/Job (7), Support for Own Wellbeing (4), and Job Satisfaction (10).

The TLCC questions were designed using a 5-point Likert scale, ranging from strongly agree to strongly disagree, with one option for "I don't know." TLCC defined the reporting score used in this study as the *favorability rating*. These ratings represent the percentage of responses that were “Agree” and "Strongly Agree."

The TLCC Survey has been administered in digital form every two years. Licensed instructional staff, school administrators, and education support professionals complete the anonymous survey. Over time, the three consistently lowest-rated constructs have been Time,

Professional Development, and Leadership Efficacy and Support (Colorado Department of Education, 2024a). Despite the survey's intent to support school improvement planning, these primary areas of concern have remained unchanged since the survey's inception. For a school to qualify for reported TLCC data, there must be a minimum of five responses and a minimum participation rate of 50% per school (Cambridge Education, 2023).

Table 3.2 presents the descriptive information based on the 353 schools that completed the 2022 TLCC survey instrument used in this study. In total, 353 schools had both TLCC and CMAS data, with their school levels being 264 elementary, 27 elementary/middle, 44 middle, ten secondary, and eight Elementary/Middle/High. The participation rates at these school levels equaled 10,974 unique staff member responses, with 8,149 elementary, 894 elementary/middle, 1,543 middle, 160 secondary, and 228 Elementary/Middle/High.

Table 3.2

School Participant TLCC Survey Responses

	School Level Response	Staff Response
School Level	Sample n=	Sample n=
All Schools	353	10,974
Elementary	264	8,149
Elementary/Middle	27	894
Middle	44	1543
Secondary	10	160
Elementary/Middle/High	8	228

Note. TLCC = Teaching and Learning Conditions Colorado.

Colorado Measures of Academic Success Assessment

The Every Student Succeeds Act allowed states to select their academic accountability measurement system (Wilkins, 2021), and Colorado has adopted the CMAS (Education

Commission of the States, 2018). Colorado has transitioned state assessments through four versions: the Colorado Student Assessment Program, the Transitional Colorado Assessment Program, the Partnership for Assessment of Readiness for College and Careers, and, last, the CMAS in 2014 (Colorado Department of Education, 2020, 2021). CMAS assesses mathematics and reading for all third- through eighth-grade students, with select grade levels in elementary and secondary grades tested in social studies and science (Colorado Department of Education, 2023b).

For the variable of student achievement, CMAS mean scores were analyzed. CMAS mean scale scores for student achievement were not reported when fewer than 16 student scores are received (Colorado Department of Education, 2019). In examining the relationship between CTE and student achievement, selecting measures that accurately reflect students' academic performance across a broad range of skills was essential. Mathematics and ELA are fundamental subjects that form the core of the educational curriculum from 3rd to 8th grades. In the context of Colorado, the choice to focus on math and ELA data for the study was further justified by the structure of the CMAS assessment. Unlike math and ELA, which are tested annually for all students in grades third through eighth, the CMAS assessment for social studies is only administered to fourth and seventh graders, and science is only administered to fifth and eighth graders. This sporadic testing group would make it challenging to use social studies and science data for a study that aimed to measure CTE and its relationship with student achievement across multiple grade levels within a school. By concentrating on math and ELA, the study utilized consistent and annually available data, ensuring a more comprehensive analysis of student achievement trends. This consistency was imperative for accurately assessing the impact of CTE

within a whole school, making math and ELA the most suitable subjects for this Colorado-focused study's objectives.

School Student Achievement Data

The data used to measure student achievement consisted of the school-level 2022 CMAS mathematics (Math) and English language arts (ELA) mean scale scores of third- through eighth-grade students. Using mean scale scores provided a summary measure of student performance at the school level. Collective teacher efficacy is a school-wide construct; therefore, aggregated student achievement data (mean scores) were appropriate for examining a school-level variable. Mean scores offered a consistent and comparable metric across different schools, which aligned with this study's research goals. Table 3.3 presents an overview of the student achievement data by school level.

Table 3.3

School-Level CMAS Achievement Score Averages in Math and ELA

School Level	n	CMAS Mean Score		SES %
		Math	ELA	
All Schools	353	725	736	47.6
Elementary	264	731	737	46.8
Elementary/Middle	27	721	732	50.5
Middle	44	723	735	51.4
Secondary	10	717	730	55.1
Elementary/Middle/High	8	735	745	34.4

Note. SES = socioeconomic status. SES represents the sample's FRL%; ELA = English language arts; CMAS = Colorado Measures of Academic Achievement.

The table includes a breakdown by school level. Additionally, the table consists of the average SES of each school level in the sample, as indicated by the percentage of students eligible for free/reduced lunch (FRL%) (Colorado Department of Education, 2024b). The lowest individual school-level SES was 2%, and the highest was 96%.

Preliminary Data Analysis

The preliminary data analysis began with a thorough data cleaning process to ensure the accuracy and reliability of the dataset used in this study. This involved identifying and addressing missing values and errors in the raw data. Missing data were handled using appropriate statistical techniques. For instance, seven schools reported mathematics data but did not report ELA data. These schools were excluded from the analysis to maintain the integrity of the results.

The data were reviewed and checked with the university research lab before and during the statistical analysis to ensure superior accuracy. The data were continuous and normal. Also, data validation was completed two times in total to ensure the accuracy of the selected sample. Additionally, data transformations were performed as necessary to meet the requirements of the statistical tests employed. This meticulous preliminary analysis set the foundation for robust and credible findings through the phases of the statistical process.

Data Analysis

Through secondary data analysis, descriptive statistics explained the school level and response rate to the TLCC Survey and CMAS assessment. Briggs et al. (2012) identified that researchers were "likely to neglect the possibility of making use of existing data sets… yet for educational leaders concerned with levels of academic achievement or social and economic changes…the analysis of such data can provide valuable insights" (p. 281). The procedures

outlined by Briggs et al. (2012) were employed for the secondary data analysis process. First, data were examined, and variables of interest were identified. The reviewed data were a cross-sectional data set from 2022 from the TLCC Survey and the CMAS assessment. Time series data were not used due to the nature of test non-administration due to the COVID-19 pandemic.

Data analysis in quantitative research "...relate[s] one or more independent variables to one or more dependent variables" (Creswell, 2014, p. 144). The independent variables in this study were the school-wide responses gathered from the TLCC Survey questions, and the dependent variables were the CMAS student achievement scores for each school. The interplay between the independent and dependent variables allowed for exploring how the teachers' perceptions may correlate with students' academic performance.

A covariate is included in a study either to "remove extraneous variation from the dependent variable, and thereby, increase the precision of the analysis, or to remove bias due to the groups not being matched on that quantitative independent variable" (Wildt & Ahtola, 1978, para. 6). The covariate in this study was SES. Covariates are included to increase the precision of the estimates of the leading independent variable and support the isolation of the relationship between the independent and dependent variables (Agresti, 2018). Although covariates are often used in causational data analysis, this is not the case for this study. Only an association between the responses on the survey and student achievement scores was considered, and "association does not imply causation" (Agresti, 2018, p. 288). Research has indicated that although SES independently affects student achievement (Coleman et al., 1966; Perry & Mcconney, 2010; Sun & Leithwood, 2012), CTE has been found to have a greater influence than SES (Goddard et al., 2004; Hoy et al., 2002; Pearce, 2007; Tschannen-Moran & Barr, 2004).

Creation of the Collective Teacher Efficacy Construct

When selecting the most appropriate CTE measurement tool, Klassen et al. (2011) stated, "We recommend the teachers' self- and collective efficacy measures created by Tschannen-Moran and colleagues (e.g., Tschannen-Moran & Barr, 2004; Tschannen-Moran & Hoy, 2001). These measures show considerably more congruence with self-efficacy theory than many of the other measures in the studies we reviewed" (p. 40). In Tschannen-Moran and Barr's (2004) study of 66 schools, their 12-item Collective Teacher Beliefs Scale (CTBS) demonstrated a reliability of .97 (Cronbach's alpha). Their 12-item instrument focused on instructional strategies and student discipline, revealing strong correlations between CTE and higher student performance in math, writing, and English, especially in eighth grade. Even when accounting for SES, collective teacher efficacy independently influenced writing scores, which confirmed the theoretical expectations about CTE's impact on educational outcomes (see Bandura, 1993).

The CTBS from Tschannen-Moran and Barr (2004) was used as a reference for the collective teacher efficacy construct developed from the TLCC survey questions. A systematic alignment of questions from the TLCC survey to the CTBS was employed to ensure the construct validity of the newly formed measure of collective teacher efficacy. Theoretical alignment was guided by collective teacher efficacy, ensuring that the questions measured by the TLCC were conceptually compatible with those in the CTBS. The alignment process involved a detailed mapping of each TLCC question to the corresponding questions and, ultimately, categories in the CTBS. For example, questions from the TLCC addressing student behavior were mapped to similar questions in the CTBS that measured responses about student discipline. Then, each item was reviewed for its categorical alignment. Observations and considerations given by two or more individuals can negate any bias that one individual may bring to alignment

(Creswell & Guetterman, 2019). Therefore, an additional reviewer rigorously examined this process to provide inter-rater reliability, ensure accuracy, and confirm the consistency of the categorization process.

The 2022 TLCC survey included 136 questions in total. Applicable TLCC questions were broadly assigned to corresponding CTBS questions. Initially, 125 unique alignments were grouped between the TLCC and CTBS questions. Next, CTBS questions were thoroughly scrutinized for their intention and purpose, eliminating 67 TLCC questions. Next, since some questions of the TLCC were given only to school leaders and some only to support staff, the questions given to only the singular groups of school leaders or support staff were eliminated. These included three questions that had been considered for possible alignment. Then, another round of question intention and purpose was reviewed for the TLCC questions, resulting in 13 unique questions from the TLCC survey questions. Six questions aligned in the category of Instructional Strategies, and seven aligned in the category of Student Discipline.

Cronbach's Alpha

Cronbach's alpha was used to validate the newly formed construct of CTE. Cronbach's alpha is a test to measure a construct's reliability, or internal consistency (Statistics Solutions, 2024). Additionally, CFA was employed to validate the newly formed construct of CTE. The CFA statistical technique "allows researchers to test the hypothesis that a relationship between observed variables and their underlying latent constructs exists" (Statistics Solutions, 2024, para. 1). The main goal of CFA was "to confirm whether the data fits a hypothesized measurement model based on theory or prior research" (Statistics Solutions, 2024, para. 2). Due to covariance matrix errors during the construct development process for Research Questions 1 and 1a, multiple phases of Cronbach's alpha (α) calculations were required to be performed. To initially

determine Cronbach's alpha, the original values for the TLCC survey question responses were used. In the Structured Equation Modeling (SEM) analysis within RStudio, an error was reported. In order to determine the cause of the error, considerations of the following occurred: ensuring that there were more observations than variables; reviewing for missing data, non-numeric entries, or outliers; consideration of insufficient data or programming errors; and review of computational precision. It was concluded that since the TLCC survey question responses were represented as a proportion, the data had to be converted from proportions to whole numbers. The following section describes the sequence of the process for calculating Cronbach's alpha in relation to the data sets.

Phase 1

Given the existence of the CTE theorized model, RStudio was used to evaluate the theorized factor structure. To ensure appropriate question alignment, all 13 questions were included in the initial Cronbach's alpha (α) analysis. In using the TLCC observed variable of favorability rating as a proportion, the construct reported a reliability score of .78 (α), deemed *fairly high* by Taber (2018). When using all 13 questions to perform the subsequent structured equation modeling, RStudio reported a covariance matrix error. After analysis, it was determined that the TLCC survey measurement scale used to represent the question response was in error due to the measurement scale being between zero and one and expressed as a proportion. The inputted TLCC data point was a number between zero and one, causing a calculation error in outputting a value between zero and one. Therefore, an interval number representative of the range of response was created and used to convert the values. This interval range included numbers 1-10. Survey favorability scores in the range of 0 to less than 0.1 were assigned a value

of 1, scores between 0.1 to less than 0.2 were assigned a value of 2, and up through 0.9 through 1 were assigned a value of 10.

Phase 2

Due to the conversion in the representation of the survey response scores, a new Cronbach's alpha calculation was completed on the 13 interval questions. After analysis, it was determined that questions T4, T5, T8, T11, and T12 should be removed, leaving seven questions as part of the CTE construct. In analyzing all the questions, these seven questions were determined to hold together as a construct with the highest Cronbach's alpha output. With the questions converted to an interval range representative of the reported score, Cronbach's alpha reported value was 0.48, which Taber (2018) considered as *acceptable*. When tested in RStudio, an error was again reported. This error was determined to be related to the broad interval range. Therefore, a typical five-point Likert scale range was employed, and the survey response data were reconverted. Survey favorability scores in the range of 0 to less than 0.2 were assigned a value of 1, scores between 0.2 to less than 0.4 were assigned a value of 2, and up through 0.8 through 1 were assigned a value of 5. In analysis, the reported $\alpha = .399$. Taber (2018) defined this value as *low*.

The same questions that formed the reliability score of .78 (α) were used in the analysis of Cronbach's alpha, with some questions excluded in order to output an increased Cronbach's alpha value. Because of the reduced specificity of the reported favorability score, it was logical that Cronbach's alpha (α) would continue to skew lower as the interval was broadened, decreasing the accuracy and detail in analyzing each item's contribution to the overall construct.

Construct Questions

The final seven questions that formed the newly constructed CTE construct using questions from the TLCC survey were:

T2 - Students have the behavioral supports needed to focus on learning.

T3 - Rules for student behavior are enforced in a consistent manner.

T7 - Teachers and support personnel have adequate time to support their students' social and emotional learning.

T8 - Staff in this school consistently seek new and improved ways of providing instruction.

T9 - The diverse academic needs of our students are met by this school's current curriculum.

T10 - Staff in this school hold themselves accountable for the academic growth of every child.

T13 - Professional learning opportunities (e.g., instructional coaching, PLCs, training) improve instruction in this school.

Creation of the Enabling Conditions of Collective Teacher Efficacy Construct

The Enabling Conditions for Collective Teacher Efficacy Scale (EC-CTES) from Donohoo et al. (2020) was used as a reference for the EC-CTE construct developed from the TLCC survey questions. Donohoo et al.'s (2020) tool assessed EC-CTE through 20 items, divided into five categories: Empowered Teachers, Embedded Reflective Practices, Cohesive Teacher Knowledge, Goal Consensus, and Supportive Leadership. Each subscale's definition, as expressed by Donohoo et al. (2020), is summarized as follows:

- Empowered Teachers: This subscale assesses the presence of teacher leadership within the school.
- Cohesive Teacher Knowledge: This subscale measures teachers' understanding of each other's practices and their agreement on effective teaching methods.
- Goal Consensus: This subscale assesses the awareness of shared goals and the processes for setting these goals.
- Embedded Reflective Practices: This subscale examines how teams collaborate to analyze student data to inform their practices.
- Supportive Leadership: This subscale evaluates how school leadership shields teachers from distractions and acknowledges team achievements.

Each subscale includes four items, with responses scored on a 6-point scale ranging from "strongly disagree" to "strongly agree."

In their research, Donohoo et al. (2020) conducted a Confirmatory Factor Analysis (CFA) to evaluate the proposed factor structure, using data from 438 participants across 42 urban, suburban, and rural schools. The analysis showed good fit across various indices (Chi-square = 490.581, df = 142; TLI = 0.942; SRMS = 0.037; RMSEA = 0.075 [0.068, 0.082]). Composite reliability for the subscales was high, with Empowered Teachers at 0.91, Embedded Reflective Practices at 0.84, Cohesive Teacher Knowledge at 0.86, Goal Consensus at 0.88, and Supportive Leadership at 0.93. Donohoo et al. (2020) concluded that the EC-CTE tool was both valid and reliable in the context of previous research on CTE (referencing Adams & Forsyth, 2006; Bandura, 1993; Donohoo, 2018; Goddard, 2002; Goddard et al., 2015; Kurz & Knight, 2004; Ross et al., 2004). Additionally, Anderson (2021) confirmed this instrument to be theoretically sound.

For this study, in order to ensure the construct validity of the newly formed measure of EC-CTE, a systematic alignment of questions from the TLCC survey to the EC-CTES was employed. Theoretical alignment was guided by CTE and EC-CTE, ensuring that the questions measured by the TLCC were conceptually compatible with those in the EC-CTES. The alignment process involved a detailed mapping of each TLCC question to the corresponding questions and, ultimately, categories of the EC-CTES. For example, questions from the TLCC addressing perceptions of school leaders were mapped to similar questions in the EC-CTES that measured responses about leadership. Then, the item was reviewed for its categorical alignment. An additional reviewer in the field rigorously reviewed this process to provide inter-rater reliability, ensure accuracy, and confirm the consistency of the categorization process.

The TLCC survey included 136 questions in total. First, applicable TLCC questions were generally assigned to corresponding EC-CTES questions. Initially, 129 unique alignments were broadly grouped between the TLCC and EC-CTES questions. Next, EC-CTES questions were thoroughly scrutinized for their intention and purpose, eliminating 85 TLCC questions. Next, since some questions of the TLCC were given only to school leaders and some only to support staff, the questions given to only the singular groups of school leaders or support staff were eliminated. These included seven questions that had been considered for possible alignment. Then, another round of question intention and purpose was reviewed for the TLCC questions, resulting in 21 unique questions from the TLCC survey questions, with three of these questions considered as possible alignment with the 20 questions of the EC-CTES. Six questions aligned in the category of Empowered Teachers, eight aligned in the category of Embedded Reflective Practices, four aligned in the category of Cohesive Teacher Knowledge, seven aligned in the category of Goal Consensus, and six aligned in the category of Supportive Leadership.

Cronbach's Alpha

During the construct development process for Research Question 2, multiple phases of Cronbach's alpha (α) calculations were performed. To initially determine Cronbach's alpha, the original values for the TLCC survey question responses were used. In the SEM analysis within RStudio, an error was reported. In order to determine the cause of the error, considerations of the following occurred: ensuring that there were more observations than variables; reviewing for missing data, non-numeric entries, or outliers; consideration of insufficient data or programming errors; and review of computational precision. It was concluded that since the TLCC survey question responses were represented as a proportion, the data had to be converted from proportions to whole numbers. The following section describes the sequence of the process for calculating Cronbach's alpha in relation to the data sets.

Phase 1

Given the existence of the CTE and EC-CTE theorized models, RStudio was used to evaluate the theorized factor structure. To ensure appropriate question alignment, all 21 questions (labeled as questions T14-T34) were included in the initial Cronbach's alpha (α) analysis. By using the TLCC observed variable of favorability rating as a proportion, the construct initially reported a reliability score of .888 (α), deemed as *reliable* by Taber (2018); however, the analysis showed that a higher α existed with the removal of 13 questions: T16, T19, T20-26, T28, T29, and T31. Using the remaining seven questions, the construct reported a final reliability score of .970 (α).

When using all seven questions to perform the subsequent multiple regression, RStudio reported a covariance matrix error. After analysis, it was determined that the TLCC survey measurement scale used to represent the question response was in error due to the measurement

scale being between zero and one and expressed as a proportion. Therefore, an interval number representative of the range of response was created. This interval range included numbers 1-10. Survey favorability scores in the range of 0 to less than 0.1 were assigned a value of 1, scores between 0.1 to less than 0.2 were assigned a value of 2, and up through 0.9 through 1 were assigned a value of 10. This was because the observed variable was reported in a ratio, which caused an error in the calculation.

Phase 2

Due to the shift in the representation of the survey response scores, a new Cronbach's alpha was completed on the 21 interval questions. After analysis, it was determined that questions T19-T21, T24, T25, T26, T28, T29, and T31 should be removed, leaving twelve questions as part of the EC-CTE construct. In analyzing all the questions, these twelve questions were determined to hold together as a construct with the highest Cronbach's alpha output. With the questions recalibrated to an interval range representative of the reported score, Cronbach's alpha reported value was 0.779, which Taber (2018) considered *fairly high*. When tested for multiple regression in RStudio, an error was again reported. This error was determined to be related to the broad interval range. Therefore, a typical five-point Likert scale range was employed, and the survey response data were recalibrated. Survey favorability scores in the range of 0 to less than 0.2 were assigned a value of 1, scores between 0.2 to less than 0.4 were assigned a value of 2, and continuing up through 0.8 through 1 were assigned a value of 5. In analysis, it was determined to retain six questions as the final construct for EC-CTE (T14, T15, T17, T27, T32, T34), with a reported $\alpha = .759$. Taber (2018) described this value as *fairly high*.

The same questions that formed the reliability score of .970 (α) were used in the analysis of Cronbach's alpha, with additional questions excluded in order to output an increased

Cronbach's alpha value. Because of the reduced specificity of the reported favorability score, it was logical that Cronbach's alpha (α) would continue to skew lower as the interval was broadened, decreasing the accuracy and detail in analyzing each item's contribution to the overall construct.

Construct Questions

The final six questions that formed the newly constructed EC-CTE construct using questions from the TLCC survey were:

T14 - Teachers' and support personnels' professional expertise is valued.

T15 - Teachers and support personnel have an adequate level of influence on important school decisions.

T17 - School leadership puts suggestions made by staff into operation.

T27 - There is a process in place for collaborative problem solving in this school.

T32 - School leadership works to build trust among staff.

T34 - Staff feel comfortable raising important issues with school leaders.

Structured Equation Modeling

Structured equation modeling (SEM) "enables researchers to explore and analyze the relationships between observed variables and underlying latent constructs" (Statistics Solutions, 2024, para. 1). This process integrates principles from factor analysis, which identifies underlying factors from observed variables, with multiple regression analysis, which evaluates how one set of variables predicts another. According to Statistics Solutions (2024), the process for SEM begins with clearly defining the theoretical construct based on theoretical considerations and previous research findings. Next, the model is estimated using a covariance matrix of the observed variables, and the validity of the measurement model is assessed by

comparing the theoretical model with the actual data. A good fit would indicate that the hypothesized construct adequately represents the data and, thus, supports the validity of the CTE and EC-CTE construct. If the initial construct did fit the data well, modifications would be made based on theoretical justifications and the CFA's modification indicators. The final step involves interpreting the results, including examining the factor loadings of the observed variables on the construct. Interpretations include examining factor loadings and fit indices such as Chi-square (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). High and significant factor loadings provide evidence for the construct validity of the CTE measure (Agresti, 2018). Overall, the use of SEM and CFA in this study provided empirical support for the validity of the newly formed constructs of CTE and EC-CTE.

Wolf et al. (2013) explained that when contemplating sample size for SEM, "investigators usually prioritize achieving adequate *statistical power* to observe true relationships in the data" (p. 2). Statistical power relates to the probability of rejecting the null hypothesis when it was, in fact, false. Various rules of thumb have been applied to the sample size for SEM. The ratio of N:q is commonly used for minimum recommendations (Jackson, 2009). In this ratio, N represents the total sample size, and q represents the number of parameters included in the model. Bentler and Chou (1987) suggested that an acceptable N:q ratio could be as low as 5:1, and Jackson (2009) recommended as high as 20:1. In this study, the two unique reduced ratios were 18.58:1 and 16.76:1, which both fall within the acceptable range for sample size and having adequate statistical power.

Collective Teacher Efficacy Analysis

Since the construct of CTE combines multiple metrics, and the desire was to determine if this construct was associated with student achievement scores, structured equation modeling was used for the statistical analysis of Research Question 1: Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by the TLCC Survey questions, and student achievement scores? and Research Question 1a: Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the socioeconomic status of the school?

Enabling Conditions of Collective Teacher Efficacy Analysis

The correlation between the EC-CTE and student achievement was determined by analyzing the EC-CTE construct and its relationship with student achievement. The construct related to the EC-CTE was analyzed through SEM to answer Research Question 2: Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy questions, as measured by the TLCC Survey questions, and student achievement scores?

The TLCC questions related to the Enabling Conditions of Collective Teacher Efficacy Scale were the independent variables. SES was the covariate, and the CMAS student achievement scores were the dependent variable. Including SES as a covariate allowed for controlling the influence of SES on the relationship. For EC-CTE, this study intended to investigate the relationship between the individual construct and student achievement.

No known prior studies exist analyzing EC-CTE and its relationship with student achievement. Since this study did not utilize the specific Enabling Conditions of Collective Teacher Efficacy Scale itself but rather formed an EC-CTE-referenced construct, it was determined to analyze the relationship in a most rigorous manner. Given that SES is a well-

known confounding variable that can impact both CTE and student achievement, the use of SES as a confounding variable allowed for a clearer understanding of the relationship between EC-CTE and student achievement.

Conclusion

This quantitative study builds on previous CTE research to create and examine the constructs of CTE and EC-CTE for their relationship with student achievement as measured by the Colorado Measures of Academic Success (CMAS) assessment. Secondary data were gathered from the Colorado Department of Education's online public domain. The CTBS (Tschannen-Moran & Barr, 2004) and EC-CTES (Donohoo et al., 2020) informed the creation of CTE and EC-CTE constructs using questions from the TLCC. The data were analyzed using Cronbach's alpha, CFA, and SEM with the purpose of investigating the relationship of collective teacher efficacy and the enabling conditions of collective teacher efficacy with student achievement and socioeconomic status. The data collection and analysis results are discussed in the next chapter.

CHAPTER IV

RESULTS

This chapter reports the results of this study, which investigated the correlation between collective teacher efficacy (CTE) and the enabling conditions of collective teacher efficacy (EC-CTE) with student achievement. Specifically, the research was directed at identifying the contexts that best supported CTE and EC-CTE, and subsequently examining their relationship with student achievement.

The chapter is organized by the sequence in which the data were analyzed. It includes an overview of descriptive statistics and frequencies, Cronbach's alpha for CTE and EC-CTE, and the Structured Equation Modeling (SEM) considering the relationship between CTE, EC-CTE, and student achievement. The results obtained from analyzing these data for each of the three research questions are addressed in this chapter.

School Participant Summary

This study involved 353 schools across Colorado, all with qualifying Teaching and Learning Conditions Colorado (TLCC) Survey scores and Colorado Measures of Academic Success (CMAS) assessment scores. More detailed information about the sample and data analysis methods is included in Chapter Three. Student achievement was measured using the school-level 2022 CMAS mathematics (Math) and English language arts (ELA) mean scale scores for third- through eighth-grade students. The sample included schools with CMAS scores from various levels (elementary, middle, secondary, and combined levels). SES was represented

by the school's free/reduced lunch percentage (FRL%). The sample's FRL% was slightly higher than the state's average, with each school level proportionally represented.

Findings for Research Questions and Hypotheses

To ensure the reliability of the research questions, Cronbach's alpha (α) was used to measure the internal consistency of the instruments. Additionally, with consideration of validity, Confirmatory Factor Analysis (CFA) was employed to test whether the data fit the hypothesized model based on the CTE theoretical expectations. Cronbach's alpha and CFA provide a comprehensive evaluation of the survey instruments. Cronbach's alpha ensures that the instrument consistently measures the constructs. CFA is used to validate the theoretical structure of the instrument, ensuring that it measures what it is intended to measure. Given the existence of the CTE theorized model, RStudio was used to evaluate the theorized factor structure.

Research Question 1

Q1 Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by selected TLCC Survey questions, and student achievement scores?

Factor Analysis

The CFA was evaluated using multiple fit indices to determine how well it fit the data. The chi-square (χ^2) test yielded a statistic of 80.332 with 26 degrees of freedom and a p-value of less than 0.001, indicating a significant difference between the model and the data. The chi-square test is used to test the goodness of fit of a model by comparing the observed data with the data expected under the model (Satorra & Bentler, 2001). Roos and Bauldry (2022) explained that although chi-square is a theoretically sound test, "it has a couple of characteristics that have led psychometricians to develop alternative methods of assessing model fit and for researchers rarely to rely on it alone" (p. 5). This study had a few reasons why the chi-square test was not

significant. Since the chi-square test is sensitive to sample size, this study's large sample size (n=353) might have been a factor. The model complexity, with its 19 parameters, might have influenced the likelihood of a deviation from the fit.

As recommended, the model fit was assessed with additional methods. Hu and Bentler (1999) suggested that a Comparative Fit Index (CFI) close to 0.95 indicates a good fit, and values above 0.95 indicate a relatively good model. For the Tucker-Lewis Index (TLI), a value close to 0.95 is considered good (Hu & Bentler, 1999), and values above 0.90 are deemed acceptable (Bentler & Bonett, 1980). Regarding the Root Mean Square Error of Approximation (RMSEA), Hu and Bentler (1999) stated that values close to 0.06 indicate a good fit, while Jöreskog and Sörbom (1993) proposed that values below 0.08 indicate a reasonable fit, and those below 0.05 indicate a close fit. The Standardized Root Mean Square Residual (SRMR) is recommended to have a cutoff value close to 0.08 to indicate a good fit (Hu & Bentler, 1999).

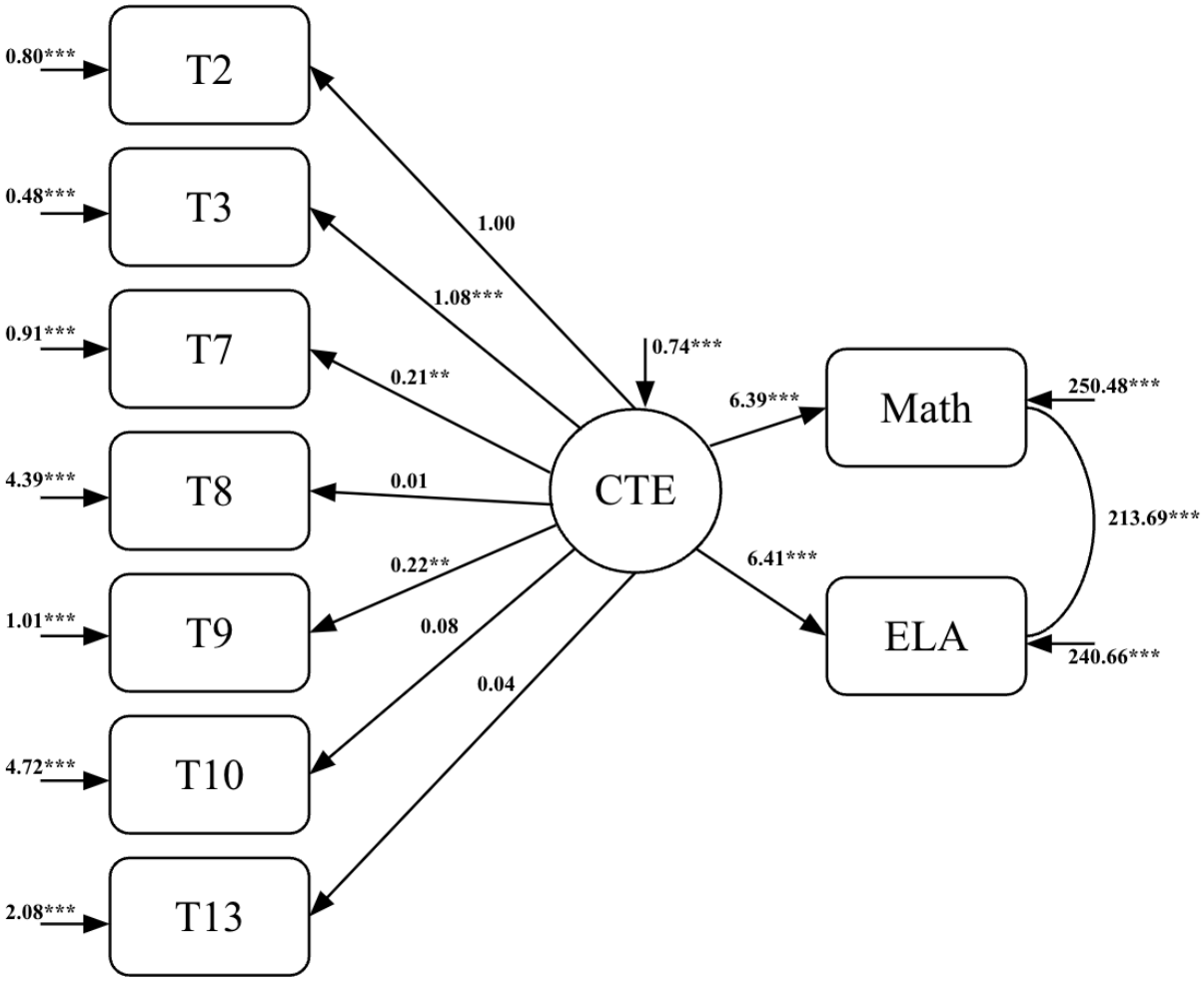
The results of this study showed that the CFI was 0.929, and the TLI was 0.901, indicating that the model fit was good, as values above 0.90 were considered acceptable. The RMSEA was 0.077, with a 90% confidence interval ranging from 0.058 to 0.096, suggesting a reasonable approximation error. The SRMR was 0.070, within the acceptable range (less than 0.08). Overall, these fit indices indicated that the model fit the data well.

Factor Loadings

Higher factor loadings indicate a stronger association between the observed variables (TLCC survey questions) and the latent variable (CTE). Figure 4.1 displays the visual representation of the SEM of CTE. Factor loadings represent how much change in the observed variable is associated with one unit of change in the latent variable (CTE). They are expressed in the original units of the variable.

Figure 4.1

Structural Equation Model Illustrating the Relationship Between CTE and Student Achievement in CMAS Math and ELA



Note. This figure is a visual representation of a structural equation model that includes both CFA and path analysis. It uses CFA to validate the measurement model (the relationship between CTE and its indicators) and path analysis to examine the structural model (the effect of CTE on Math and ELA achievement). CTE = collective teacher efficacy; CMAS = Colorado Measures of Academic Achievement; ELA = English language arts. Statistical significance is indicated by the asterisks (*** $p < 0.001$, ** $p < 0.01$).

Residual variances indicate the unexplained variance (error) in the observed variable (UCLA, 2021). In other words, residual variances focus on what is not explained by the model. High residual variances for some observed variables (e.g., T8 = 4.39, T10 = 4.72) suggested that other factors not captured by CTE may have influenced these variables.

CTE had a significant positive relationship with both Math (6.393) and ELA (6.410) scores at $p < 0.001$, indicating that higher CTE is associated with better student performance in Math and ELA. Additionally, a significant positive covariance existed between Math and ELA scores (213.689) at $p < 0.001$, suggesting that students who perform well in one subject tend to perform well in the other.

Standardized loadings represented the relationship between each observed variable (TLCC questions) and the latent variable (CTE). The standardized loading was expressed as correlation coefficients. This measure indicated the strength of the relationship between each observed variable and the latent variable. It helped determine whether the observed variables were good indicators of the latent variable and focuses on the strength of the relationship that the model explains. For example, the standardized loading of T3 is 0.802 (see Table 4.1). This meant that CTE explained 80.2% of the variance in T3. Table 4.1 presents the factor loadings, standardized loadings, and significance levels for the CTE indicators.

Table 4.1

Factor Loadings, Standardized Loadings, and Significance Levels for CTE Indicators

Question	Factor Loading	Standardized Loading	P-value	Relationship
T2	1.000	0.694	-	Strong
T3	1.078***	0.802	0.000	Strong
T7	0.212**	0.188	0.003	Weak
T8	0.011	0.005	0.941	Negligible
T9	0.216**	0.181	0.004	Weak
T10	0.082	0.033	0.597	Weak
T13	0.042	0.025	0.685	Weak

Note. CTE = collective teacher efficacy.

T2 and T3 had high factor loadings (1.000 and 1.078, respectively) and high standardized loadings (0.694 and 0.802, respectively). T3's p-value of less than 0.001 indicated a statistically significant association with CTE. These results suggested that T2 and T3 are strong indicators of CTE, making substantial contributions to the latent construct. T7 and T9 had lower factor loadings (0.212 and 0.216, respectively) but statistically significant p-values (0.003 and 0.004, respectively). Their standardized loadings (0.188 and 0.181) suggested that they are moderate indicators of CTE, contributing meaningfully, though less powerfully than T2 and T3. T8, T10, and T13 had very low factor loadings (0.011, 0.082, and 0.042, respectively) and non-significant p-values (0.941, 0.597, and 0.685, respectively). Their standardized loadings were also low (0.005, 0.033, and 0.025), indicating weak or negligible associations with CTE.

Hypothesis 1

H1 A positive relationship exists between the collective teacher efficacy scores from the TLCC Survey and CMAS student achievement scores, suggesting that higher collective teacher efficacy is associated with higher student achievement.

The regressions table (see Table 4.2) provides the data used to analyze the results relating to the hypothesis. The p-values for the Math and ELA regressions were both less than 0.001. Since both p-values are less than 0.001, these values suggested a statistically significant positive relationship between CTE and student achievement in both Math and ELA. This supports the hypothesis that higher CTE was associated with higher student achievement.

Table 4.2

Regression Analysis of CTE on Math and ELA Achievement

Model	Estimate[a]	Std. Err	z-value	P (>|z|)	Std.lv	Std.all
Math ~ CTE	6.393	1.267	5.047	0.000	5.5	0.328
ELA ~ CTE	6.410	1.247	5.140	0.000	5.514	0.335

Note. CTE = collective teacher efficacy; ELA = English language arts; Std.lv = standardized latent variables.

[a] The estimate value indicated that for every one-unit increase in CTE, there is approximately a 6-unit increase in achievement scores for both Math and ELA.

Research Question 1a

Q1a Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the socioeconomic status of the school?

Factor Analysis

The CFA was evaluated using multiple fit indices to determine how well it fits the data. The chi-square (χ^2) test yielded a statistic of 102.204 with 33 degrees of freedom and a p-value of less than 0.001, indicating a significant difference between the model and the data. Therefore, as recommended by Roos and Bauldry (2022), the model fit was assessed with additional methods. The CFI was 0.940, and the TLI was 0.918, indicating a good model fit, as values above 0.90 are

considered acceptable. The RMSEA was 0.077, with a 90% confidence interval ranging from 0.060 to 0.094, suggesting a reasonable approximation error. The Standardized Root Mean Square Residual (SRMR) was 0.082, within a borderline acceptable range (less than 0.08). Overall, these fit indices suggest that the model fits the data well.

Factor Loadings

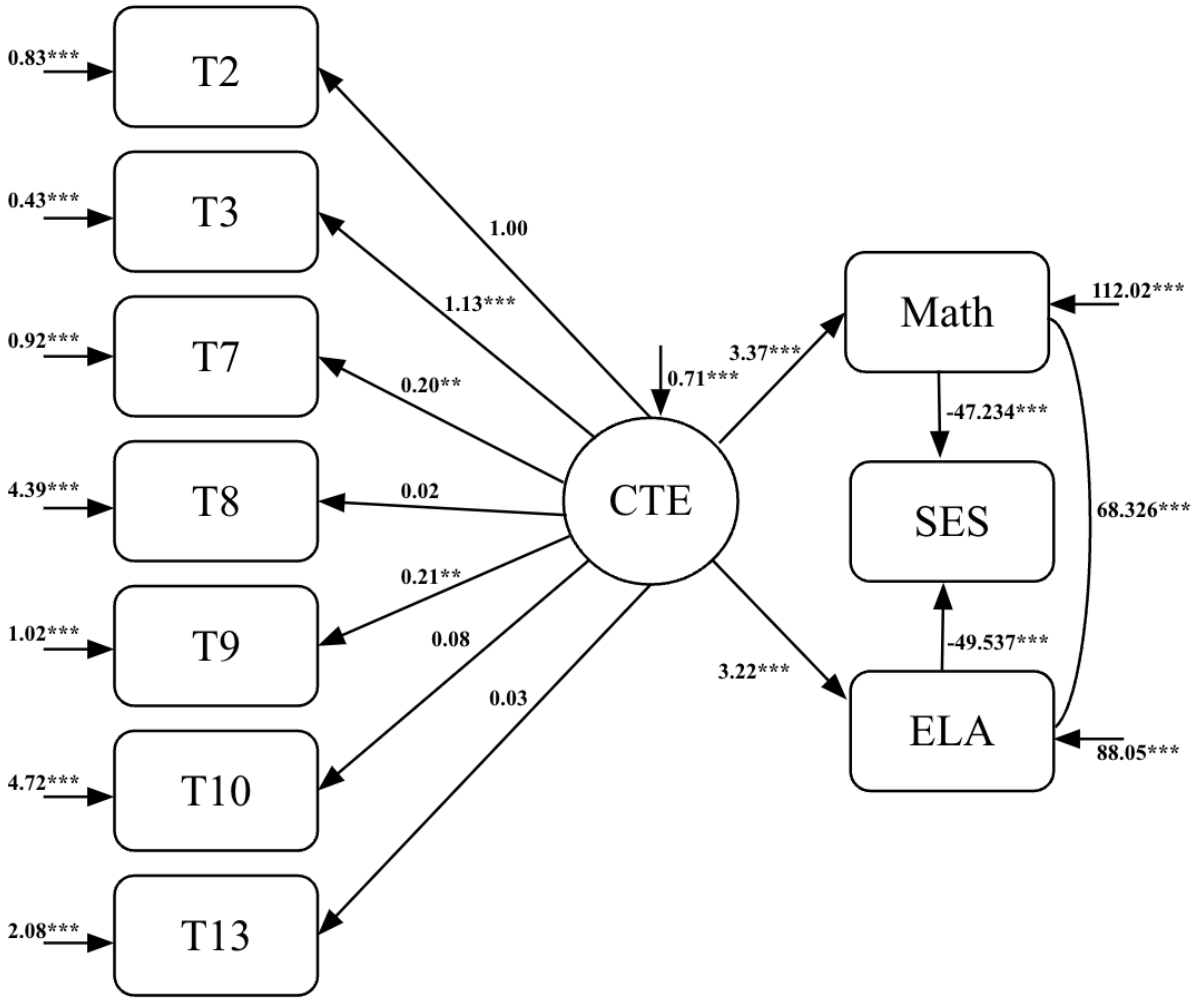
Higher factor loadings indicated a stronger association between the observed variables (TLCC survey questions) and the latent variable (CTE). The visual representation of the SEM of CTE when controlling for SES is displayed in Figure 4.2. Factor loadings represented how much change in the observed variable is associated with one unit of change in the latent variable (CTE). They were expressed in the original units of the variable.

Residual variances indicated the unexplained variance (error) in the observed variable. In other words, residual variances focus on what is not explained by the model. High residual variances for some observed variables (e.g., T8 = 4.39, T10 = 4.72) suggested that other factors not captured by CTE may influence these variables.

The regression coefficients showed that CTE had a significant positive relationship with both Math (3.365) and ELA (3.221) scores at $p < 0.001$, indicating that higher CTE was associated with better student performance in Math and ELA. SES had a significant negative effect on Math (-47.234) and ELA (-49.537), suggesting that lower SES was associated with lower achievement. Additionally, a significant positive covariance existed between Math and ELA scores (68.326) at $p < 0.001$, suggesting that students who performed well in one subject tended to perform well in the other.

Figure 4.2

Structural Equation Model Illustrating the Relationship Between CTE, SES, and Student Achievement in CMAS Math and ELA



Note. The figure is a visual representation of a structural equation model that includes both CFA and path analysis. It uses CFA to validate the measurement model (the relationship between CTE and its indicators) and path analysis to examine the structural model (the effects of CTE and SES on Math and ELA achievement). CTE = collective teacher efficacy; CMAS = Colorado Measures of Academic Achievement; ELA = English language arts. Statistical significance is indicated by the asterisks (*** $p < 0.001$, ** $p < 0.01$).

Table 4.3 presents the factor loadings, standardized loadings, and significance levels for the CTE indicators when controlling for SES. Standardized loadings focus on the strength of the relationship that the model explains. For example, the standardized loading of T3 was 0.824. This means that CTE explained 82.4% of the variance in T3.

Table 4.3

Factor Loadings, Standardized Loadings, and Significance Levels for CTE Indicators When Controlling for SES

Question	Factor Loading	Standardized Loading	P-value	Relationship
T2	1.000	0.678	-	Strong
T3	1.134***	0.824	0.000	Strong
T7	0.201**	0.174	0.005	Weak
T8	0.018	0.007	0.905	Negligible
T9	0.206**	0.170	0.006	Weak
T10	0.084	0.033	0.594	Negligible
T13	0.029	0.017	0.784	Negligible

Note. CTE = collective teacher efficacy; SES = socioeconomic status.

T2 and T3 had high factor loadings (1.000 and 1.0134, respectively) and high standardized loadings (0.678 and 0.824, respectively). T3's p-value of less than 0.001 indicated a statistically significant association with CTE. These results suggest that T2 and T3 are strong indicators of CTE, making substantial contributions to the latent construct. T7 and T9 have lower factor loadings (0.201 and 0.206, respectively) but statistically significant p-values (0.005 and 0.006, respectively). Their standardized loadings (0.174 and 0.170) suggest that they are moderate indicators of CTE, contributing meaningfully, though less powerfully than T2 and T3. T8, T10, and T13 have very low factor loadings (0.018, 0.033, and 0.017, respectively) and non-

significant p-values (0.905, 0.594, and 0.784, respectively). Their standardized loadings were also low (0.007, 0.033, and 0.017), indicating weak or negligible associations with CTE. Data analysis determined that the exclusion of these questions did not support an increase in the Cronbach's alpha value; therefore, the questions were included in the construct as they held together well with the other included questions.

Hypothesis 1a

H1a Collective teacher efficacy independently contributes to explaining the variance in student achievement scores, even when controlling for the socioeconomic status (SES) of students, demonstrating that the influence of collective teacher efficacy on student achievement is significant beyond the effects of SES.

The regressions table (see Table 4.4) provides the data used to analyze the results relating to the hypothesis.

Table 4.4

Regression Analysis of CTE (SES-Controlled) on CMAS Math and ELA Achievement

Model	Estimate[a]	Std. Err	z-value	P (>|z|)	Std.lv	Std.all
Math ~ CTE	3.365	0.825	4.077	0.000	2.89	0.172
Math ~ SES	-47.234	2.196	-21.512	0.000	-47.234	-0.745
ELA ~ CTE	3.221	0.739	4.357	0.000	2.708	0.168
ELA ~ SES	-49.537	1.950	-25.409	0.000	-49.537	-0.795

Note. CTE = collective teacher efficacy; SES = socioeconomic status; ELA = English language arts; CMAS = Colorado Measures of Academic Achievement; Std.lv = standardized latent variables.

[a] The estimate value indicated that, when controlling for SES, for every one-unit increase in CTE, there was approximately a 3-unit increase in achievement scores for Math and ELA.

The p-values for the Math and ELA regressions are both less than 0.001. Since both p-values are less than 0.001, they suggested that CTE independently contributed to explaining the variance in student achievement scores, even when controlling for the SES of students.

Research Question 2

Q2 Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy, as measured by selected TLCC Survey questions, and student achievement scores?

Factor Analysis

The CFA was evaluated using multiple fit indices to determine how well it fit the data. The chi-square (χ^2) test yielded a statistic of 38.592 with 25 degrees of freedom and a p-value of 0.040, indicating that the model fit the data reasonably well. However, the test was significant, suggesting some discrepancies between the model and the data.

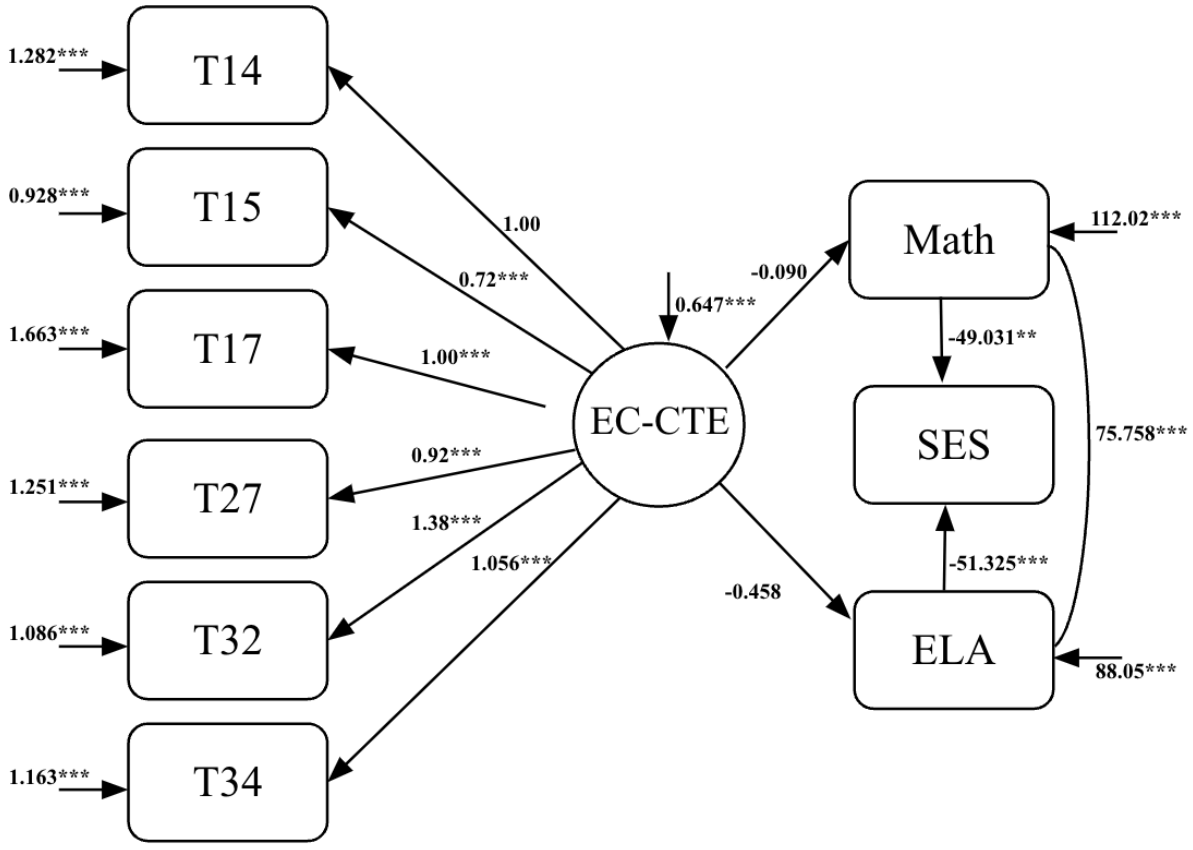
The model fit was assessed with additional methods. The CFI was 0.990, and the TLI was 0.985, indicating an excellent fit, with both indices being close to 1. The RMSEA was 0.039, with a 90% confidence interval ranging from 0.008 to 0.063, suggesting a close fit. The SRMR was 0.051, indicating a good fit. These fit indices suggest that the model provides a good to excellent fit to the data.

Factor Loadings

Higher factor loadings indicate a stronger association between the observed variables (TLCC survey questions) and the latent variable (CTE). Figure 4.3 displays the visual representation of the SEM of EC-CTE. Factor loadings represent how much change in the observed variable is associated with one unit of change in the latent variable (CTE). They are expressed in the original units of the variable. An example using the data from this study is that for each unit increase in EC-CTE, the observed variable of T32 increased by 1.38 units.

Figure 4.3

Structural Equation Model Illustrating the Relationship Between the EC-CTE, SES, and Student Achievement in CMAS Math and ELA



Note. This figure is a visual representation of a structural equation model that includes both CFA and path analysis. It uses CFA to validate the measurement model (the relationship between EC-CTE and its indicators) and path analysis to examine the structural model (the effects of EC-CTE and SES on Math and ELA achievement). EC-CTE = enabling conditions of collective teacher efficacy; CMAS = Colorado Measures of Academic Achievement; ELA = English language arts. Statistical significance is indicated by the asterisks (*** $p < 0.001$, ** $p < 0.01$).

Residual variances indicate the unexplained variance (error) in the observed variable. In other words, residual variances focus on what is not explained by the model. All observed variables were around 1, showing that their variances were similar.

The regression coefficients showed that EC-CTE did not have a significant direct effect with either Math (-0.090) or ELA (-0.090) scores at $p = 0.913$ (Math) and $p = 0.532$ (ELA), indicating that neither higher nor lower EC-CTE was associated with student performance in Math and ELA. SES significantly negatively affected Math (-49.031) and ELA (-51.325), suggesting that lower SES was associated with lower achievement. Additionally, a significant positive covariance existed between Math and ELA scores (75.758) at $p < 0.001$, suggesting that students who performed well in one subject tend to perform well in the other.

Table 4.5 presents the factor loadings, standardized loadings, and significance levels for the CTE indicators when controlling for SES. Standardized loadings indicated the strength of the relationship between each observed variable (TLCC) and the latent variable (EC-CTE). For example, the standardized loading of T32 was 0.729. This means that EC-CTE explained 72.9% of the variance in T32.

The data indicated that all six observed variables (T14, T15, T17, T27, T32, and T34) were significant indicators of the latent variable (EC-CTE). T32 stands out as the strongest indicator of EC-CTE, with the highest standardized loading (0.729). The statistical significance of all loadings suggested that each variable contributed to the construct of EC-CTE.

Table 4.5

Factor Loadings, Standardized Loadings, and Significance Levels for the EC-CTE Indicators When Controlling for SES

Question	Factor Loading	Standardized Loading	P-value	Relationship
T14	1.000	0.579	-	Strong
T15	1.723***	0.517	0.000	Strong
T17	0.998***	0.529	0.000	Strong
T27	0.920***	0.552	0.000	Strong
T32	1.377***	0.729	0.000	Strong
T34	1.056***	0.619	0.000	Strong

Note. EC-CTE = enabling conditions of collective teacher efficacy; SES = socioeconomic status.

Hypothesis 2

H2 A positive relationship exists between the scores of enabling conditions of collective teacher efficacy from the TLCC Survey and CMAS student achievement scores, indicating that better enabling conditions are associated with higher student achievement.

The regression analysis (see Table 4.6) provides the data used to determine the results of the hypothesis. The estimate for Math was -0.090 with a p-value of 0.913, and the estimate for ELA was -0.458 with a p-value of 0.532. These results indicated no statistically significant relationship between EC-CTE and Math achievement scores and no statistically significant relationship between EC-CTE and ELA achievement scores. Therefore, the hypothesis was not supported.

The estimate for SES with Math was -49.031 with a p-value of less than 0.001, and the estimate for SES with ELA was -51.325 with a p-value of less than 0.001. These results

indicated a statistically significant negative correlation of SES on Math achievement scores and a statistically significant negative correlation of SES on ELA achievement scores.

Table 4.6

Regression Analysis of EC-CTE (SES-Controlled) on CMAS Math and ELA Achievement

Model	Estimate[a]	Std. Err	z-value	P (>|z|)	Std.lv	Std.all
Math ~ EC-CTE	-0.090	0.822	-0.110	0.913	-0.073	-0.004
Math ~ SES	-49.031	2.251	-21.782	0.000	-49.031	-0.757
ELA ~ EC-CTE	-0.458	0.734	-0.625	0.532	-0.369	-0.022
ELA ~ SES	-51.325	2.005	-25.594	0.000	-51.325	-0.806

Note. EC-CTE = enabling conditions of collective teacher efficacy; SES = socioeconomic status, ELA = English language arts; CMAS = Colorado Measures of Academic Achievement; Std.lv = standardized latent variables.

[a] The estimate value indicated that, when controlling for SES, there is no increase in achievement scores for Math and ELA for every one-unit increase in EC-CTE.

Summary and Conclusion

Table 4.7 summarizes the fit indices for the CFA models examining CTE and the EC-CTE in relation to SES. The table includes each model's chi-square statistic ($\chi 2$), degrees of freedom (df), CFI, TLI, RMSEA, and SRMR. The CTE model shows a good fit with a CFI of 0.929, TLI of 0.901, RMSEA of 0.077, and SRMR of 0.070. The combined CTE/SES model also demonstrated a good fit, with a CFI of 0.940, TLI of 0.918, RMSEA of 0.077, and SRMR of 0.082. The EC-CTE/SES model indicated an excellent fit, with a CFI of 0.990, TLI of 0.985, RMSEA of 0.039, and SRMR of 0.051.

This study investigated the relationship between two constructs grounded in CTE theory. First, this study examined a new CTE construct, determined by similarity with questions on the

CTBS measurement tool (see Tschannen-Moran & Barr, 2004), with consideration of its relationship with student achievement. Next, this study considered the emerging theory of EC-CTE with student achievement by examining the relationship of the newly formed EC-CTE construct, as influenced by the EC-CTES measurement tool (see Donohoo et al., 2020), with student achievement. Through CFA and SEM, this study investigated how these constructs related to educational outcomes in Colorado elementary and middle schools.

Table 4.7

Results of the Confirmatory Factor Analysis of CTE and EC-CTE with SES in Relationship with CMAS Math and ELA Achievement Scores

Model	χ^2	df	CFI	TLI	RMSEA	SRMR
CTE	80.332	26	0.929	0.901	0.077	0.070
CTE/SES	102.204	33	0.940	0.918	0.077	0.082
EC-CTE/SES	38.592	25	0.990	0.985	0.039	0.051

Note. CTE = collective teacher efficacy; EC-CTE = enabling conditions of collective teacher efficacy; SES = socioeconomic status; ELA = English language arts; CMAS = Colorado Measures of Academic Achievement.

The analysis revealed several findings. First, CTE showed a significant positive relationship with student achievement in both Math and ELA. Schools with higher levels of CTE tended to have students who performed better academically. Two of the newly formed CTE construct questions showed high factor loadings with the newly formed CTE construct, while the other questions were weak or negligible.

In contrast, EC-CTE did not exhibit a direct significant effect on student achievement. All six questions in the newly formed EC-CTE construct showed strong factor loadings and were determined as significant indicators of EC-CTE. Additionally, the study highlighted the

persistent influence of SES on student achievement. SES showed a significant negative relationship with both math and ELA scores.

The next chapter will provide an interpretation of the study's findings. The positive relationship of CTE with student achievement will be discussed. Chapter Five also addresses the need for more research into the direct correlation of EC-CTE with student achievement while also discussing how EC-CTE can indirectly support collective teacher efficacy. Additionally, the chapter will examine the persistent negative effect of SES on student performance. Finally, the study's limitations and recommendations for future research are provided.

CHAPTER V

DISCUSSION AND CONCLUSIONS

This quantitative, correlational study aimed to investigate the relationships between collective teacher efficacy (CTE), its enabling conditions (EC-CTE), and student achievement in third through eighth grades in Colorado. The purpose of this chapter is to discuss the findings related to the research questions, interpret these findings within the context of existing literature and theoretical frameworks, and explore the implications for practice and policy. This chapter also includes the study's limitations and recommendations for future research. Additionally, unexpected results that were identified during the analysis are addressed in this chapter.

The Structure Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) results indicated that the collective teacher efficacy (CTE) models exhibited good fit indices. The enabling conditions of collective teacher efficacy (EC-CTE) model demonstrated an excellent fit. These findings suggest a strong construct validity in investigating the constructs' relationships with student achievement.

Furthermore, this study's results revealed that newly formed CTE construct had a significant positive correlation with student achievement in both mathematics and English language arts, with higher CTE levels correlating to better academic performance. Socioeconomic status (SES) was negatively correlated with student performance in both subjects. The newly formed EC-CTE construct did not directly affect student achievement.

Additionally, SES was negatively correlated with student performance in both subjects, highlighting the persistent challenge SES poses to academic success.

Distinguishing the Collective Teacher Efficacy and Enabling Conditions of Collective Teacher Efficacy Constructs

It was noted that, in this study, no questions that aligned with CTE also aligned with EC-CTE. This finding is meaningful and prompts a deeper theoretical exploration to understand why this might be the case.

The lack of overlapping questions between CTE and EC-CTE constructs in the TLCC survey can be theoretically explained through the distinct nature of these constructs. First, these constructs have different focus areas. Collective teacher efficacy focuses on the perceptions among teachers regarding their collective impact on student achievement (Bandura, 1977). The questions that aligned with CTE centered on teachers' beliefs and perceived effectiveness. These beliefs accurately aligned with Bandura's (1977) four sources of efficacy (mastery experiences, vicarious experiences, social persuasion, and affective states).

EC-CTE, conversely, relates to the specific conditions or factors within a school environment that facilitate the development of CTE (Donohoo et al., 2020). The questions that aligned with EC-CTE focused on the availability of resources, quality of leadership, and structural supports within the school. These components are aligned with the school's contextual elements (i.e., analysis of the teaching task and assessment of teaching competence) and are centered around locus of control (see Rotter, 1966).

Additionally, CTE versus EC-CTE is a comparison of direct versus indirect influence. Collective teacher efficacy directly measures teachers' efficacy beliefs, which are immediate and directly observable in their interactions and instructional practices. The enabling conditions of collective teacher efficacy (EC-CTE) indirectly influences these beliefs by creating a favorable

environment. The conditions measured by EC-CTE provide the necessary support for CTE to flourish but do not directly measure the efficacy beliefs themselves. Therefore, CTE and EC-CTE operate at different levels within the school ecosystem. Collective teacher efficacy operates at the level of teacher perceptions and collaborative interactions, while EC-CTE operates at the systemic level, influencing the broader organizational context. This hierarchical relationship means that while EC-CTE supports the existence of CTE, the specific elements measured by each construct do not necessarily overlap because they function at different layers of the school environment.

Understanding this distinction between CTE and EC-CTE is necessary for researchers and practitioners. Donohoo et al. (2020) stated:

> Collective efficacy scales are designed to capture the degree to which collective efficacy is present in a school and therefore measure teachers' future-oriented perceptions about their collective ability to motivate students, deal with disciplinary issues, and facilitate student learning. They are not designed to measure the antecedents of CTE, which would perhaps be more useful for school and district leaders in shaping their efforts to improve CTE in the institutions under their care (p. 150).

For researchers, this distinction highlights the need for precise measurement tools to capture each construct's nuances accurately. For practitioners, it emphasizes the importance of creating enabling conditions within schools to foster collective teacher efficacy. By focusing on both constructs, educational leaders may create a more holistic approach to improving student outcomes, addressing teachers' internal beliefs and the external conditions that support these beliefs (Anderson et al., 2023).

The theoretical distinction between CTE and EC-CTE helps explain why no questions in the TLCC survey aligned with both constructs. This separation highlights the importance of addressing both the internal and external factors that contribute to effective teaching and learning environments.

Collective Teacher Efficacy Construct Questions

The details of how the construct of CTE is formed are central to understanding how educator beliefs and practices influence student outcomes. This section examines the specific questions used to measure CTE, particularly focusing on their alignment with theoretical expectations and the questions of the TLCC Survey.

The strong factor loadings for T2 and T3 reflected aspects of student discipline and supported the theoretical expectation that this dimension is central to collective teacher efficacy. From the TLCC survey, T2 and T3 were as follows:

- T2 - Students have the behavioral supports needed to focus on learning.
- T3 - Rules for student behavior are enforced in a consistent manner.

Some TLCC questions aligned with ideas or practices described in multiple CTBS survey questions. T2 aligned with CTBS 8, and T3 aligned with CTBS 4, 7, and 10. The CTBS questions were:

- CTBS 4: To what extent can school personnel in your school establish rules and procedures that facilitate learning?
- CTBS 7: How well can teachers in your school respond to defiant students?
- CTBS 8: How much can school personnel in your school do to control disruptive behavior?
- CTBS 10: How well can adults in your school get students to follow school rules?

T2 addressed various aspects of creating a safe and supportive environment, fostering trust, and providing adequate social-emotional support. These factors contribute to effectively managing disruptive behavior in schools, aligning with CTBS 8. T3 addressed setting expectations, enforcing rules, maintaining a safe and supportive environment, and allocating time for various responsibilities. These elements clarified appropriate student behavior, aligning with CTBS 4, 7, and 10.

T8, T10, and T13 had low factor loadings, suggesting that these questions did not significantly contribute to measuring CTE within the newly formed construct. From the TLCC survey, T8, T10, and T13 were as follows:

- T8 - Staff in this school consistently seek new and improved ways of providing instruction.
- T10 - Staff in this school hold themselves accountable for the academic growth of every child.
- T13 - Professional learning opportunities (e.g., instructional coaching, PLCs, training) improve instruction in this school.

T8 aligned with CTBS 1 and 11, T10 aligned with CTBS 1 and 5, and T13 aligned with CTBS 9. The CTBS questions were:

- CTBS 1: How much can teachers in your school do to produce meaningful student learning?
- CTBS 5: How much can teachers in your school do to help students master complex content?
- CTBS 9: How much can teachers in your school do to help students think critically?
- CTBS 11: How much can your school do to foster student creativity?

CTBS 9 and 11 were particularly challenging in aligning adequately with the TLCC questions, as questions embodying fostering critical thinking and creativity were not included in the TLCC Survey. The CTBS 1 included aspects related to teaching practices, accountability, student support, and continuous improvement efforts, which could contribute to meaningful student learning. T8, although focused on teachers' motivation to seek new ways to improve instruction, was not directly aligned with creativity but embodied aspects such as instructional innovation and professional development. The results of these alignments were not highly unexpected, as they were initially included to ensure alignment with each CTBS question. In its final alignment, four questions from the TLCC aligned with the CTBS Student Discipline category, and three aligned with the CTBS Instructional Strategies category.

With consideration of the model of CTE alone, the results of this study showed that the Comparative Fit Index (CFI) was 0.929, and the Tucker-Lewis Index (TLI) was 0.901, indicating that the model fit was good, as values above 0.90 were considered acceptable. The Root Mean Square Error of Approximation (RMSEA) was 0.077, with a 90% confidence interval ranging from 0.058 to 0.096, suggesting a reasonable approximation error. The Standardized Root Mean Square Residual (SRMR) was 0.070, within the acceptable range (less than 0.08). Overall, these fit indices suggest that the model fits the data well.

For the model of CTE when controlling for SES, the CFA indicated a good fit for the data, validating the CTE construct. The high CFI of 0.940 and TLI of 0.918, along with a RMSEA of 0.077 and SRMR of 0.082, confirmed the adequacy of the model. These indices suggested that the TLCC Survey effectively captured the dimensions of CTE, even when considering the control for SES.

Enabling Conditions of Collective Teacher Efficacy Construct Questions

The details of the formation of the construct of EC-CTE are essential to understanding how educator beliefs and practices influence student outcomes. This section examines the specific questions used to measure EC-CTE, particularly focusing on their alignment with theoretical expectations and the questions of the TLCC Survey.

The factor loadings indicated that all six observed variables (T14, T15, T17, T27, T32, T34) were significant indicators of the latent variable (EC-CTE). The standardized loadings ranged from 0.517 to 0.729, with T32 being the strongest indicator of EC-CTE. From the TLCC survey, the EC-CTE-aligned questions were as follows:

- T14 - Teachers' and support personnels' professional expertise is valued.
- T15 - Teachers and support personnel have an adequate level of influence on important school decisions.
- T17 - School leadership puts suggestions made by staff into operation.
- T27 - There is a process in place for collaborative problem solving in this school.
- T32 - School leadership works to build trust among staff. *(strongest indicator)*
- T34 - Staff feel comfortable raising important issues with school leaders.

Some TLCC questions aligned with ideas or practices with multiple of Donohoo et al.'s (2020) Enabling Conditions of Collective Teacher Efficacy Scale (EC-CTES) questions. Due to the copywriting on the EC-CTES, specific questions cannot be revealed. Permission for survey question reference was permitted for this study (see Appendix). Though the specific questions cannot be published, the categorical alignment can be described. The following TLCC questions aligned with EC-CTE questions that were categorized into each of the following categories:

- Empowered Teachers: T14, T15 and T17

- Embedded Reflective Practices: none
- Cohesive Teacher Knowledge: none
- Goal Consensus: T27
- Supportive Leadership: T32 and T34

Notably, no questions on the TLCC were identified for inclusion in the constructs of Embedded Reflective Practices or Cohesive Teacher Knowledge. Although questions such as “Our work together is guided by a shared vision that is student focused” and “School staff participate in the school's improvement planning process (e.g., Unified Improvement Plan, school based improvement) in a meaningful way” were initially identified for possible alignment, statistically these questions were classified for exclusion when computing Cronbach’s alpha as they did not adequately hold together with the other questions to form the construct.

Cronbach’s alpha and CFA confirmed the reliability and validation of the theoretical structure of the EC-CTE construct. The high CFI score of 0.990, the TLI value of 0.985, a RMSEA of 0.039, and SRMR of 0.051 indicated an excellent model fit, suggesting that the TLCC Survey effectively captured the dimensions of EC-CTE as theorized by Donohoo et al. (2020). Donohoo et al. (2020) identified supportive leadership, empowered teachers, goal consensus, embedded reflective practices, and cohesive teacher knowledge as key components of EC-CTE.

The Relationship Between Collective Teacher Efficacy and Student Achievement

In reference to Research Question 1, Is there a statistically significant relationship between the collective teacher efficacy construct, as measured by the TLCC Survey questions, and student achievement scores?, the findings indicated a significant positive relationship between CTE and student achievement scores in both Math and ELA. The regression analysis

showed statistically significant positive relationships between CTE and student achievement in Math and ELA, with p-values less than 0.001. The results of this study aligned with previous research that found that CTE has an impact on improving student outcomes (see Eells, 2011; Hoy et al., 2002; Moolenaar et al., 2012; Pewee-Childs, 2023; Qadach et al., 2020). The positive relationship between CTE and student achievement aligns with Bandura's (1977) social cognitive theory, which posits that collective efficacy beliefs influence group performance.

Notable Results and Possible Reasons

Notable results and possible reasons for those results are detailed in this section.

Highest Factor Loadings Relating to Student Behavior

Of the questions included in the newly formed CTE construct, the two highest loading questions related to student behavior and discipline. In the TLCC survey, T2 stated that students have the behavioral supports needed to focus on learning, while T3 emphasized that rules for student behavior are enforced consistently. Questions that loaded less highly related to instructional strategies. These questions highlighted that student discipline was central to fostering a productive learning environment. These higher loadings could be due to the question wording being more theoretically aligned with CTE or could be due to the interaction of student behavior and discipline with student achievement.

High Model Fit and Low Factor Loadings

It was notable that there existed a high CFI and TLI and a low RMSEA and SRMR for the model, with a CFI of 0.929, a TLI of 0.901, a RMSEA of 0.077, and a SRMR of 0.070, indicating a good fit for the model. These indices suggest that, even with the inclusion of the above questions, the theoretical model of CTE aligned well with the observed data, validating the CTE construct.

There existed relatively low factor loadings and non-significant p-values for some TLCC questions (T8, T10, T13):

T8 - Staff in this school consistently seek new and improved ways of providing instruction.

T10 - Staff in this school hold themselves accountable for the academic growth of every child.

T13 - Professional learning opportunities (e.g., instructional coaching, PLCs, training) improve instruction in this school.

Though not unexpected, it is important to note that these questions did not effectively measure CTE and discuss the possible reasons. The low factor loadings for T8, T10, and T13 could be due to misalignment between these TLCC questions and the theoretical dimensions of CTE. Additionally, these questions had very high residual variances, indicating that the CTE construct did not explain much of the variability in responses to these questions. This suggested that factors outside of the CTE framework may have influenced these questions.

Misalignment could also stem from the nuanced wording differences and the specific context in which these questions were asked, which might not resonate with the respondents' perceptions of collective teacher efficacy. Klassen et al. (2011) explained that “in order to avoid conceptual and measurement problems that hampered early teacher efficacy studies, researchers have been encouraged to phrase self-efficacy (or collective efficacy) items with phrasing reflecting forward-looking capability” (p. 26). Two seminal CTE surveys, the Collective Teacher Efficacy Scale (CTES) (Goddard et al., 2000) and the Collective Efficacy Short Form (CE-Short Form) (Goddard, 2002) were validated and confirmed CTE as a predictor of student achievement. Tschannen-Moran and Barr (2004) and Klassen et al. (2011) determined that

Goddard's surveys were not appropriately aligned with CTE theory, specifically relating to the wording of the questioning. Tschannen-Moran and Barr (2004) then developed their own survey, the Collective Teachers Belief Scale, which Klassen et al. (2011) concluded was more congruent with theory. Klassen (2010) highlighted the benefits of using this instrument to measure CTE in concluding that the Tschannen-Moran and Barr's (2004) instrument provided a conceptually sound approach by focusing on teachers' beliefs about their collective ability to influence student achievement through evaluating individual teachers' perceptions of CTE.

The selected TLCC questions also might have needed to have been better aligned with the survey categories of CTE (instructional strategies and student discipline). Instead, the questions may have captured aspects of individual teacher practices or school-wide policies not encapsulated in the referenced CTE instrument (e.g., Tschannen-Moran & Barr, 2004). Goddard's surveys (see Goddard, 2002; Goddard et al., 2000) categorized questions into Group Competence and Task Analysis, with more focus on the teachers' competence pedagogy and student and school conditions and circumstances rather than Tschannen-Moran and Barr's (2004) survey categories of instructional strategies and student discipline. Additionally, external factors, such as school culture, administrative support, and specific local conditions, might have influenced how teachers perceived and responded to the questions.

Additional Variances

The residual variances for Math (250.482) and ELA (240.659) achievement scores were also high, indicating that while CTE explained a significant portion of the variance in student achievement, substantial factors outside of CTE influenced these outcomes. Factors outside of CTE that have been found to influence student outcomes are student SES (Pennycuff, 2010) or student demographics variables, such as parents with post-high school education (Okpala et al.,

2000). Additionally, teacher quality (Yeh & Ritter, 2023), availability of instructional resources (Greenwald et al., 1996), and access to after-school academic support (Cooper et al., 1999) could contribute to unexplained variance in student achievement. Factors such as classroom size, school infrastructure, and overall learning environment have also played a role in student performance (Adams & Forsyth, 2006). The CTE construct does not capture these factors.

The latent variable (CTE) exhibited significant variance (0.74), indicating substantial variability in the CTE construct across the sample schools. Though the value indicated that the latent construct was well represented by the observed variables, this also suggested that perceptions of collective efficacy varied widely among teachers at different schools. Differences in school environment (Hoy et al., 2002; J. C. Lee et al., 2011), leadership styles (Cansoy, 2020; Nordick et al., 2019), and family support (Skaalvik & Skaalvik, 2007) can lead to varying levels of collective efficacy among teachers. Schools with strong teacher leadership (Derrington & Angelle, 2013) and collaborative cultures (Ross et al., 2004; Tschannen-Moran & Barr, 2004) will likely exhibit higher CTE, while those with less supportive environments may show lower CTE. Access to and quality professional development opportunities can differ significantly across schools, affecting teachers' collective efficacy (Cantrell & Callaway, 2008; Donohoo, 2017; Rauf et al., 2012). The degree to which schools in this study already have policies and practices supporting collective efficacy could vary, which may have led to differences in how teachers perceived their collective ability to influence student outcomes.

The Relationship Between Collective Teacher Efficacy and Student Achievement When Controlling for Socioeconomic Status

In reference to Research Question 1a: Does collective teacher efficacy make an independent contribution to explaining the variance in student achievement when controlling for the socioeconomic status (SES) of the school?, the findings revealed that CTE, as measured by

the TLCC Survey questions, made an independent and significant contribution to student achievement scores in Math and ELA, even when controlling for students' SES. The data supported the hypothesis, with regression analyses showing statistically significant positive relationships between CTE and student achievement scores. Specifically, the p-values for Math and ELA regressions were less than 0.001, indicating strong statistical significance. These results align with previous studies (Bandura, 1993; Goddard et al., 2000, 2004; Hoy et al., 2002; Jackson, 2009; Parker et al., 2006; Tschannen-Moran & Barr, 2004) that emphasized the independent role of CTE in influencing student outcomes, regardless of socioeconomic factors.

Notable Results and Possible Reasons

Notable results and possible reasons for those results are detailed in this section.

Significant Positive Relationship Between Collective Teacher Efficacy and Student Achievement When Controlling for Socioeconomic Status

While controlling for SES, CTE had a significant positive relationship with Math achievement (Estimate = 3.365, $p < 0.001$), and CTE had a significant positive relationship with ELA achievement (Estimate = 3.221, $p < 0.001$). These results align with prior research (e.g., Bandura, 1993; Barr, 2002; Tschannen-Moran & Barr, 2004).

High Negative Correlation of Socioeconomic Status with Student Achievement

The study's results showed a high negative correlation of SES with student achievement, particularly the Math SES Estimate = -47.234, $p < 0.001$, and the ELA SES Estimate = -49.537, $p < 0.001$. The strong negative relationship between SES and student achievement is consistent with existing research (e.g., Bozkurt et al., 2021; Moolenaar et al., 2012; Parker et al., 2006; Pennycuff, 2010), highlighting the significant challenges faced by students from lower SES backgrounds (see Sirin, 2005).

The Relationship Between the Enabling Conditions of Collective Teacher Efficacy and Student Achievement

In reference to Research Question 2: Is there a statistically significant relationship between the enabling conditions of collective teacher efficacy, as measured by the TLCC Survey questions, and student achievement scores?, the findings indicated no statistically significant relationship between the EC-CTE, as measured by the TLCC Survey questions, and student achievement scores in both Math and ELA. Therefore, the hypothesis was not supported by the data. The regression analysis showed non-significant relationships between EC-CTE and student achievement in Math and ELA, with p-values of 0.913 and 0.532, respectively.

The developers of the EC-CTE (Donohoo et al., 2020) suggested the need for further research into the relationship between EC-CTE and student achievement. There is no known prior research on the relationship of EC-CTE with student achievement, so this study's results are a first look at this correlation. Due to the proven relationship of CTE with student achievement and the theoretical basis of EC-CTE from CTE, similar relational results as with CTE could be thought to exist. However, there are possible reasons why this may not be the case. These reasons are explored in more detail later in this section.

Notable Results and Possible Reasons

Notable results and possible reasons for those results are detailed in this section.

High Model Fit and High Factor Loadings

The CFA showed excellent model fit indices with a CFI of 0.990 and a TLI of 0.985. The RMSEA was 0.039, indicating a close fit, and the SRMR was 0.051, indicating a good fit. These indices suggest that the measurement model fits the data well, providing strong validation for the EC-CTE construct.

The factor loadings indicated that all six observed variables (T14, T15, T17, T27, T32, T34) were significant indicators of EC-CTE. The standardized loadings ranged from 0.517 to 0.729, with T32 being the strongest indicator of EC-CTE. This suggested that the TLCC survey questions effectively captured some aspects of EC-CTE. The included questions were as follows:

T14 - Teachers' and support personnels' professional expertise is valued.

T15 - Teachers and support personnel have an adequate level of influence on important school decisions.

T17 - School leadership puts suggestions made by staff into operation.

T27 - There is a process in place for collaborative problem solving in this school.

T32 - School leadership works to build trust among staff.

T34 - Staff feel comfortable raising important issues with school leaders.

Lack of Significant Direct Effect on Student Achievement

Despite the theoretical and empirical support for the positive relationship of CTE with student outcomes, the data did not show a statistically significant relationship between EC-CTE and student achievement. This result was unexpected, given the strong validation of the EC-CTE construct and the reported relationship with CTE. Donohoo et al.'s (2020) work in developing the Enabling Conditions of Collective Teacher Efficacy Scale (EC-CTES) was influenced by prior researchers (see Adams & Forsyth, 2006; DuFour & DuFour, 2010; Goddard et al., 2015; Marzano & Waters, 2009; Ross et al., 2004) who defined specific educational components that were antecedents of CTE. Donohoo et al. (2020) collapsed these components into their five EC-CTE categories. However, the regression analysis indicated a negligible result with estimates of -0.090 ($p = 0.913$) for Math and -0.458 ($p = 0.532$) for ELA. This finding suggested that higher EC-CTE does not directly translate to higher student achievement scores in Math and ELA.

Significant Negative Correlation with Socioeconomic Status

SES had a significant adverse effect on Math (-49.031, $p < 0.001$) and ELA (-51.325, $p < 0.001$) achievement scores. These results, again, recognized the substantial influence of SES on student performance, which may overshadow the relationship with EC-CTE.

Exclusion of Certain Teaching and Learning Conditions Colorado Survey Questions

Specific TLCC questions initially considered for alignment with the EC-CTE construct were excluded during the question alignment process. For example, questions like "Our work together is guided by a shared vision that is student-focused" and "School staff participate in the school's improvement planning process in a meaningful way" did not hold together with other questions to form the construct. This was unexpected as these questions seemed theoretically aligned with the EC-CTES. With the exclusion of particular questions, not all categories of the EC-CTES were represented. Considering the original 21 questions tested with Cronbach's alpha, all five categories of EC-CTE were represented. Therefore, in its initial review, the TLCC Survey did include questions identified as representative of EC-CTE. However, the Cronbach's alpha calculation indicated that the excluded questions did not form a stronger construct as compared to the value of the final selected questions as a construct. This discrepancy could suggest that the TLCC Survey questions each individually were not accurately representative of the EC-CTE construct, or it might indicate that the pre-defined categories of EC-CTE need further review.

Though researchers have found impactful elements of the antecedents of CTE (named by Donohoo et al. (2020) as EC-CTE) in areas such as teacher leadership (Adams & Forsyth, 2006), school leadership (Goddard et al., 2015), and goal consensus and cohesion (Ross et al., 2004), the findings of this study may suggest that EC-CTE's direct correlation with student achievement

may be limited. There exists a complex interaction of factors that influence student achievement. Furthermore, addressing the significant influence of SES and contextual factors is essential for increasing student academic success.

Implications for Practice and Policy

This section explores the implications of the study's findings in educational practice and policy. This section reviews the potential practical applications for educators and policy recommendations that could enhance efficacy and outcomes in educational settings.

Collective Teacher Efficacy

Understanding CTE's independent and significant relationship with student achievement offers key insights for educators, administrators, and policymakers. This section explores potential practical strategies for enhancing CTE in schools and policy recommendations to promote effective teaching practices and improve student outcomes.

Practice

The significant relationship between CTE and student achievement emphasizes the need for schools to foster collective efficacy among teachers and consider CTE measurement strategies. One consideration would be for professional development programs to focus on building collaborative practices and shared beliefs in teachers' capabilities to positively influence student outcomes.

Furthermore, Tschannen-Moran and McMaster (2009) found that participation in professional development formats that focused on supporting components of the sources of self-efficacy (see Bandura, 1977), which are foundational to CTE, increased teachers' sense of self-efficacy in instruction and implementation of new strategies.

Considering expectations for professional development and school processes and procedures is within the responsibility of school leaders. Donohoo (2018) emphasized the importance of school leaders' role in building a culture designed to increase CTE by stating:

> School leaders must work to build a culture designed to increase collective teacher efficacy, which will affect teachers' behavior and student beliefs. The power and promise of collective efficacy is that it can be influenced within schools, so focusing on it as a change point is a viable path to greater student achievement, greater commitment to learning, and a more inviting place to come and learn. (p. 44)

If school leaders focus on areas that help create a supportive and collaborative teaching environment to enhance CTE, ultimately, student outcomes could improve.

If CTE is not measured in a state- or district-mandated format, school leaders could consider their own measurement strategies. This process could be completed through the use of a seminal CTE measurement tool. Tschannen-Moran and Barr's (2004) CTBS measurement tool could guide these efforts. Moreover, creating specific tools for use in schools could enhance principal access and usability. Digital versions of CTE-specific measurement tools or integration into existing surveys could support the measurement process. The precise wording and inclusion of all CTE-related questions would be necessary.

The practical implications of this study suggest that schools should prioritize fostering CTE to improve student outcomes, particularly in contexts with diverse socioeconomic backgrounds. Research has consistently shown that SES is a strong predictor of student achievement, with lower SES often associated with fewer resources and greater challenges (Sirin, 2005). Enhancing CTE can help mitigate these adverse effects by empowering teachers to persevere beyond these constraints (Barr, 2002; Goddard & Goddard, 2001).

The positive relationships between CTE and student achievement, the validation of the CTE indicators, and the good model fit are all encouraging findings that support the importance of fostering CTE in schools. The significant negative correlation of SES with student achievement highlights the continued need for targeted interventions to address socioeconomic disparities in education and the potential CTE integration into these interventions.

Administrators should prioritize the factors that contribute to CTE (Ernst, 2021). Schools can implement strategies to strengthen CTE by focusing on professional development programs that emphasize identified areas of need based on their school survey results. By incorporating CTE elements such as increasing teaching skills and knowledge, creating opportunities for collaboration, involving teachers in decision-making, and providing quality feedback into schools' strategic planning processes, schools can enhance the overall effectiveness of their teaching staff and, consequently, student performance (Brinson & Steiner, 2007).

Policy

In 2008, Colorado approved HB08-1384, (HB 08-1384, 2008) titled "Teacher Recruitment and Retention." This bill declared that since "teachers have a great impact in student achievement…teacher quality can account for the majority of variances in student learning and test scores" (para. a). It further stated, "The teaching and learning conditions under which teachers practice their profession, though often overlooked, are essential elements to student achievement and teacher retention" (para. b). To address these concerns, the bill enacted a biennial survey for all teachers in public schools to support teacher recruitment, retention, and student achievement, as well as to examine the relationship between school administration and teaching conditions. After many revisions and iterations, this survey is now titled the Teaching and Learning Conditions Colorado (TLCC) Survey.

A policy consideration could be incorporating a CTE construct into this survey with additional or reworded questions that more appropriately align with collective teacher efficacy. Given the strong correlation of CTE with student outcomes (Eells, 2011) and the state requirement for the TLCC survey, a more strategic approach to integrating CTE measurements could be beneficial for school improvement efforts within the state.

From a policy perspective, the findings advocate for including CTE as a key component in educational improvement initiatives. Researchers (Abedini et al., 2018; Donohoo, 2018; Goddard et al., 2000; Tschannen-Moran & Barr, 2004) have advocated for consistent measurement of collective teacher efficacy. The introduction of a consistent measurement could involve revising teacher evaluation systems to include CTE-related questions or integrating CTE constructs into state-wide surveys like the TLCC Survey, with questions designed to capture the nuances of CTE in diverse educational settings. It would be imperative to employ careful consideration in the alignment and wording of CTE survey questions and the importance of considering broader school and community factors that influence teacher efficacy and student achievement. Due to the non-consistent factor loadings, neither the TLCC Survey questions as written nor the newly formed CTE construct were concluded to accurately measure CTE within its theoretical construction. The TLCC Survey could embed the precise language from an existing seminal CTE measurement tool, but all questions would need to be included in their totality.

Furthermore, in relation to SES, providing resources and support for professional development focused on building CTE could help mitigate the negative relationship of low SES with student achievement (Donohoo, 2017). Policies that allocate resources and funding for professional development focused on enhancing CTE could support schools in implementing

effective practices. It would be essential to consider an equitable distribution of resources to ensure that schools serving lower SES populations would have the necessary support to build strong collective teacher efficacy.

Enabling Conditions of Collective Teacher Efficacy

Understanding the independent and significant relationship of EC-CTE with student achievement when controlling for SES offers new insights for educators, administrators, and policymakers. This section explores practical strategies for enhancing EC-CTE in schools and policy recommendations to promote effective teaching practices and improve student outcomes.

Practice

The lack of previous research exploring the relationship between EC-CTE and student achievement indicates a significant gap in the literature. It is important to note that enabling conditions, often referred to in research as the antecedents of CTE, are foundational elements that precede the existence of collective teacher efficacy. These factors have been validated as theoretically relevant to fostering CTE (see Anderson, 2021; Donohoo et al., 2020). This study's findings suggest that, while enabling conditions help to build CTE, their direct impact on student achievement may be mediated through the fully developed construct of CTE rather than acting independently.

Despite the non-significant findings regarding the direct impact of EC-CTE on student achievement, the five categories of EC-CTE (Empowered Teachers, Embedded Reflective Practices, Cohesive Teacher Knowledge, Goal Consensus, and Supportive Leadership) provide a framework for school leaders to develop a conducive environment for fostering collective teacher efficacy. These five categories represent malleable contextual factors that can be adjusted and measured in school practices (Donohoo et al., 2020) and are detailed below:

Empowered Teachers. Teachers feel more empowered when they are part of essential school decisions and their professional expertise is valued. This feeling of value increases their sense of ownership and responsibility towards school improvement projects.

Embedded Reflective Practices. Even though none of the TLCC questions directly fit this category, encouraging a culture where teachers regularly reflect on and discuss their teaching strategies can lead to continuous improvement and professional growth.

Cohesive Teacher Knowledge. Providing collaborative professional development opportunities that enhance shared knowledge and instructional practices among teachers can strengthen the school's overall instructional capacity. There were no questions on the final TLCC-influenced construct that included this category.

Goal Consensus. Setting clear, shared goals focused on student success and ensuring all staff are on the same page can create a unified direction for school improvement efforts.

Supportive Leadership. Building trust among staff and fostering an environment where teachers feel comfortable raising important issues can create a supportive and collaborative school culture, which is essential for developing and sustaining collective teacher efficacy.

By focusing on these five categories, school leaders can create an environment that supports the development of CTE, ultimately leading to improved student achievement.

Policy

Incorporating measures of EC-CTE into surveys like the TLCC Survey may provide valuable data for school improvement strategies. Including EC-CTE measures may help identify areas where schools need to focus their efforts to build a supportive environment conducive to high collective efficacy. Policymakers could consider the inclusion of an EC-CTE construct in such surveys to gather insights into the conditions that foster CTE within schools.

Additionally, using the five categories of EC-CTE as a guide for school improvement plans could help schools develop targeted strategies to address specific areas of need. This alignment could provide schools with a framework to systematically develop and measure the conditions that support CTE (Anderson, 2021; Donohoo et al., 2020).

Recommendations for Future Research

The findings from this study provide insights into the constructs of CTE and EC-CTE and their relationship with student achievement. However, they also highlight several areas where further research is needed to deepen the understanding and enhance the practical application of these constructs. The following sections outline key areas for future research, with additional considerations aimed at addressing current gaps and building on the findings of this study.

Theoretical Consideration of the Constructs

The results from the CTE question alignment further validate the importance of the precision of wording and intention in questions relating to the theoretical construct of collective teacher efficacy. This aligns with previous studies that noted discrepancies in research tools not aligning with theoretical constructs (see Goddard, 2002; Klassen et al., 2011; Tschannen-Moran & Barr, 2004). For instance, Goddard (2002) and Tschannen-Moran and Barr (2004) noted the incorrect focus on theory in one of Goddard's CTE measurement tools, while Klassen et al. (2011) emphasized the strong impact of single-word changes, such as using "can" instead of "will" in question phrasing. Careful consideration in developing and refining CTE survey instruments is necessary in order to ensure they accurately capture the constructs they intend to measure.

Additionally, the findings of this study reinforce existing theoretical frameworks from Adams and Forsyth (2006) and Goddard et al. (2000) that emphasize the importance of CTE in

schools while focusing mainly on contextual factors (see Tschannen-Moran & Barr, 2004). By demonstrating that CTE significantly contributes to student achievement beyond the influence of SES, this research supports the work of researchers (e.g., Bandura, 1993; Barr, 2002; Goddard et al., 2000; Pearce, 2007) who identified CTE as a predictor of academic performance.

This study's findings suggest no statistically significant relationship between EC-CTE and student achievement, and no known existing studies corroborate similar or opposing results in achievement scores. While the newly formed EC-CTE construct held together as evidenced by a reliable Cronbach's alpha, this study represents an initial attempt to align TLCC survey questions with the EC-CTE construct proposed by Donohoo et al. (2020). While the alignment process was thorough, the theoretical constructs may require additional validation for its accuracy in representing EC-CTE, primarily since two categories of the five categories as identified by Donohoo et al. (2020) were not represented.

The findings suggest numerous external and contextual factors influence the measurement of CTE and EC-CTE with student achievement. To address this, future research should focus on the alignment and wording of CTE and EC-CTE survey questions. Specifically, it is necessary to ensure that these questions are precisely aligned with the theoretical constructs they intend to measure or are direct questions from the already validated instruments. This approach ensures that the data collected accurately reflects the constructs being studied.

Enabling Conditions of Collective Teacher Efficacy with Student Achievement

The validity of these findings is an important consideration. Further validation of the EC-CTE construct in different educational contexts would be beneficial to understanding its applicability and impact. Given the emerging construct of EC-CTE and the limited research on its relationship with student achievement, the alignment of a portion of this study’s findings with

previous CTE research suggested that the observed lack of a relationship between EC-CTE and student achievement may be consistent in future studies as well. Future research could explore the potential mediation effect of EC-CTE on student achievement, with particular consideration of all five categorical inclusions defined by Donohoo et al., (2020).

Longitudinal Designs

One gap identified in existing literature is the need for longitudinal studies related to CTE (Klassen et al., 2011). Future research could consider conducting longitudinal studies that review the implementation of practices and assess their impact over time. This approach would provide insights into the long-term relationships between the practices associated with CTE and student achievement and the interventions used to create and enhance either of these constructs.

Sample Selection

The sample of this study consisted of 353 schools, of which 264 were elementary schools. This represented 75% of the sample. Much existing literature already investigates elementary. Research into middle and high schools specifically would be helpful.

Furthermore, this study did not delineate school sizes as categorized by the Colorado Department of Education in its school size designation (i.e., rural, suburban, urban, etc.). Future studies could complete a similar investigation with additional details of school size and results aggregated in that manner. Though CTE or EC-CTE is not included, Kuziemko (2006) completed an example of a study in this context. The researcher found that math scores and attendance rates increased in smaller schools. Knowledge of this interaction with accounting for CTE could add to existing knowledge.

Socioeconomic Status

The significant negative correlation of SES with student achievement highlights the continued need for specific interventions to address socioeconomic disparities. Future research could investigate the potential integration of CTE into these interventions to understand how enhancing CTE could mitigate the adverse effects of low SES on student achievement. After they examined the relationship of SES and student achievement, Sirin (2005) stated:

> Thus, to significantly reduce the gap in achievement between low and high-SES students, policy decisions at the local, state, and federal levels must aim at leveling the playing field for students deemed to be at risk academically as a result of their family SES. (p.446)

The way in which CTE could have an influence in addressing this challenge deserves more investigation.

Recommendations for Educational Leaders and Policy Makers

Educational leaders and policymakers have an important role in enhancing CTE and its enabling conditions (Donohoo et al., 2020). To enhance CTE's positive impact on student achievement, strategic initiatives that support and maintain CTE among teachers must be introduced. This section offers practical recommendations for educational leaders and policymakers. By emphasizing CTE and EC-CTE, educational leaders can foster supportive and collaborative school cultures that promote ongoing improvement and student success.

Practice

The significant relationship between CTE and student achievement highlights the need for schools to foster collective efficacy among teachers. Professional development programs are

an accessible starting point for this enhancement. Tschannen-Moran and Barr's (2004) CTBS measurement tool could guide these efforts.

Tschannen-Moran and McMaster (2009) found that professional development formats supported efficacy components. Schools can strengthen CTE by implementing professional development programs that emphasize instructional strategy support through coaching and feedback, with thoughtful consideration that the professional development program is designed in a hands-on, applicable format (Tschannen-Moran & McMaster, 2009). Administrators are central to implementing this type of professional learning (Donohoo, 2017).

Despite the non-significant findings regarding the direct correlation of EC-CTE with student achievement, Donohoo et al. (2020) and Anderson et al. (2023) have confirmed that the five categories of EC-CTE (Empowered Teachers, Embedded Reflective Practices, Cohesive Teacher Knowledge, Goal Consensus, and Supportive Leadership) provide a framework for developing a conducive environment for fostering collective teacher efficacy.

Policy

Given the positive relationship between CTE and student achievement, policymakers might include CTE as a key component in educational improvement initiatives. This could involve revising teacher evaluation systems to include CTE-related metrics or integrating CTE constructs into state-wide surveys like the TLCC Survey. Including a CTE construct in the TLCC Survey could provide actionable data to support school improvement efforts.

Policies should allocate resources and funding for professional development focused on enhancing CTE and EC-CTE and ensure equitable distribution of resources to support schools serving lower SES populations. Incorporating measures of EC-CTE into surveys like the TLCC

could provide valuable data for school improvement strategies, helping to systematically develop the conditions that support collective teacher efficacy.

Limitations

One limitation of this study was within the statistical methods. Although robust, the use of CFA and SEM might have had limitations in fully capturing the complexities of the constructs and their relationships with student achievement. Issues with covariance matrix errors and the resulting recalibration of survey response scales might have impacted the reliability and validity of the findings. Due to the covariance errors, the TLCC survey responses had to be converted from proportions to interval scales. This conversion process might have introduced some error or imprecision, potentially affecting the measurements' accuracy and the study's overall findings.

Second, the CTE and EC-CTE constructs were created from an existing instrument in the hope that the constructs would effectively measure the variables. However, the TLCC Survey question representation of CTE and EC-CTE was non-comprehensive, as the newly formed constructs were limited to questions on the survey.

Next, this study relied on self-reported data about personal beliefs. Bandura (1977) explained that self-reported personal beliefs could be influenced by social desirability bias, recall bias, and participants' current moods or circumstances. The TLCC Survey uses a Likert scale format, assuming an equal distance between intervals for quantitative analysis. However, this assumption can be problematic if respondents perceive intervals differently, affecting the reliability and validity of the results (Creswell & Guetterman, 2019). Additionally, respondents might avoid extreme ends of the scale, leading to a central tendency bias where most responses cluster around the middle. Additionally, the TLCC Survey questions themselves were not ultimately concluded to embody the CTE or EC-CTE constructs as a whole. Collective teacher

efficacy and EC-CTE specific data through a designated measurement tool could have supported a more accurate measurement of these constructs.

Another limitation was that schools without qualifying TLCC and CMAS scores were excluded from the analysis. This exclusion could have introduced bias if the excluded schools had systematically different characteristics from the included ones.

Lastly, this study only focused on quantitative data. While the quantitative approach provided statistical analysis and comparison of the tested constructs with student achievement, the narrative of how the CTE or EC-CTE beliefs were developed and enhanced and insight into their implementation approaches and strategies were lacking.

Delimitations

This study focused on elementary and middle schools in Colorado, deliberately excluding high schools since this school level does not test on CMAS. This approach targeted the specific grade levels most relevant to the research questions. The student achievement assessment used in this study was a key consideration. CMAS measures student achievement for third through eighth graders. However, some participating schools spanned Kindergarten through eighth grade or sixth through twelfth grade, resulting in incomplete assessment data for all grade levels. The TLCC Survey measured staff perceptions across all grade levels. Since the unit of analysis for this study was the school, with CTE theoretically grounded as a construct affecting student achievement at the whole school level, CMAS scores were used to assess student achievement across the entire school in conjunction with TLCC data. Schools were selected based on having qualifying TLCC and CMAS scores, ensuring that only schools with sufficient data were included in the analysis, thus providing a controlled sample for the study.

Summary

This research focused on identifying TLCC survey questions that aligned with CTE and EC-CTE and then analyzing the constructs' relationship with student outcomes while controlling for SES. These findings highlighted the need for careful consideration in the alignment and wording of survey questions hoping to measure collective teacher efficacy. The validation of the CTE and EC-CTE model fits and the positive relationship between CTE and student achievement were encouraging findings. However, the significant negative correlation of SES with student achievement confirmed prior research and highlighted the continued need for interventions to address socioeconomic disparities in education. Integrating strategies to increase CTE into these interventions may support mitigating some of the adverse effects of low SES on student achievement.

The emerging EC-CTE construct and its direct relationship with student achievement needs further investigation. This study suggested a complex interaction of factors that influence student achievement. Further investigation of supportive contextual factors, such as those identified in the EC-CTES (Donohoo et al., 2020), is essential for future research.

School leaders play a pivotal role in school improvement efforts. Their influence is vital in creating a culture that fosters CTE through providing necessary support, resources, and professional development opportunities. Effective school leadership can drive the implementation of strategies that foster and enhance CTE, address SES disparities, and improve overall student outcomes. Future research should continue to explore the complexities of CTE and EC-CTE and its relationship to student outcomes. School leaders are integral in creating the conditions that allow CTE to thrive and, ultimately, impact student outcomes positively.

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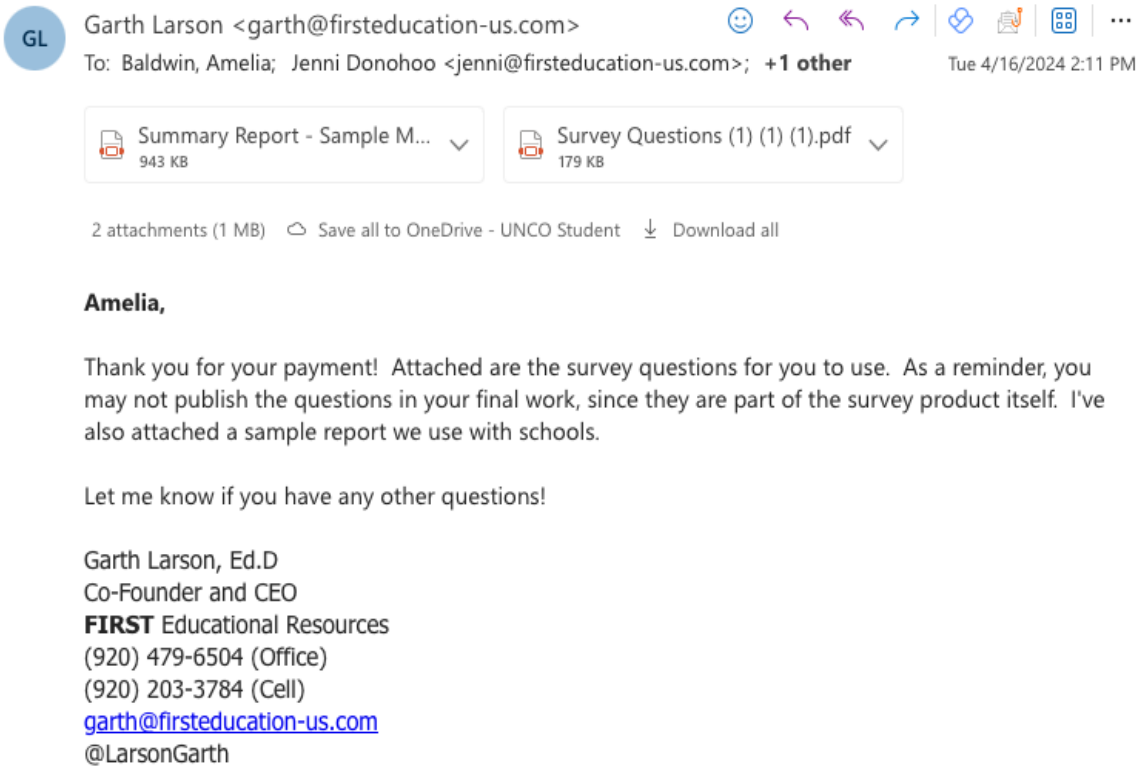
APPENDIX

PERMISSION TO REVIEW ENABLING CONDITIONS OF COLLECTIVE TEACHER EFFICACY SURVEY QUESTIONS

PERMISSION TO REVIEW ENABLING CONDITIONS OF COLLECTIVE TEACHER EFFICACY SURVEY QUESTIONS



GL

Garth Larson <garth@firsteducation-us.com>

To: Baldwin, Amelia; Jenni Donohoo <jenni@firsteducation-us.com>; **+1 other**

Tue 4/16/2024 2:11 PM

Summary Report - Sample M... 943 KB

Survey Questions (1) (1) (1).pdf 179 KB

2 attachments (1 MB) Save all to OneDrive - UNCO Student Download all

Amelia,

Thank you for your payment! Attached are the survey questions for you to use. As a reminder, you may not publish the questions in your final work, since they are part of the survey product itself. I've also attached a sample report we use with schools.

Let me know if you have any other questions!

Garth Larson, Ed.D
Co-Founder and CEO
FIRST Educational Resources
(920) 479-6504 (Office)
(920) 203-3784 (Cell)
garth@firsteducation-us.com
@LarsonGarth