AN UNTAPPED OPPORTUNITY TO SUPPORT TEACHER AND STUDENT MOTIVATION: INVESTIGATING THE ROLE OF TEACHING MOTIVATION REGULATION IN EDUCATION COURSES

By

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A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

Educational Psychology and Educational Technology—Doctor of Philosophy

2023

ABSTRACT

This mixed methods design-based research study investigated a novel instructional intervention targeting students' motivational regulation strategy use across two semesters in a teacher education course. Course sections (n = 30) were randomly assigned to either an intervention of control condition. Students in the intervention condition received additional instruction and completed activities that connected theories of motivation with specific motivational regulation strategies. Survey measures were used to assess whether there were significant differences in students' motivational beliefs and motivational regulation strategies over the course of a unit on motivation theories and due to condition assignment. Following data collection for the first semester (Study 1a), interviews were conducted to contextualize the quantitative findings and generate recommendations for a redesigned intervention (Study 1b). A redesigned intervention was tested in the second semester (Study 2) and there was an enhanced focus on the potential benefits of a unit on motivation theories due to the findings from Study 1. Overall, there were no statistically significant effects of the intervention on students' motivational beliefs of motivational regulation strategy use. However, there were statistically significant differences in students' achievement goals, mindset beliefs, and implicit theories of willpower after taking the educational psychology course and a moderating effect of the condition with students' perceptions of teacher enthusiasm on growth mindset beliefs. There were also significant changes to students' motivational regulation beliefs across the semester, specifically increased self-consequating and regulation of mastery goals, and decreased regulation of performance goals (Study 2). The findings of this study also suggest that preservice teachers' motivational beliefs and regulation strategy use is associated with teaching-related competence beliefs. Taken together, there were mixed findings of the study, which highlight

opportunities for future investigation. The study has implications for metamotivation, motivational regulation intervention development, and the teaching of educational psychology.

To the love of my life, Lewis, and my (fur) partner in crime, Liza.

ACKNOWLEDGEMENTS

There were many times while I was working on my Ph.D. that I doubted if I would be able to do it. I know that I would not be where I am today – writing the final part of my dissertation – if it were not for the support system, I am fortunate to have.

My husband Lewis has been my biggest source of strength and support throughout the ups and downs of graduate school. From the moment in Singapore that I first mentioned the idea that I wanted to get my Ph.D. to finishing many years later here in Lansing, he has been by my side. Graduate school was something we both sacrificed a lot to be able to make happen – it is no small thing to move across the country, start a new teaching job, shoulder the bulk of the financial burden, and provide emotional support and encouragement (for years!). Lewis, words cannot express how much I appreciate you. I love you.

I would also like to thank my family. It has been a wonderful gift to have my dad and stepmom move to Michigan in the final stages of this journey. They have been a great support throughout this journey, but particularly over the final phase and following the tragedy on February 13, 2023. My mom is always there when I need someone to talk to and knowing that I have someone to call when I need to has been tremendously helpful over the years. I also appreciate Russ for his encouragement and for reassuring me that I have what it takes to get a Ph.D. My sister, Gabbie, my brother, Scott, my sister-in-law, Diana, and my nephews, Scott and Valentin, have been cheerleaders along the way, and I am very appreciative of them. I also feel lucky to have married into a great crew – thank you Heather, Mike, Allie, and Jon, for your encouragement throughout this journey!

Running has become a huge part of my graduate school experience – there truly is no better way to brighten your mood and alleviate stress than getting outside on a run with your

friends. I would like thank the entire Mid-Michigan Running Club for being there for me throughout graduate school, global pandemics, and following a mass shooting on the grounds of the campus where we most like to run. No matter what was happening in the world around us (and let's be honest, it has been a lot these past few years!), it was reassuring to know that we would still meet and go for a run. I would especially like to acknowledge Catherine, Barb, Faith, Kathryn, Anne, Jen, Jocelyn, Sarynna, Claire, and Lauren. You are all amazing and I feel so lucky to have you as friends.

I have the best neighbors! Don, thank you for helping keep our house up and running when we have had very little time, and expertise, in how to do things like install blinds, change doorknobs, remove rose bushes, care for peonies, and the list goes on. Your cocktails have also helped with this grad school journey. Connie, thank you for providing countless delicious meals for us, especially during my comprehensive exams. I have also enjoyed taking a break from working on this dissertation to enjoy one of your delicious muffins! But, beyond all of the help you've provided us, I appreciate your friendship. It is so wonderful to know we have good friends living right next door to us.

Of course, my EPET community has been a huge part of this journey, and I am deeply appreciative of them. I would like to thank my close colleagues and friends, Krystal, Kimberly, Brooke, Vicky, and Samuela. I would also like to the members of the MI State Motivate Lab, with a special thanks to the postdocs and senior grad students who mentored me (You-kyung, Minhye, Stacy, Pei Pei, Kristy, Emily, Dela, and Arianna). Working alongside undergraduate researchers has been one of the best parts of graduate school! I would like to acknowledge Meredith, Sawyer, Daijin, Becca, Robin, Aubrey, Rae, Gigi, Madison, and Danielle. Also, a special thanks for Dorothy, she came through to help me get various pieces of this dissertation

across the finish line and is an incredible researcher. I also wanted to appreciate our program secretary, Sharon, for being a great listener and helping me navigate the logistics of graduate school. I have always looked forward to stopping by the 513 office bay to see you.

My committee has provided meaningful feedback to me throughout this dissertation process – and the final product is better because of all of them. I would like to thank my committee members, Lisa, Jen, Cary, and Chris, for their guidance and support in this journey. I feel so fortunate to have an incredible committee chair – Lisa. I am deeply appreciative for your support throughout graduate school. I have learned so much from working with you over the past five years and appreciate you having high expectations and encouraging me to become the scholar I want to be. You are an exceptional scholar, and I feel so lucky to have learned from you. I would also like to thank my first research mentors MSU-Denver, particularly Bethany Fleck-Dillen, who believed I had what it takes to pursue a graduate degree. I would also like to thank Dr. DeLeon Gray for being a steadfast mentor over the years and encouraging me to pursue community-engaged and equity-focused scholarship.

Working on the ASPiRES Project with the best collaborators a person could have has been another highlight of graduate school. Thank you Lindsay, Jamie, Jim, Lindy, Zoe, Brooke, and Samuela, for being a part of this work. I would also like to thank my research colleagues (particularly Meetal) at LearnPlatform by Instructure. They have provided critical support as I neared the finish line of graduate school.

Finally, I would like to thank the instructors and students that took part in this research study. You are an inspiration and the reason I did this research. Spartan Strong.

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Chapter 1:

Introduction

Schools throughout the country, particularly those that serve high-poverty students, are facing a crisis: there are not enough teachers to educate their students (Garcia & Weiss, 2019). Teacher attrition is a contributing factor to these shortages – two-thirds of the teachers leave the profession for reasons other than retirement and the turnover rates are 50% higher in Title I schools that serve low-income students (Carver-Thomas & Darling-Hammond, 2017). The teacher shortage highlights the need to equip preservice teachers with the knowledge and skills that counter attrition in the face of the complex and unpredictable challenges they will face in their jobs (Garcia & Weiss, 2019). In other words, teachers must have more than content and pedagogical knowledge (Southerland et al., 2011), they must also have the motivational beliefs (e.g., self-efficacy) and behaviors (i.e., self-regulation) that allow them to effectively respond to challenges they encounter and persist in the profession. Furthermore, by providing teachers with increased knowledge about motivation and the capacity to better regulate their motivation, their ability to support their students' motivation, engagement, and achievement may be enhanced (Kramarski, 2018; Lauermann & Karabenick, 2013).

One promising avenue to help teachers maintain motivation is to support their development of self-regulated learning while they are still students themselves (i.e., preservice teachers). Self-regulated learning is the process of systematically monitoring and controlling thoughts, behaviors, and motivation to reach learning goals (Kim et al., 2021; Pintrich, 2000; Pintrich & Zuhso, 2007; Zimmerman, 1986). Importantly, self-regulated learning assumes that students take an active role in selecting and enacting strategies (cognitive, behavioral, and motivational) that will help them complete tasks and reach their goals (Boekarts, 1996; Winne &

Hadwin, 1998; Zimmerman, 2000). Further, students construct and refine their self-regulated learning strategies over time in response to the learning environment, their goals, and past performance (Pintrich, 2000). In addition to this "self-oriented feedback loop" contributing to the development of self-regulation (Dent & Koenka, 2016, p. 427), students can be taught how to better self-regulate (Boekaerts & Corno, 2005; Schunk & Zimmerman, 1997; Zumbrunn et al., 2011). There has been extensive research about the efficacy of interventions used to increase students' self-regulated learning (see Jansen et al., 2019 for a review), but the focus of this prior work is on cognitive and behavioral regulation, so there is still limited understanding of how interventions may influence students' motivational regulation even though it is a critical component of self-regulated learning.

Self-regulated learning influences achievement and persistence (Dent & Koenka, 2016; Jansen et al., 2019; Richardson et al., 2012; Robbins et al., 2004). Since motivational regulation is implicated in self-regulated learning more broadly, and in turn achievement and persistence, teaching students how to better regulate their motivation has clear benefits for them as learners. Additionally, for students that plan to become teachers, there may be unique benefits because having the ability to regulate their own motivation may be requisite for being able to teach their students self-regulation (i.e., triple SRL-SRT model of self-regulated learning; Kramarski & Heaysman, 2021). Specifically, teachers must have self-regulation themselves (i.e., learner's role) to be able to help their students develop as self-regulated learners (i.e., teacher's role). In other words, a precondition for teaching self-regulated learning, is for the teacher to be a self-regulated learner themselves (Peeters et al., 2013).

Prior research has found that teachers play an important role in promoting students' development of self-regulated learning (Bembenutty, 2013) by modeling self-regulated learning

(Perry et al., 2008), providing suggestions or examples of how to enhance self-regulated learning (Spruce & Bol, 2015), and being able to recognize when students face obstacles and helping them overcome them (Peeters et al., 2013). However, it cannot be taken for granted that teachers innately know how to effectively model and teach self-regulated learning, rather, they must be taught self-regulated teaching skills themselves (Kramarski & Kohen, 2017; Peeters et al., 2013). Despite the importance of teachers having high levels of self-regulated learning, there is limited prior research that investigates how to provide preservice teachers with training on self-regulated learning (Kramarski & Kohen, 2017; Spruce & Bol, 2015). Furthermore, prior research on self-regulated teaching suffers a similar problem to self-regulated learning literature more broadly: self-regulated learning research has largely focused on understanding how students' develop and use different cognitive and metacognitive strategies to facilitate learning (e.g., Dent & Koenka, 2016; Winne, 2018). Motivational regulation initiates and sustains the other aspects of self-regulated learning (i.e., metacognitive and behavioral), so while understudied, it is a critical piece of the puzzle (Boekaerts, 1996; Pintrich, 2000; Wolters, 2003). Consequently, there is a particular need to understand how to facilitate the development of preservice teachers' motivational regulation.

Thus, a critical question arises: how do we teach preservice teachers to regulate their motivation? Explicit instruction about motivation may be one avenue for increasing an individual's metamotivational knowledge, and in turn, their ability to effectively regulate their motivation (Wolters, 2003). However, prior research has not investigated whether pairing instruction about motivation theories can be leveraged to influence students' motivation regulation (Miele & Scholer, 2018). Educational psychology courses provide a particularly ripe opportunity to test whether teaching about motivation theories and motivational regulation

influences students' self-regulated learning. Furthermore, as educational psychology courses are often required as part of teacher education programs, instruction about self-regulation has the potential to help future teachers become more effective learners, and in the future, more effective teachers (Dembo, 2001). Equipping preservice teachers with an enhanced ability to support their students' motivational regulation will ensure they are better able to help their students succeed, which will contribute to their own success as teachers (Bembenutty et al., 2022). Therefore, the teaching of motivational regulation may be one avenue to support teachers' persistence in the profession. Furthermore, as students enrolled in educational psychology courses may also include non-preservice teachers, there are implications of teaching motivational regulation for helping all students be better able to self-regulate their learning regardless of their future professional plans.

To address the need to understand how to support college students' self-regulated learning, this dissertation research uses a design-based research approach (Bell, 2004; Design-Based Research Collective, 2003; McKenney & Reeves, 2018) to develop and test the effectiveness of an instructional intervention to promote motivational regulation as part of an educational psychology course. A design-based research approach was selected for this study because the goal is to use an iterative, data-driven process to develop an effective instructional intervention (McKenny & Reeves, 2014). Aligned with this broad approach, I used iterative experiments (two studies) to test a new approach for supporting students' development of motivational regulation skills. Specifically, for the first study, I used a 2 (intervention vs. control) X 2 (preservice teachers vs. other majors) experimental design to examine the direct effects of the intervention on students' motivational regulation strategy use and teaching motivation[1], with

[1] Teaching motivation was only assessed for students planning to become teachers.

an emphasis on potential differences based on whether students plan to become teachers. Additionally, as part of the first study, I conducted interviews with a purposive sample of participants about their motivational regulation strategies and perceptions of the intervention to more fully characterize the quantitative findings from the first study and inform potential improvements to be tested for the second study (Creswell & Plano Clark, 2018; Ivankova & Wingo, 2018; Nastasi et al., 2007). Furthermore, since motivational regulation is associated with one's broader motivational beliefs (Kim et al., 2020) and was taught as part of a unit on motivation theories, I also investigated whether the intervention and the teaching of motivation theories, were associated with changes in students' motivational beliefs. For the second study, I redesigned aspects of the intervention based on the findings from the first study and investigated whether the modified intervention was effective in shifting students' motivational regulation strategies. Additionally, I also more precisely examined whether students' motivational beliefs shifted as a function of being taught about motivation theories and investigated the role of students' perceptions of their instructors' motivation as a potential factor shaping their own motivational regulation. By examining motivational regulation, this study addresses an understudied area of motivation research (Wolters, 2011; Miele & Scholer, 2018). Moreover, this study provides a novel contribution to the educational psychology literature by testing a novel instructional intervention within the context of educational psychology courses, with implications for teacher preparation programs.

Chapter 2:

Literature Review

In this chapter I begin by discussing the theoretical framework. Next, I provide an overview of the concept of motivational regulation (Wolters, 2003), including how it is situated within the broader achievement motivation and self-regulation literature, with a particular focus on potential beneficial outcomes for college students and preservice teachers in particular. Then, I summarize the literature on motivation interventions, with a focus on interventions used to influence students' motivational beliefs and self-regulation, since both are implicated in motivational regulation. As part of this review, I also examine extant literature on interventions specifically focused on equipping future and current teachers with the skills needed to support their students' self-regulated learning. I aim to show how and why an instructional intervention in the context of an educational psychology course may be particularly effective in supporting students' development of motivational regulation and highlight the potential added benefits for students that plan to become teachers.

How to Support Motivational Regulation: Theoretical Framework

Theories of achievement motivation posit that an individual's distinct beliefs about whether they can and want to do an academic task explain why they choose to engage in and persist on the task (Schunk et al., 2014). While it is well-established that students' beliefs are important proximal predictors of engagement and persistence (Eccles & Wigfield, 2020), we do not fully understand how students' beliefs influence their selection and use of different strategies to maintain motivation over time (Wolters, 2003). Models of self-regulated learning describe these processes by examining how an individual takes an active and purposeful role in maintaining their cognition, behavior, and motivation in achievement situations (Pintrich, 2000).

Regulation of motivational states has been identified as a critical component of self-regulated learning (Wolters, 2003). For this dissertation study, I used an integrated theoretical framework of achievement motivation to examine whether students' motivational beliefs and motivational regulation strategies shift as they learn about theories of motivation in the context of a teacher education course. In the next section, I describe how this theoretical framework underpins motivational self-regulation.

Integrated Theoretical Perspective of Achievement Motivation

Achievement motivation is the result of how one answers two anchor questions that reflect an individuals' beliefs, goals, and values. The first question, "can I do this?", captures an individual's competence beliefs and the second question, "why do I want to do this?" denotes their goals and value beliefs for the outcomes of the task (Eccles & Wigfield, 2002). These two questions provide an "anchor point" for understanding the unique sets of beliefs that underpin motivation and a way for consolidating constructs from multiple theories (Linnenbrink-Garcia & Wormington, 2019, p. 741). In other words, the two questions (can and why) provide a framework for an integrated theoretical approach for conceptualizing achievement motivation. The integrative perspective of achievement motivation detailed by Linnenbrink-Garcia and colleagues (Linnenbrink-Garcia et al., 2018; Linnenbrink-Garcia & Wormington, 2019) draws from prominent motivation theories including interest (Renninger & Hidi, 2016), social cognitive (Bandura, 1986), expectancy-value (Eccles et al., 1983), and achievement goal theories (Ames, 1992; Dweck & Leggett, 1988). Using this integrative approach to studying motivation is helpful because it allows for balancing precision with utility – a challenge within the achievement motivation literature (Anderman, 2020) that may contribute to the challenge of using research in teaching practice (Linnenbrink-Garcia & Wormington, 2019). In terms of precision, it is

beneficial to account for the fact that no single construct or theory of achievement motivation fully encapsulates the processes that instigate and maintain engagement in a task (Linnenbrink-Garcia et al., 2018; Linnenbrink-Garcia & Wormington, 2019; Wigfield & Cambria, 2010). For example, achievement goals, value beliefs, and interest answer the same question ("why do I want to do this?"), but are conceptually distinct and form a broader set of beliefs that may lead to different patterns of motivation (Urdan & Kaplan, 2020). In terms of utility, students in teacher education courses learn about multiple beliefs that underpin motivation (Anderman, 2020; Murphy & Alexander, 2000), but there is a need for them to be able to find connections across the theories of common themes. An integrative perspective of achievement motivation does this by providing a rich and parsimonious framework that students can use to make sense of their own motivational beliefs and related regulation strategies as they learn about multiple theories of motivation. Given the focus of this dissertation work on not only gaining a nuanced understanding of whether students' motivational beliefs and regulation strategies are impacted by different instructional approaches, but also on providing actionable insights for teacher education, an integrative perspective of motivation that balances precision and utility is needed.

To provide an overview of the theoretical basis of the integrative perspective of achievement motivation, I briefly describe social cognitive, expectancy-value, interest, and achievement goal theories and then describe the constructs from each theory using the two anchor questions ("*can I do this*?" and "*why do I want to do this*?") stipulated by the integrative perspective of motivation (Linnenbrink-Garcia & Wormington, 2019). Social cognitive theory stipulates that self-efficacy is important for motivation (Bandura, 1986). Self-efficacy captures an individual's beliefs about whether they have the capacity to be successful on a particular task or domain. When a student has high self-efficacy beliefs, they believe that they either have, or

can develop, the skills needed to achieve. Expectancy-value theory stipulates that both an individual's expectation of success (i.e., competence (expectancy) beliefs) *and* perceived value (i.e., subjective task value) of a particular task are the proximal predictors of achievement and achievement-related choices (Eccles et al., 1983; Eccles & Wigfield, 2020). In other words, expectancy-value theory acknowledges that it is important not only for a student to believe they can do the task, similar to social cognitive theory, but that it is also necessary for them to want to do the task because it is valuable to them. On the other hand, interest theory focuses on why students want to engage in a task (Renninger & Hidi, 2016). Interest can be both a state and a more enduring trait-like motivational phenomena and is characterized by positive emotions, such as enjoyment and curiosity, which can be supported by the environment, but also reflects what an individual finds to be meaningful. Achievement goal theory also provides an answer to the question: "why do I want to do this?". Achievement goal theory stipulates a framework for understanding how the aims or purposes (i.e., mastery and performance goal orientations) an individual has within achievement settings influences patterns of cognition, affect, and behavior (Ames, 1992; Dweck & Leggett, 1988; Nicholls, 1984). Furthermore, according to achievement goal theory students' mindset beliefs, or implicit theories about the malleability of intelligence, underpin achievement goals (Cury et al., 2006; Dweck & Leggett, 1988).

In addition to stipulating how an individuals' beliefs about whether they can and want to do a task, there are several other reasons why these four theories (i.e., social cognitive, expectancy-value, interest, and achievement goal) were included in the integrative perspective of achievement motivation. First, these theories were included because of the preponderance of research tying the focal constructs of each theory with academic outcomes (e.g., Linnenbrink-Garcia & Patall, 2016; Wigfield & Cambria, 2010). Second, the theories use social-cognitive

frameworks of motivation that assume the individual has agency over their motivation which is a result of their beliefs (Wigfield et al., 2016; Bandura, 2006). Given the assumption that humans have agency to organize their thoughts, emotions, and behaviors for goal pursuit, social-cognitive frameworks are also useful for understanding self-regulated learning (Usher & Schunk, 2018). Third, prior research that found evidence that integrating across theories is useful (Conley, 2012) because the constructs interact in meaningful ways. For example, prior research on achievement goals found that students endorse multiple types of goals simultaneously (e.g., performance-approach and mastery-approach goals), which form distinct combinations that differentially relate to achievement outcomes (Wormington & Linnenbrink-Garcia, 2017). Another example, is that prior research found there is a multiplicative effect of expectancy and value beliefs, so looking at them together is important (Trautwein et al., 2012). The integrative perspective on achievement motivation does not conceptualize motivation as being derived from innate needs as stipulated by self-determination theory (Deci & Ryan, 1985), but does have alignment with the notion that there can be different forms of motivation, such as intrinsic motivation (Linnenbrink-Garcia & Wormington, 2019). For example, prior research using this perspective found that students with more intrinsic forms of motivation (i.e., high task value and mastery goals) had higher achievement and engagement (Linnenbrink-Garcia et al., 2018). In the next two sub-sections, I describe the motivational constructs described by an integrative perspective of achievement motivation in more detail using the two anchor questions (Linnenbrink-Garcia & Wormington, 2019).

Can I Do This? Self-efficacy and expectancy beliefs capture an individual's perceptions of whether their current and/or expected levels of competence are adequate for them to be successful on a given task or within a particular domain (Wigfield & Eccles, 2000). In other

words, both types of competence beliefs provide the answer to the question: *can I do this?* Since expectancy beliefs have conceptual overlap with self-efficacy, researchers often use domain- or task-specific measures of self-efficacy to measure expectancy beliefs and reflect perceived competence (Linnenbrink-Garcia & Wormington, 2019). Competence beliefs are theorized to influence students' value beliefs (Trautwein et al., 2012) and achievement goals (Dweck & Leggett, 1988), so it is important to consider these beliefs together as an integrated motivational belief system (Linnenbrink-Garcia et al., 2018).

Why Do I Want To Do This? There are several sets of beliefs from this integrative perspective that provide an individual with the answer to the question of *why do I want to do this?*: interest (Renninger & Hidi, 2016), subjective task value (Eccles et al., 1983), and achievement goals (Ames, 1992). Subjective task value, a key construct in expectancy-value theory, encapsulates an individual's beliefs about why they may want to engage in a particular task or domain and is composed of four different dimensions: intrinsic value, utility value, attainment value, and cost (Wigfield & Eccles, 2020). Intrinsic value captures the enjoyment and interest one may get while engaged in a task. There is conceptual overlap between intrinsic value and individual interest (as conceptualized by interest theory, Renninger & Hidi, 2016), therefore, it is reasonable to use subjective task value to represent interest (Linnenbrink-Garcia & Wormington, 2019). Utility value refers to the perceived usefulness of a task for an individual's current or future plans. Attainment value arises when a task is aligned with one's sense of self or identity. An individual's beliefs about the relative costs of engaging in a particular task combine with their value perceptions to inform their overall assessment of whether they want to do the task (i.e., subjective task value; Eccles et al., 1983). Cost reflects an individual's beliefs about whether engaging in a task will be worth the effort (i.e., effort cost), whether the task will be too

stressful (i.e., emotional or psychological cost), and whether it is worth giving up other alternatives to do the task (i.e., opportunity cost, Perez et al., 2014). Expectancy-value theory is a foundational framework for understanding how students' achievement-related choices are informed by their beliefs about their ability and the value of task-engagement, which lead to different outcomes.

In addition to thinking about the value a task may have, a person can also answer the question of why they would want to do something by assessing whether it aligns with their primary purpose within an achievement situation. According to achievement goal theory, there are two potential aims a person has within achievement situations that provide them with a reason for engaging in a particular task (Dweck, 1986; Maehr & Nicholls, 1980; Nicholls, 1984). The first reason is that they want to develop their competence by learning something new – a mastery goal. Alternatively, they may be driven to show themselves as more competent than others – a performance goal. These two types of achievement goals are hypothesized to develop as a function of an individual's implicit beliefs about the malleability of ability, which in turn, result in distinct patterns of cognition, affect, and behavior (Dweck & Leggett, 1988). Specifically, it is posited that when an individual believes their ability can be improved through effort, they will be more likely to endorse mastery goals, whereas the belief that ability is fixed will be associated with performance goals. Therefore, in addition to providing a reason for engaging in a particular task, achievement goals are also thought to provide a framework for how an individual interprets achievement situations because it reflects their implicit beliefs about whether they can meaningfully enhance their ability level.

The original dichotomous model of achievement goals has been extended to include an approach-avoidance valence for performance goals (Elliot, 1999). This extension provided a

more nuanced conceptualization of achievement goals and led to the development of additional models of achievement goals, including the trichotomous, 2 X 2, and 3 X 2 models. The trichotomous model uses three types of achievement goals: mastery-approach, performance-approach, and performance-avoidance (Midgley et al., 2001). Individuals with mastery-approach goals will seek to learn as much as possible. Mastery-approach goals arise when students believe they can learn and improve by exerting greater effort -- a growth mindset (Dweck, 2000). The primary aim of performance-approach goals is to display competence while the focus of performance-avoidance goals is on avoiding the appearance of incompetence. Performance goals are associated with fixed mindset beliefs (Dweck & Leggett, 1988). Specifically, students with a fixed mindset and high perceived competence are hypothesized to endorse performance-approach goals because they believe they will compare favorably to others (Cury et al., 2006). Whereas, students with a fixed mindset and low perceived competence are posited to adopt performance-avoidance goals because they believe they are likely to appear incompetent relative to others. The 2 X 2 achievement goal model also includes mastery-avoidance goals, which reflect the aim of avoiding losing skills that a person once had (Cury et al., 2006). The 3 X 2 achievement goal model distinguishes between task, self, and other-based goals with an approach-avoidance valence (Elliot et al., 2011). In the present study, I used the trichotomous achievement goal framework because mastery-avoidance goals are found to be less common and relevant to younger populations who are not yet experiencing cognitive or physical declines due to aging (Elliot & McGregor, 2001). Furthermore, the 3 X 2 framework describes achievement goals as standards rather than broader goal orientations (Urdan & Kaplan, 2020), which is different from how motivational regulation of achievement goals was conceptualized (Wolters, 2003). Since achievement goals provide an underlying purpose and framework for understanding

achievement-related tasks, they are important constructs to understanding patterns of motivation (Linnenbrink-Garcia et al., 2018).

The integrative perspective of achievement motivation assumes that the different constructs combine to explain whether a person will be motivated or not in a given situation or with regard to a specific task (Linnenbrink-Garcia & Wormington, 2019). Given this, it is important to examine multiple variables concurrently when considering how motivational beliefs intersect with self-regulated learning (Winne & Hadwin, 2008). Furthermore, prior literature found that beliefs included in an integrative perspective of motivation are associated with self-regulated learning, including self-efficacy, mastery goals, value, and interest (Pintrich, 2000; Schunk & Ertmer, 2000; Wigfield, 1994; Wolters, 2003). In the next section, I will examine the relations of specific motivational beliefs with self-regulated learning, and motivational regulation in particular, to provide a rationale for a motivational regulation intervention as part of an instructional unit that uses an integrative perspective of motivation.

Motivational Regulation: A Critical Factor of Self-Regulated Learning

Self-regulated learning is defined as "the ways that learners systematically activate and sustain their cognitions, motivations, behaviors, and affects, toward the attainment of their [learning] goals" (Schunk & Greene, 2018, p. 1). Models of self-regulated learning assume that individuals are active agents in their learning and construct "their own meanings, goals, and strategies" based on their situation and their personal beliefs and goals (Pintrich, 2000, p. 452). Self-regulated learning is informed by one's broader motivations and goals (Efkides et al., 2018). Once a person sets a goal for themselves, which is informed by their broader motivational beliefs (e.g., self-efficacy, value perceptions), they will use self-regulation strategies to monitor, control, and regulate particular aspects of their cognition, motivation, behavior. While self-regulated

learners are characterized as effective at managing their thoughts (e.g., use cognitive and metacognitive strategies; Butler & Winne, 1995; Winne, 2018) and behaviors (Zimmerman, 1989), they are also able to control their own states of motivation (Pintrich, 2000). This ability to instigate, monitor, and maintain motivation (i.e., motivational regulation; Wolters, 2003) is positively related to engagement and achievement (Schwinger & Steinsmeier-Pelster, 2012). The importance of motivational regulation to self-regulated learning more broadly is evident across multiple models of self-regulated learning (see Panadero, 2017 for a review). Nevertheless, despite the importance of motivational regulation for self-regulated learning, and in turn achievement, there is limited knowledge of how a person seeks to manage their motivation and use what they understand about motivation (i.e., metamotivational knowledge; Miele et al., 2020) to do so. Therefore, this dissertation research is focused on investigating whether learning about motivation influences motivational regulation, since it is an important, but understudied, component of self-regulated learning.

A Social Cognitive Perspective of Motivational Regulation

Social cognitive theory assumes that an individual has agency to control aspects of their beliefs, actions, and environment, while also being influenced by these factors (i.e., model of triadic reciprocal causation; Bandura, 1989). This assumption, that students can actively monitor and control their motivation, is fundamental to models of motivational regulation (Wolters, 2003) and is aligned with an integrative theoretical perspective on motivation (Linnenbrink-Garcia & Wormington, 2019). According to social cognitive theory, personal, environmental, and behavioral factors all contribute to self-regulated learning (Usher & Schunk, 2018); therefore, a social cognitive perspective provides a useful and comprehensive framework for understanding the processes that underpin motivational regulation. Specifically, a social

cognitive perspective to motivational regulation details how an individual's integrated motivational beliefs (i.e., personal factors), knowledge/skills of motivational regulation strategies (i.e., behavioral factors), and educational and contextual supports for motivation (i.e., environmental factors) co-determine one's engagement in the process of motivational regulation. Using the model of triadic reciprocal causation (Bandura, 1989), I will describe the specific behavioral strategies one may use to regulate their motivation and examine the personal and environmental factors contribute to motivational regulation, by reviewing the extant literature.

Motivational Regulation Strategies

Within the broader self-regulation literature, researchers have begun to outline models that more specifically describe motivational regulation (Wolters, 2003). The metamotivational model of motivation regulation provides a framework for understanding the processes involved in motivation regulation, as one aspect of self-regulated learning (Miele & Scholer, 2018). This model stipulates that the strategies a person uses to monitor and control their motivation (i.e., motivation regulation) are directly influenced by their beliefs about the functioning of their own motivational states and understanding of motivation (i.e., metamotivational knowledge; Miele & Scholer, 2018). To be able to successfully regulate motivation, one must apply metamotivational knowledge to monitor and control motivation (Miele & Scholer, 2018). Metamotivational knowledge provides an individual with information about the strategies that can be used to boost motivation (i.e., strategy knowledge), how to optimize particular aspects of motivation for different types of tasks (i.e., task knowledge), and the motivational strategies that work best for them (i.e., self-knowledge; Miele & Scholer, 2018). Metamotivational feelings provide information students use to monitor their motivation. When an individual is struggling to maintain motivation for a particular task, metamotivational feelings are an indicator of which

motivational component (i.e., belief, value or goal) needs to be targeted. In other words, an individual uses their metamotivational feelings to identify a specific motivational strategy that can be used to address a lack of motivation. For example, a student may feel frustrated because they have low self-efficacy, so they can use efficacy self-talk (e.g., "You can do this!") as a strategy to regulate their motivation (Miele & Scholer, 2018).

To regulate motivation, a person may use a variety of strategies that target different beliefs, and therefore shift their metamotivational feelings, for a particular task. Prior work has identified that students report using many distinct motivation regulation strategies (Wolters, 1999a; Miele & Scholer, 2018). These strategies include: (1) self-consequating (i.e., providing oneself with an extrinsic reinforcement or punishment, Graham et al., 1998); (2) performance self-talk (i.e., focus on performance-oriented goals, Wolters, 1998); (3) mastery self-talk (i.e., focus on learning-oriented goals, Wolters, 1998); (4) interest enhancement (i.e., use strategies to increase immediate enjoyment or situational interest, Sansone et al., 1999); (5) environmental structuring (i.e., efforts to change surroundings to make task completion easier; Zimmerman & Martinez-Pons, 1986); (6) value enhancement (i.e., making the reasons for doing a task salient, Wolters & Rosenthal, 2000); (7) efficacy management (i.e., influence competence beliefs for a task, Wolters, 1998); and (8) cost reduction (i.e., cognitive reappraisal to reduce emotional costs, Miele & Scholer, 2018). Existing measures, such as the scale by Wolters and Benzon (2013) used in this study, focus on the first six strategies, so those strategies were the focus of this research. Prior empirical research on motivational regulation has largely focused on identifying the strategies students use to regulate their motivation and distinguishing these strategies from other aspects of self-regulated learning (i.e., metacognitive, cognitive, and behavioral strategies; Wolters, 2011). There is an increasing body of literature that has found evidence of motivational

regulation not only being a distinct, but also a core component of self-regulated learning. Prior research on motivational regulation has investigated how students target motivational regulation strategies to fit with particular types of tasks (i.e., task-motivation fit; see Miele et al., 2020 for a review) and whether specific strategies are correlated with motivational beliefs and contextual factors. It cannot be assumed that college students already have what they need to effectively regulate their motivation. In fact, college students have reported having difficulty managing their motivation, therefore they would benefit from interventions that support development of motivational regulation (Pychyl et al., 2000). To understand how to potentially intervene to support students' development of motivational regulation, it is important to consider how motivational regulation strategies relate to students' motivational beliefs, contextual factors, and achievement-related behaviors and outcomes. .

Predictors of Motivational Regulation Strategies. An important assumption of models of self-regulated learning is "everything a student does can be said to be motivated" (Winne & Hadwin, 2008, p. 297). Thus, it follows that students' broader motivational beliefs and experiences will predict motivational regulation. Prior research bears this hypothesis out. In this section, I provide a detailed overview of the extant literature that investigated how students' motivational beliefs are associated with motivational regulation strategies, with a focus on beliefs aligned with an integrative theoretical perspective of motivation (Linnenbrink-Garcia & Wormington, 2019). Pulling from social-cognitive theory (Bandura, 1997) and expectancy-value theory (Eccles et al., 1983), several researchers have focused on the role of competence beliefs as a predictor of students' use of motivational regulation strategies (i.e., anchor question: *can I do this?*). For example, Wolters and Benzon (2013) found that students' academic self-efficacy was positively associated with their performance self-talk and environmental structuring, but

negatively associated with interest enhancement. In contrast to these findings, a more recent study found that competence beliefs were positively associated with interest enhancement, and in turn, increased pleasure in academic tasks (Smit et al., 2017). There are also studies that investigated the relation of self-efficacy with motivational regulation strategies as a composite, rather than specific types of strategies, and found a positive association them to be positively associated (Wolters, 1998; Zhang & Liu, 2019). Taken together, these findings suggest that students' broad academic self-efficacy may be associated with motivational regulation strategy use, but it is unclear which specific strategies are influenced, and particularly so for interest enhancement.

Researchers have also investigated the potential influence of self-efficacy for self-regulated learning broadly, and motivational regulation in particular, for students' use of motivational regulation strategies. Specifically, researchers found that students' self-efficacy for self-regulated learning was positively associated with increased use of motivational regulation strategies (Kim et al., 2020, 2022). Similarly, prior research found that students' more specific sense of self-efficacy for motivational regulation was also associated with motivational regulation strategy use and quality of use (Kryshko et al., 2022; Trautner & Schwinger, 2020). These studies did not differentiate between motivational regulation strategies and used composite measures, so it is not clear which specific types of strategies may be implicated by students' self-efficacy for self-regulated learning and motivational regulation.

There has also been prior research examining how students' value beliefs and goals may be associated with their use of motivational regulation strategies (i.e., anchor question: *why do I want to do this?*). First, students' subject task value beliefs for the academic task were found to be associated with students' motivational regulation strategy use as a whole (i.e., composite

measure; Smit et al., 2017; Wolters & Pintrich, 1998; Zhang & Liu, 2019). However, one study investigated the relation of perceived task value with specific regulation strategies and found there was a positive association between value and regulation of mastery and performance goals, self-consequating, and regulation of value, but was not associated with environmental structuring or interest enhancement (Wolters & Benzon, 2013). Second, researchers have also examined the relations of achievement goals with motivational regulation strategies and found that mastery goals were associated with an array of regulation strategies (i.e., regulation of mastery orientation, environmental structuring, self-consequating, regulation of value, and interest enhancement), but performance goals were only associated with regulation of performance goals (Wolters & Benzon, 2013). Relatedly, another study found that mastery goals were associated with regulation of mastery orientation (specifically mastery self-talk; Wang et al., 2017), so the type of goals a student has may be congruent with the types of goal regulation strategies they use. It follows that students' mindset beliefs may also be important to motivational regulation strategy use since they are posited to underpin achievement goals (Dweck & Leggett, 1988). For example, a student with a fixed mindset may be more likely to adopt performance goals, and in turn, have higher regulation of performance goals, whereas a student with a growth mindset, may have higher mastery goals, and therefore, use a broader set of strategies. A recent study that examined students different types of goals (i.e., social, well-being, academic), rather than their achievement goals, found that have goals that facilitate one another versus conflicting goals predicted students' motivational regulation strategy use (Kim et al., 2021). Therefore, the research seems to tentatively indicate that it is important for students to have congruent goals and a mastery goal orientation to facilitate use of multiple motivational regulation strategies. Furthermore, students' perceptions of the value of a particular task is associated with

motivational regulation strategy use, but there is very limited research about exactly which strategies are implicated.

Students' implicit theories about willpower are also found to predict self-regulation (Job et al., 2015; Miller et al., 2012). Implicit theories about willpower reflect students' beliefs about the level to which willpower is limited, and therefore depleted after exercising self-regulation. Prior research demonstrated that when an individual has a nonlimited theory of willpower (i.e., the belief that willpower is not constrained and self-generating) were able to exercise greater self-regulation over time than those that had a limited theory of willpower (i.e., the belief that the ability to self-regulate is easily depleted; Job et al., 2010, 2015; Miller et al., 2012). These findings suggest that the beliefs students have about the nature of willpower are also important predictors of self-regulation broadly, and therefore may be implicated in motivational regulation. Taken together, the extant research suggests that students' motivational beliefs are important predictors of motivational regulation strategies. In other words, the extant research suggests that students must be motivated in the first place (i.e., believe they want to and can do the task) to employ strategies to maintain their motivation.

In addition to personal factors, motivational regulation is also theorized to be influenced by contextual factors including task characteristics and explicit instruction or modeling (Pintrich, 2004; Schwinger & Stensmeier-Pelster, 2012; Wolters, 2003). Research indicates that the relation between motivation and motivational regulation may be particularly important when tasks are more externally regulated, such as those common in schooling (Gillet et al., 2012). Specifically, prior research found a negative relation between students' level of autonomy and motivational regulation strategy use (Garn & Morin, 2021). For example, research found that students used self-consequating (rewards) to regulate their motivation to finish their homework,

which is typically not something they have autonomy over (Zimmerman & Martinez-Pons, 1986, 1990). Additionally, prior achievement was associated with beginning of semester motivational regulation strategy use, which further supports the notion that extrinsically-oriented factors may be important to consider as antecedents to motivational regulation (Garn & Morin, 2021). However, it is also important to consider that students' use of motivational regulation strategies may be differentiated depending on whether they are more extrinsically or intrinsically oriented to the task at hand, as prior research suggests that there is alignment between the type of motivational beliefs one has and the strategies they use (e.g., mastery orientation goals with regulation of mastery orientation; Wolters & Benzon, 2013). In addition to research that shows students may use motivational regulation strategies when they have minimal autonomy, but are motivated to complete a task, there is also research that indicates students will seek to regulate their motivation when the task at hand is not interesting (Sansone et al., 1992, 1999). For example, when students were asked to complete a boring task (i.e., copying down letters), they used strategies to make it more creative (i.e., used letters they copied to write words), and in turn more interesting. Thus, the research students may be inclined to use motivational regulation strategies, such as self-consequating and interest enhancement, to maintain their motivation for required tasks where they have minimal autonomy.

Even though students may use motivational regulation strategies without being explicitly taught to do so, knowledge of motivation (also referred to as metamotivational knowledge) is also hypothesized to be a critical antecedent to motivational monitoring and motivational regulation; therefore, it may be beneficial to intervene to teach students motivational regulation strategies (Boekaerts, 1996; Wolters, 2003, 2011). Motivational knowledge would include students motivational beliefs, such as self-efficacy and subjective task value, and "declarative,

procedural, and conditional knowledge needed to enact motivational regulation strategies effectively" (Wolters & Benzon, 2013, p. 200). Having this knowledge would enable students to be able to understand the relative effectiveness of different strategies, which in turn, may influence the quality of their strategy use (Engelschalk et al., 2017). As the quantity and quality of motivational regulation strategy use is associated with effort and academic performance (Engelschalk et al., 2017), it is important to know how to support students' development of greater motivational knowledge. Given this, there has been some prior research that investigates the role of instructional supports for students' knowledge and use of motivational regulation strategies.

Within this area of research there have been several studies that support the notion that explicit instruction can promote students use of motivational regulation strategies. For example, providing motivational scaffolding in an online course (i.e., prompts to spur students to reflect on their level of motivation and how they can increase it if they need to) have been shown to be effective at increasing motivational regulation (Daumiller & Dresel, 2019). Another study found that asking students questions about their value for the task increased their usage of value enhancement strategies (Devolder et al., 2012). Additionally, the teacher can play an important role in support students' use of motivational regulation strategies. Prior research found that having teachers provide instruction about different strategies, modeling them, and displaying visible reminders of strategies may be associated with increased strategy usage (McCann & Turner, 2004). Additionally, research also suggests that students can be taught to use self-praise (a form of self-consequating) to regulated their motivation for writing tasks (Graham et al., 1998). One important caveat of these findings is that effectiveness of teaching may depend on interpersonal dynamics between the teacher and student. Specifically, a study found that teacher

humility and teacher-student relationships predicted increased use of motivational regulation strategy use (Kwok et al., 2022). Furthermore, students' perceptions of their teachers' motivation may also play an important role, as teachers' perceived task value and engagement was positively associated with students' motivational regulation (Zhang & Liu, 2019). It is also important to note that a limitation of this prior research is that it generally investigated motivational regulation strategies in aggregate, so there is limited understanding of how teaching of motivational knowledge may differentially influence the development and use of each type of strategy.

In sum, the prior research suggests that students motivational beliefs are associated with their motivational regulation strategy usage (e.g., Kim et al., 2020; Smit et al., 2017; Wolters & Benzon, 2013). Furthermore, the extant literature also suggests that teaching of motivational knowledge, which includes students' understanding of both motivational beliefs and regulation strategies, may be a viable way to increase students' increase motivational regulation (e.g., Daumiller & Dresel, 2019; Devolder et al., 2012). However, there is a limited understanding of how specific motivational regulation strategies are differentially influenced by students' motivational beliefs and precisely how to effectively support students' development of motivational knowledge.

Outcomes of Motivational Regulation Strategies. Gaining increased motivational regulation is beneficial for college students, and may have added benefits for those that are planning to become teachers. A focus of prior research has been on examining the relation of motivational regulation strategies with beneficial behavioral outcomes including increased effort, persistence, engagement, and decreased procrastination. Early research found that students' use of self-consequating, specifically giving themselves rewards, resulted in increased effort

(Jackson & Molloy, 1983, 1985). This finding has been replicated in additional cultural contexts, namely Australia and Japan, and extended to include environmental structuring as an additional motivational regulation strategy that is associated with increased effort (Purdie & Hattie, 1996). Studies that used composite scales for motivational regulation strategy use also found a positive relation with effort (Schwinger & Otterpohl, 2017; Smit et al., 2017). However, the findings for the association of interest enhancement with effort are mixed. Some studies found there to be no significant association between interest enhancement and effort (Schwinger et al., 2009; Schwinger & Steinsmeier-Pelster, 2012), while others did (Wolters, 1999b). Since prior research shows that effort regulation predicts academic performance (Richardson et al., 2012), an important extension of this research has been to examine effort as a mediating variable that explains the association of motivational regulation strategies with academic performance. Specifically, prior research found that regulation of mastery goals (i.e., mastery self-talk) and value enhancement predicted increased academic performance and decreased dropout intentions via effort regulation among secondary students (Kryshko et al., 2020). In addition to specifically examining effort regulation as a mediator, researchers have also examined the potential role of procrastination. For example, motivational regulation strategies were generally shown to have significant indirect effects on students' academic performance via decreased academic procrastination for the majority of strategies (Grunschel et al., 2016) and when measured using a composite scale (Kim et al., 2020). Additionally, environmental structuring was specifically shown to be associated with decreased procrastination (Ljubin-Golub et al., 2019). However, while all of the motivational regulation strategies were negatively associated with procrastination, there was one exception: regulation of performance goals (i.e., performance self-talk) was not (Grunschel et al., 2016). This anomalous finding in the case of regulation of

performance goals was also true when examining the relations of motivational regulation strategies with metacognitive strategy use (Wolters & Benzon, 2013). Thus, there is some initial evidence that regulation of performance goals should not necessarily be promoted as a recommended strategy for students.

Another area of investigation has examined the relation of motivational regulation strategy use with engagement. This research demonstrated that motivational regulation strategies as a whole were associated with increased engagement among students (Park & Liu, 2018) and teachers (Zhang & Liu, 2019). Additionally, regulation of mastery goals was specifically show to be positively associated with engagement (Wang et al., 2017). Motivational regulation strategies are also shown to be positively associated with other forms of self-regulated learning. Prior research revealed that motivational regulation strategies as a whole (Teng & Zhang, 2016) and specific strategies including interest enhancement and self-consequating (Graham et al., 1998; Lohbeck & Moschner, 2022; Wolters & Rosenthal, 2000) were associated with increased use of cognitive and metacognitive strategies. Motivational regulation strategies as a whole were also shown to be positively associated with students' subjective task value beliefs (Daumiller & Dresel, 2019). Furthermore, interest enhancement and self-consequating had similar positive associations with adaptive motivational beliefs, specifically subjective task value and mastery goals (Wolters & Rosenthal, 2000).

A final set of outcomes that have been examined in the prior literature are persistence and performance as direct outcomes from motivational regulation strategy usage. Environmental control, self-consequating (Nota et al., 2004), and interest enhancement (Sansone et al., 1992, 1999) were positively associated with persistence. Additionally, this relation also held when motivational regulation strategies were measured using a composite scale (Kim et al., 2021).

These relations were similar when examining direct effects of motivational regulation strategy use with performance. Specifically, regulation of mastery goals, value enhancement (Kryshko et al., 2020), environmental control, self-consequating (Nota et al., 2004), and composite measures were positively associated with academic performance (Kim et al., 2021; Teng & Zhang, 2018). Taken together, there is compelling evidence that intervening to increase college students' motivational regulation will be benefit them.

There is potentially even greater benefit of increasing motivational regulation for students who plan to become teachers themselves (i.e., preservice teachers). First, it is imperative that preservice teachers are able to effectively self-regulate because this will help them to persist and succeed in their future profession (Corno, 2004; Dembo, 2001; Wheatley, 2002). As teachers must be able to develop their practice over time and adjust to ever-changing demands, "it is difficult to imagine an effective teacher who has not developed self-regulated learning strategies" (Randi, 2004, p. 1851). Self-regulation is found to facilitate teachers' ability to develop their teaching practice over time, and better refine their teaching approaches (Tricarico & Yendol-Hoppey, 2012). Thus, this review of literature suggests that being a self-regulated learner is critical for students who plan to become teachers. Second, it is important for teachers to have high levels of self-regulation themselves to be able to effectively support their students' development of self-regulated learning (Bembenutty, 2013; Peeters et al., 2014; Perry et al., 2008; Spruce & Bol, 2015). Therefore, preservice teachers should receive training for future adaptation to the workplace (Panadero, 2017). Teachers support their students' development of self-regulated learning via indirect (i.e., modeling) and direct (i.e., explicit instruction) methods (Dignath & Veenman, 2021), thus, they must be self-regulated learners themselves, and self-regulated teachers (i.e., dual model of self-regulation; Kramarski & Kohen, 2017; Kramarski,

2018). In sum, research indicates that intervening to support college students' development of motivational regulation is beneficial for all students, but is likely to have additional advantages for preservice teachers. Given this, the next question is what is the best way to intervene to support college students' and preservice teachers' development of motivational regulation?

A New Approach to Teaching Preservice Teachers about Motivation

A majority of preservice teachers will take an educational psychology course as part of their teacher education training (Patrick et al., 2011). As part of this course, most students will learn about prominent theories of achievement motivation such as self-determination theory (Deci & Ryan, 2000), expectancy-value theory (Eccles et al., 1983), and achievement goal theory (Ames, 1992; Dweck & Leggett, 1988). However, even though students in educational psychology courses will learn about motivation theories, these courses will vary in how they present the applicability of motivation theory to teaching practice (Patrick et al., 2011). Some courses may focus on how motivation theory is aligned to specific pedagogical strategies (e.g., Woolfolk's Educational Psychology (2019) textbook includes a detailed table outlining "Strategies that Support and Undermine Motivation in the Classroom", pp. 496-497; strategies include those stipulated by achievement goal theory to promote students' mastery goals (i.e., TARGET model, Ames, 1992)). Another approach is to show teacher education students how motivation theory applies to classroom teaching by providing an overview of interventions that can be used to shift the beliefs that underpin students' achievement motivation (e.g., online growth mindset interventions; Dweck, 2000). However, I propose that there is a third method that can be used to teach preservice teachers about motivation: explicitly teaching them how to apply metamotivational knowledge to effectively regulate their own motivation, and thus, become more self-regulated learners, which will enable them to more effectively support their

future students' self-regulation (Peeters et al., 2014; Perry et al., 2008; Spruce & Bol, 2015). Using this third approach has the potential to not only equip preservice teachers with the knowledge and skills they need to succeed in their personal endeavors as students and teachers, but also be able to promote their students' motivational regulation. It is hypothesized that teachers must be self-regulated learners themselves before they can instruct and model self-regulated learning strategies for their students (i.e., reciprocal self-regulatory processes of teachers' dual self-regulated learning and self-regulated teaching roles; Kramarski, 2018).

For this dissertation research, I adapted a teacher-training model previously used to train preservice teachers on self-regulated learning (Kramarksi & Heaysman, 2021) to investigate the efficacy of a new approach to teaching college students, with a particular focus on preservice teachers, about supporting student motivation as part of a unit on motivation theories. This training model is aligned with prior work on self-regulated learning that provided external supports to facilitate preservice teachers' development of self-regulation (Zimmerman, 2000); see Table 1 for an overview of the training model; a detailed overview is also provided below. Furthermore, by adapting this training model for specific application to motivation regulation, the present study investigates the hypothesis that explicit teaching about motivational regulation is associated with increased motivation regulation strategy use (Wolters, 2003). To provide context for the development of this new training model, I first review prior theory and literature on self-regulation interventions for both the learning of self-regulation (i.e., for students) and the teaching of self-regulation (i.e., for teachers). Following this review, I provide a detailed overview of the motivational regulation training model for preservice teachers developed and tested as part of this dissertation study.

The Role of Social Learning on the Development of Motivational Regulation

Models of self-regulated learning emphasize the importance of social processes to the development of self-regulatory practices (Schunk & Zimmerman, 1997). Therefore, these processes are also posited to be important for the development of motivational regulation (Wolters, 2011). Based on prior research from self-regulated learning, Wolters (2011) identified several specific forms of social influence that may affect motivational regulation, including: modeling, scaffolding, direct instruction, and sociocultural processes. Within the self-regulated learning literature, all interventions designed to increase self-regulatory strategy used some sort of explicit form of instruction (e.g., Butler, 1998; Pressley & Harris, 2006). However, research also found that more implicit forms of teaching, such as modeling, were effective for helping students develop self-regulated learning skills (Schunk & Zimmerman, 1997).

To capture the potential social influences and process of internalization of self-regulation knowledge and skills, Schunk and Zimmerman (1997) proposed a developmental model of self-regulatory competence. According to this model, self-regulation must be learned and does not arise on its own without some sort of social influence. The model describes four developmental levels that lead to self-regulation: observation, emulation, self-control, and self-regulation. The first level, observation, entails the learner observing a social model as they engage in the cyclical process of self-regulation. In addition to watching someone use self-regulation, observation also includes verbal description and/or social guidance and feedback about a self-regulation strategy. The second level of the developmental model of self-regulatory competence is emulation. At this level, the learner practices the behaviors that they observed. The third level is the self-control level, where they begin to internalize the new behaviors but do not transfer them to different situations. At the third level, the learner may use strategies to self-reinforcement and internal

standards to maintain self-regulation, so this level is particularly relevant to motivational regulation. The fourth and final level is *self-regulation*, which occurs when the learner has fully internalized the self-regulatory behaviors and is able to transfer them to their own unique situations. At the fourth level, students' self-efficacy for self-regulation is posted to influence the level to which they are self-regulated.

The developmental model of self-regulatory competence (Schunk & Zimmerman, 1997) provides a framework for understanding how students learn about self-regulation. Therefore, the model is useful for understanding the different ways that students' motivational regulation may be influenced as they learn about motivational theories in the context of an educational psychology course. For example, an instructor could both explicitly teach and model motivational regulation strategies, which may spur students to develop a new motivational regulation strategy (via the developmental phases) and in turn, influence how they plan for, execute, and reflect on the role that motivational regulation strategies play in their task performance. Prior research has found that the social environment impacts students' development of self-regulation, but this work has largely focused on metacognitive and cognitive knowledge and strategy use, so there is a need to examine how these social learning processes apply to motivational regulation (Wolters, 2011). Furthermore, as teacher education programs often include an educational psychology course that includes content about motivation (Anderman, 2020; Patrick et al., 2011), these courses may provide a viable context for teaching students about motivational regulation because it relates to content on motivational theories and future careers as teachers (i.e., learning how to support students' motivation).

Self-Regulation Interventions for Students

Given the importance of self-regulation to achievement (Dent & Koenka, 2016), a focus of prior research has been on the development of effective interventions to promote students' development of self-regulation (Schunk & Greene, 2018). While both implicit and explicit processes are theorized to influence the development of self-regulated learning, an emphasis of the interventions has been on direct instruction (i.e., "the period of intervention", p. 5; Schunk & Greene, 2018). Since agency and metacognition are essential aspect of self-regulated learning, using direct instruction that provides students with information they can use to assess learning conditions and choose specific actions are needed (Winne & Hadwin, 1998; Winne & Nesbit, 2009; Zimmerman, 2000). In fact, prior research suggests that explicit instruction about strategies and benefits of strategy use is essential for interventions to be effective (Dignath et al., 2008). Direct instruction of self-regulated learning is a viable approach, but it is important to more precisely understand what instructional components are associated with these positive outcomes.

Prior research also indicates that multi-faceted instructional interventions are more effective than those that use a single teaching technique (Dignath et al., 2008; Richardson et al., 2012). Furthermore, self-regulated learning develops over time with practice, feedback, and observation (Dignath & Büttner, 2008; Zimmerman & Kitsantas, 2005), so a developmental approach to teaching self-regulation is needed. Additionally, using direct instruction has been shown to positively impact students' self-regulation when methods associated with social-cognitive models of learning are included (i.e., modeling and scaffolding; Dignath et al., 2008; Lavery, 2008; Xu et al., 2022). For example, vicarious learning has been found to be an important part of learning self-regulation (Zimmerman, 2013). Additionally, providing direct feedback helps students develop self-regulated learning skills (Butler & Winne, 1995), so

methods that incorporate feedback, including one-on-one coaching (Cleary & Zimmerman, 2004) and supporting students' self-assessment using rubrics and scripts (Panadero et al., 2012) have been shown to support self-regulation. It is also important for instruction of self-regulated learning strategies to be done in context so students can immediately apply and test strategies to support their learning (Hattie et al., 1996). In addition to specific instructional strategies that are recommended by prior research, it is important to consider the role of motivation in students' learning of self-regulation as students' motivational beliefs are found to predict their motivational regulation (see review of predictors above).

In sum, the extant research on interventions to support self-regulated learning shows that there are viable interventions for increasing students' cognitive and metacognitive strategy use, but a dearth of research on interventions related to motivational regulation. Thus, there is a need to examine how to effectively support students' development of motivational regulation and prior research on learning strategies provides insights as to potential viable approaches that can be adapted.

Self-Regulation Interventions for Pre-Service Teachers

For teachers to be able to model and teach their students self-regulation, it is important for them to be self-regulated themselves (Bembenutty, 2013; Dembo, 2001). Furthermore, it is important for teachers to self-regulate their own learning because the complexity of their job duties require them to be lifelong learners (Butler et al., 2004; Delfino et al. 2010). In response to the need to support teachers' development of self-regulation, there have been efforts to identify how best to do this. One important consideration is the timing of interventions to promote teachers' self-regulated learning. One notable study found that including training on self-regulated learning as part of teacher education course resulted in greater pedagogical knowledge

gained among preservice teachers (Kramarski & Michalsky, 2009). Additionally, research focused on practicing teachers found that they do not always self-regulate their own learning, so they must be taught how to do this (van Eekelen et al., 2005). These findings suggest that including self-regulated learning before one becomes a teacher may help them better learn how to teach. To do this, it is important for self-regulated learning to be explicitly emphasized as part of teacher education courses, as university instructors tend to be more focused on content rather than learners' development (Oolbekkink-Marchand et al., 2006). Educational psychology courses provide an opportunity for pre-service teachers to learn self-regulated learning, specifically, motivational regulation, as these topics can be seamlessly incorporated into instruction about motivational theories. To respond to this opportunity and need to ensure preservice teachers are self-regulated learners themselves, a motivational regulation training model is needed.

A New Motivational Regulation Training Model for Preservice Teachers

My approach for training preservice teachers motivation regulation was modeled off prior work aimed at training teachers about self-regulated learning: the triple SRL-SRT process model (Kramarski, 2018; Kramarski & Heaysman, 2021). This model was selected because it is applicable to the future roles of preservice teachers (i.e., use self-regulation to learn (SRL), to improve their teaching practice (teacher focused-SRT), and to help their students improve their self-regulation (student focused-SRT)). Additionally, the model is grounded in social cognitive theory and reflects the developmental process of self-regulation (Schunk & Zimmerman, 1997; Usher & Schunk, 2018; Zimmerman, 2008). The triple SRL-SRT training model was developed and tested in the setting of teacher professional development with the aim of helping practicing teachers to use self-regulation in their various roles (Kramarski & Heaysman, 2021). Due to the emphasis of the model on both learning and teaching applications, it may also be a fruitful

training model for students that plan to become teachers (preservice teachers). The triple SRL-SRT training model includes four cyclical phases. The first phase provides explicit instruction that exposes learners (i.e., teachers in a professional development setting) to information about self-regulated learning strategies, including declarative knowledge (what it is), procedural knowledge (how it should be used), and conditional knowledge (when it should be used). The second phase of the training model is to address the learners' motivational beliefs and self-efficacy for self-regulated learning. During this phase learners are prompted to reflect on their beliefs and how they may influence their self-regulation. The third phase of the training model prompts learners to engage in an immersive experience where they try using a new self-regulated learning strategy. The final phase entails learners reflecting on their immersive experiences to examine how a particular self-regulation strategy worked for them and potential ways to further improve their self-regulation. This triple SRL-SRT training model has been empirically tested among practicing teachers and has shown initial positive results (Kramarksi & Heaysman, 2021). Specifically, a study of elementary school teachers showed that the immersive experience of applying self-regulated learning strategies to teaching practices helped teachers learn about the strategies (Heaysman & Kramarski, 2019). Another set of studies found that written reflections about self-regulated learning practices were beneficial (Heirweg et al., 2012; Zepeda et al., 2019). As this training model is relatively new, there is limited empirical testing of it, but initial research, as well as its grounding in self-regulated learning theory (i.e., Schunk & Zimmerman, 1997), suggest that the training model may have merit for being adapted to teaching college students about motivational regulation.

Therefore, for the present study, I adapted the triple SRL-SRT model for college students, with a particular focus on the potential added benefits for preservice teachers. This adapted

approach[2] includes four distinct steps (which are similar to those stipulated by the triple SRL-SRT model): (1) exposing students to motivation theoretical frameworks using an integrative approach to motivation; (2) explicit instruction about motivational regulation strategies; (3) collaborative learning activities to facilitate students' knowledge construction and conceptual application through peer discussion and feedback; and, (4) reflective self-questioning prompts to foster deeper engagement and application of the core concepts. As mentioned above, this training approach is aligned with a social-cognitive approaches to self-regulated learning, and specifically, Zimmerman's developmental model of self-regulation (see Table 1). Specifically, during this training program, students will enact the four developmental levels of self-regulation (Schunk & Zimmerman, 1997). Students will observe motivational regulation strategies used by their instructors and via explicit explanations, they will use emulation and self-control to apply motivational regulation strategies to their own learning tasks, and they will use self-regulation to reflect on the efficacy of their ability to regulate their motivation and identify areas for improvement.

The training model is designed with a focus on helping preservice teachers develop greater motivational regulation, but is likely to be beneficial to students taking educational psychology regardless of their planned careers. The training model emphasizes that individuals must become better self-regulated learners in order to use self-regulation in their teaching and help their students develop self-regulation (Kramarski & Heaysman, 2021); thus, when the model is used as part of a college course, the emphasis is on self-regulated learning (vs. teaching applications) and is relevant to all students. Nevertheless, there may be differences among

[2] My training approach is adapted from Kramarski & Heaysman (2021) Triple SRL-SRT Training. The triple SRL-SRT model was developed to promote self-regulation generally, but, for the purpose of this study, I will adapt the model to be specifically focused on developing motivational regulation.

students who plan to become teachers and those who do not. In particular, preservice teachers may perceive information presented about motivation theories and motivational regulation strategies to be more relevant to their future profession (Dembo, 2001) and, therefore, have greater motivation for learning the information and using the strategies. In sum, the motivational regulation intervention may be helpful for all students that take the educational psychology course, but may have an added benefit for preservice teachers.

Present Study

The present study uses a design-based research approach (Bell, 2004; Design-Based Research Collective, 2003; McKenney & Reeves, 2018) to iteratively develop and test the effectiveness of an instructional intervention to promote motivational regulation as part of an educational psychology course. Aligned with a design-based approach (McKenney & Reeves, 2018), I conducted a series of two studies to develop and test the effectiveness of a motivational regulation intervention. For the first study, I employed mixed methods approach (QUAN → qual; Creswell & Plano-Clark, 2018) to understand whether an instructional intervention targeting students motivational regulation strategies was effective and students' perceptions of the intervention. I also conducted ancillary analyses to investigate whether there were impacts of taking a course that covers motivational theories on students' motivational beliefs and regulation strategy use regardless of whether they also experienced the intervention. I used the results of the first study to understand what aspects of the intervention should be modified to increase the effectiveness of it. The second study was conducted to test whether the redesigned intervention was more effective than the first version. Additionally, the second study examined the role of teaching motivation theories on students' motivational beliefs and regulation strategies regardless outside of the intervention as this was revealed to be an important consideration in the

first study. The discussion of both studies considers implications of this research for the teaching of motivation as part of educational psychology courses, interventions targeting motivational regulation, and preservice teacher preparation. I provide detailed methods and results for the first study in Chapter 3 and the second study in Chapter 4. I also briefly discuss the implications of each study in these chapters, but provide a more detailed discussion of the research findings as a whole in Chapter 5 with a focus on implications for designing and developing motivational regulation interventions.

Positionality Statement

I am cisgender female White Ph.D. candidate in an educational psychology and educational technology doctoral program. My research focus was developed as I reflected on my own struggles as a secondary English Language Arts and Special Education teacher. As a teacher, I often struggled with maintaining my own motivation for the profession, which was in part due to my difficulty helping my students be motivated in my class. These experiences led me to seek out resources to improve my own motivation and that of my students. My personal experiences as a teacher also influence my teaching. I taught a section of the course that is the focus of the present study for over three years.

It is important to acknowledge how my own experiences shape my focus and interpretation of the results presented in this dissertation. For example, in interpreting the interview data, I may be inclined to focus on the experiences that resonate with my own, so it is important for me to be aware of that tendency and seek out other perspectives. Additionally, both my race and gender represent the majority of teachers in the U.S., so it is imperative that I critically interrogate assumptions that I make to ensure that may not represent the experiences of those from other genders and cultures. Furthermore, as part of the Discussion (Chapter 5), I

reflect on how my positionality may have influenced my interactions with participants and the course instructors, particularly as an instructor of the course.

Chapter 3:

Study 1

The primary aim of this dissertation research is to design and develop an effective novel motivational regulation intervention. Therefore, I used a design-based approach (McKenney & Reeves, 2018) and conducted a series of two studies to iteratively develop and test the effectiveness of a motivational regulation intervention (see Figure 1). Chapter 3 describes the findings for the first study, which followed a mixed methods approach (QUAN → qual; Creswell & Plano-Clark, 2018) to inform how the intervention should be redesigned (tested in Study 2; see Chapter 4). Due to this sequential approach, I present Study 1 in two parts. Study 1a details the quantitative portion of the study, which informed the research question and data collection and analysis for the qualitative portion of the study (Study 1b). The aim of the first study was to understand *whether* (Study 1a) and *how* (Study 1b) the instructional intervention influenced students' motivational regulation strategy use to identify what aspects of the intervention should be modified to increase the effectiveness of it.

Study 1a

The purpose of Study 1a was to test the effectiveness of a novel instructional intervention targeting students' motivational regulation strategy use as a complementary component to a unit on theories of motivation in an educational psychology course. To this end, Study 1a used a quasi-experimental design and quantitative methods to answer three research questions, detailed below.

Research Questions

Research Question 1a: Does teaching students about motivational regulation (intervention) change their motivational regulation strategy use? To my knowledge, there

are not studies that have tested whether teaching students about motivational regulation changes their motivational regulation strategy use, but prior theoretical literature suggests this may be effective (Wolters, 2003; Miele & Scholer, 2018). Additionally, prior research on self-regulated learning more broadly suggests that instruction about strategy use is a viable approach (Dignath et al., 2008), especially when it is coupled with modeling of strategy use and self-reflection (Kramarski & Heaysman, 2021). Thus, I hypothesized that an intervention focused on motivational regulation strategies that includes these elements (i.e., explicit instruction, modeling, reflection) would impact students' motivational regulation strategy use. Furthermore, as the target course for this intervention included both students who planned to become teachers and those who did not, even though it was a teacher education course, I also investigated whether the effect of the intervention varied as a function of students' status as preservice teachers (i.e., RQ 1b[3]). Theory suggests that perceived relevance of course content is important for learning (Acee et al., 2018), therefore, I hypothesized that preservice teachers would have greater change in their motivational regulation strategies compared to students not planning to become teacher.

Research Question 2a: Does teaching preservice teachers about motivational regulation (intervention) change their beliefs about teaching (i.e., teaching self-efficacy, responsibility for supporting student motivation, teaching career intentions)? Due to the potential positive implications of increased motivational regulation strategy use for preservice teachers (i.e., triple SRL-SRT processes; Kramarski & Heaysman, 2021), I also investigated the potential of additional positive benefits of the intervention for this subgroup. Since prior literature suggests that motivational regulation strategy use is positively associated with

[3] Research Question 1b: Does the effect of the intervention vary as a function of students' status as preservice teachers?

persistence (e.g., Kim et al., 2021) and adaptive motivation beliefs (e.g., Wolters & Rosenthal, 2000), I hypothesized that the motivational regulation intervention would have positive relations with preservice teachers' beliefs about teaching. Furthermore, I hypothesized that these relations would be mediated by preservice teachers' motivational regulation strategy use (i.e., RQ 2b[4]).

Research Question 3a: Does teaching students about motivational regulation (intervention) change their implicit theories about willpower? Prior research suggests that students' unconscious beliefs about the level to which willpower is limited (i.e., implicit theories about willpower) influence self-regulation (Job et al., 2015). When students believe their willpower cannot be easily depleted, they exercise greater self-regulated learning. However, it is not clear whether students' implicit theories about willpower may be influenced by learning more about self-regulation, and in particular, motivational regulation strategies. Therefore, I examined whether teaching about motivational regulation influenced students' implicit theories about willpower and if this relation was mediated by students' motivational regulation strategy use (i.e., RQ 3b[5]).

I provide a detailed method for the quantitative phase of the first study (Study 1) in the next section, followed by results, and a brief discussion.

Method

Design Research Process. This study used an educational design research process that is iterative and flexible (McKenney & Reeves, 2014). Specifically, for Study 1a, I used a quasi-experimental design and quantitative methods to test the effectiveness of a first prototype of the

[4] Research Question 2a: Is the relation between the intervention and beliefs about teaching mediated by preservice teachers' motivational regulation strategy use?
[5] Research Question 3a: Is the relation between the intervention and implicit theories about willpower mediated by students' motivational regulation strategy use?

motivational regulation instructional intervention. The second step of Study 1a was to evaluate the results of this first assessment of the intervention to specify what information was most important to gain using qualitative data collection and analysis (i.e., Study 1b). Then, the final step was to use the results from this first evaluation to develop a new prototype of the intervention and conduct another evaluation. This final step is detailed in Study 2 (Chapter 4). This cyclical process of design and construction, analysis and exploration, and evaluation and reflection is aligned with educational design research processes (McKenney & Reeves, 2014).

Setting and Participants. Quantitative data were collected from undergraduate students enrolled in a teacher education course at a large public university located in the Midwestern U.S. within a single semester (i.e., spring 2022; see Table 2 for study timeline). The course, Reflections on Learning, covers prominent theories of learning, development, and motivation. At the time of data collection, the course was required for all teacher education students and was typically taken within the first two years by this subset of students. The course was also taken by students in other majors as an elective credit anytime during college. The course covers prominent educational psychology theories on socio-contextual influences on learning, cognitive and behavioral development, and motivation. A primary objective of the course is for students to be able to integrate theoretical knowledge with practical application to address the needs of learners in an educational setting.

During the spring 2022 semester, the course was comprised of 14 sections with 25 students in each section for a total enrollment of 350 students. These sections were taught using multiple modalities by graduate student instructors. Specifically, three sections were fully asynchronous online, six sections were occasionally synchronous online (i.e., included four synchronous zoom class sessions over the semester), and five sections were fully synchronous

face-to-face. To assign sections to intervention or control condition, I did a series of coin tosses within each type of modality to randomly assign them to condition. There were two exceptions: two of the sections of the occasionally synchronous modality were taught by the same instructor and three of the sections of the fully synchronous modality were taught by the same instructor, so in these instances I counterbalanced the condition assignment. All section assignments are detailed in Table 3. The study was deemed exempt by the university's Institutional Review Board (ID: STUDY00007064).

Recruitment and Eligibility. All students and instructors of the course participated in the study activities, including survey data gathering, and instructional activities. Students were given the opportunity to consent to have their survey data used as part of the study or to opt out of the study, but still complete study activities as part of the course. All instructors were recruited to participate in the study during regularly scheduled meetings and were given the option to opt out. Instructors were provided information about the study activities during these meetings and via email.

There was broad participation in the study: of the total eligible students for the study, 75% participated in the study. Student participants (n = 264) were 69% female and 82% White/European American, 8% Asian/Asian American, 7% Black/African American, and 3% Hispanic/Latinx. Pre-service teachers made up 43% of the participants in the study. All 11 graduate student instructors participated in the study.

Procedure. The sequence of events for this study, including the focal instructional unit and measurement timing, are detailed in Table 2.

Intervention Procedure. The graduate student instructors assigned to the intervention condition participated in a training session, during a regularly scheduled instructor meeting, that provided them with information about how to incorporate additional instruction about motivation regulation strategies, collaborative reflection activities, and individual student reflections as part of the motivation theories unit. For the motivation unit, the instructors teaching in an online-focused course section (i.e., fully asynchronous or occasionally synchronous) were provided with online content tailored to the intervention (i.e., included additional information and activities about motivational regulation strategies) or "business as usual" course content. In other words, the online instructors did not need to do anything different in their teaching work due to the intervention as the modules were modified depending on their condition assignment prior to the start of the unit. The "business as usual" course content provided an overview of prominent motivation theories encapsulated by the integrative approach to motivation.

The instructors of the face-to-face course sections were provided with google slides and activities (printed worksheets) to facilitate instruction for both the intervention and control conditions. Similar to the online sections, the instructors were provided with all of the materials they needed for instruction of the motivation unit, so rather than creating their own class materials, they reviewed and used those created for the purposes of this study. The intervention condition google slides and activities included information about motivational regulation strategies. Additionally, students enrolled in their sections were provided with reflection "exit tickets" to prompt them to consider how they could apply the motivational regulation strategy they learned about in class to their own lives as students (see Figure 2 for an example). These exit tickets were presented as making a comprehensive "motivation booster tool-kit" that students were encouraged to use as they needed to for other courses and in their lives. The

instructors in the control condition were provided with the same materials used in prior semesters for teaching about motivation, which did not include the additional components related to motivational regulation but did provide an overview of the core tenets of prominent motivation theories (i.e., expectancy-value theory, achievement goal theory, self-determination theory).

Motivational Regulation Intervention. The motivational regulation intervention was tested within an educational psychology course for preservice teachers as part of a 4-week unit on motivation theory. This unit used an integrated theoretical perspective to teaching students about motivation (Linnenbrink-Garcia et al., 2018), students were presented with information about motivation theories (Step 1), including self-determination theory (Deci & Ryan, 2000), expectancy-value theory (Eccles et al., 1983), interest development theory (Renninger & Hidi, 2016), and achievement goal theory[6] (Ames, 1992; Dweck & Leggett, 1988). After presenting the theoretical concepts of each motivation theory, the instructors in the intervention sections made an explicit connection between each theory and relevant motivational strategies (Step 2) by presenting information on how students could use specific strategies to regulate their own motivation. For example, after presenting information about competence beliefs as part of a class session on expectancy-value theory, instructors told students that they could boost their own sense of competence using efficacy self-talk (e.g., "I can do this"; Miele & Scholer, 2018). Next, instructors modeled motivational regulation by describing a scenario in which they used the strategy themselves (Step 3). For example, after presenting information about achievement goal theory, which emphasizes the importance of focusing on learning rather than normative comparison for sustaining motivation, instructors shared a story about a time they felt

[6] Mindset theory was presented in conjunction with achievement goal theory due to the theoretical connections between them (i.e., Dweck & Leggett, 1988).

discouraged by a particular task, and highlighted how they used mastery self-talk (i.e., "hard work is a sign that I am learning something new") to boost their motivation. Following instruction about motivation theories and motivational regulation strategies, the students were provided with opportunities to engage in collaborative learning activities to apply what they learned to different scenarios through discussion with peers (Step 4). For example, instructors presented students with a specific scenario that requires motivation regulation (e.g., completing an assignment that they do not want to do) and had them work in groups to develop a "motivation plan" where they identified potential strategies that could be used to increase their motivation. At the end of each class during this unit, students completed "exit tickets" that include self-questioning reflective prompts (Step 5) to encourage students to apply metamotivational knowledge and evaluate different approaches they could use to regulate motivation for an upcoming task. This final self-reflective step is theorized to be critical to the development of motivational regulation as it influences how the student will seek to regulate their motivation for future tasks (Zimmerman, 1998).

Fidelity Checks. To ensure that the instructors in the intervention condition enacted the motivation regulation instruction as intended, and that the control condition instructors did not include instruction about motivation regulation, one lesson was observed for all instructors of the face-to-face sections of the course. The online-focused sections of the course were monitored to ensure that the instructors did not modify the provided course content in any substantive way. Additionally, the final written reflection assignments for the motivation unit were reviewed to ensure that students in the intervention condition responded to a modified question related to motivational regulation and that students in the control condition were not provided with this

modified question. The students in all sections of the course, regardless of modality, completed this final reflection assignment.

Survey Administration. Students in both conditions completed a pre- and post-survey immediately prior to and following the motivation unit (see Table 2 for a detailed timeline). Students were given course credit (participation points) for completing the surveys and received course credit whether or not they chose to participate in the study. The surveys were administered online using Qualtrics prior to the beginning and following the end of the motivation unit. The surveys were included in the online course content modules for the online-focused sections and were presented during a class meeting for the face-to-face sections. Instructors were provided with a list of students who completed the surveys so they could assign course credit, but were not made aware of whether a student consented to participate in the study.

Self-reported survey measures were collected for this study. See Appendix C (Supporting Information) for measures and items and Table 4 for a construct list, measurement occasions, and scale reliability. For the purpose of this dissertation study, I adapted the measures to capture domain-general (rather than domain-specific) motivational beliefs and motivational regulation strategies for two reasons: (1) motivation regulation strategies have traditionally been measured by having students self-reflect on when they do not feel motivated to do a task and this may not apply to a specific class or domain for all students within a college level course as they have more choice in the courses they are taking, and, (2) students enrolled in the focal course have varied disciplinary interests. The students that are enrolled in the course do not identify with the same specific-domain. For example, there may be a student that plans to be a secondary science teacher, and therefore, most identifies with science as their primary domain, whereas another student that plans to be a kindergarten teacher may identify with early childhood education as

their focal domain. Given the varied domains that students may most identify with in the course, all measures were adapted to be focused on academic courses and school generally versus a specific course or subject.

Motivational Beliefs. Items used to assess students' motivational beliefs used a Likert-type scale with 1 = Strongly disagree to 5 = Strongly agree. I measured six different types of motivational beliefs variables: (1) academic self-efficacy, (2) self-efficacy for self-regulated learning; (3) achievement goals, (4) task value/personal interest, (5) mindset beliefs, and (6) implicit theories of willpower. Five items adapted from the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000) were used to measure academic self-efficacy (e.g., "I'm certain I can master the content in the courses I am taking this semester"). Self-efficacy for self-regulated learning was measured using an adapted version of a scale developed by Zimmerman et al. (1992). This scale included eight items; a sample item is "I can concentrate when I am in class." An adapted version of the PALS was also be used to measure achievement goals (mastery-approach goals: 5 items; performance-approach goals: 5 items, performance-avoidance goals: 4 items). A sample item used to measure mastery-approach goals is "It's important to me that I learn a lot of new concepts in my courses." The final motivational belief variable is task value. Task value was measured using a six-item scale adapted from the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich et al., 1991). A sample item from this scale is "It is important for me to learn the material in my courses." Implicit theories of willpower was measured using an adapted scale developed by Job et al. (2010) and included two subscales: strenuous mental activity and resisting temptations. Each subscale had three items; a sample item for strenuous mental activity is "After a strenuous mental activity, you feel energized for further

challenging activities", and a sample item for resisting temptations is "If you have just resisted a strong temptation, you feel strengthened and you can withstand new temptations."

Motivational Regulation Strategies. To measure motivational regulation strategies, I used a scale developed by Wolters and colleagues (motivation regulation strategy use Wolters, 1999b; Wolters & Rosenthal, 2000; Wolters & Benzon, 2013). All of the motivation regulation strategy use items were measured using a Likert-type scale with 1 = Not at all to 5 = Very often. The directions for these items included a prompt for "students to consider when they were reading or studying for a course they are taking and did not feel like working hard to finish or for some reason lost motivation for doing the work that needed to get done" (Wolters & Benzon, 2013, p. 207). The prompt also included examples such as feeling bored with the task or not seeing the relevance of it. For example, a sample item used to measure regulation of value is "I think up situations where it would be helpful for me to know the material or skills." The scale includes 31 total items for six different motivational regulation strategies (regulation of value: 6 items; regulation of performance goals: 5 items; self-consequating: 5 items; environmental structuring: 4 items; regulation of situational interest: 5 items; regulation of mastery goals: 5 items).

Teaching Beliefs. In order to examine the relations of condition and motivational regulation strategy use with teaching motivation, I measured three different teaching belief variables: (1) teacher efficacy; (2) teacher responsibility for student motivation; and (3) teaching career intentions. I measured these variables at both the pre- and post-survey to account for prior beliefs in the final analysis that examines T2 teaching motivation beliefs. Teacher efficacy and teacher responsibility for student motivation were measured using Likert-type scales with 1 = Strongly disagree to 5 = Strongly agree. The teacher efficacy scale included six items used to

measure two dimensions (efficacy for student motivation and efficacy for teaching; Lauermann & Karabenick, 2013). A sample item used to measure teacher efficacy is "I am confident that I will be able to get any of my students interested in the subject I teach." The scale used to measure teacher responsibility for student motivation included three items (e.g., "I would be personally responsible if a student of mine was not interested in the subject I teach."). Teaching career intentions were measured using a single-item ("To what extent do you intend to pursue a career in teaching?") measured on a Likert-type scale with 1 = Definitely will not and 10 = Definitely will (Woodcock et al., 2012).

Demographics. Students were also asked to self-report their racial group, gender, first generation status, year in school, and major to provide descriptive information about the sample and to evaluate whether there are any systematic differences between the control and intervention conditions as part of the Time 1 survey.

Contact Information. Students were asked to self-report their contact information for follow-up data collection, including the interviews for this study as well as potential longitudinal follow-ups as part of the Time 2 survey.

Analytic Plan. Table 5 provides an overview of the research questions and planned analyses. Prior to conducting my primary analysis, I first conducted a series of preliminary analyses to establish the assumptions of my planned analyses are met. Descriptive statistics, ANOVAs, and Grubbs' tests were conducted in SPSS version 24 and all other quantitative analyses were conducted using MPlus Version 8.4 (Muthén & Muthén, 1998–2019). All primary analyses were conducted using Mplus v.8.4 (Muthén & Muthén, 1998-2019), using full information maximum likelihood (FIML) estimation to account for missing data (Graham, 2003). Prior research indicates that there is a suppression effect of using all motivational

regulation strategies in the same model (Schwinger & Steinsmeier-Pelster, 2012; Smit et al., 2017), so I examined each strategy separately for all the analyses. To investigate whether there was a potential effect of learning about motivation theories on students' motivational beliefs and motivational regulation strategy use regardless of condition, I conducted a series of repeated measures mixed ANOVAs as part of a post-hoc ancillary analysis.

Results

Preliminary Analysis. First, I used Grubbs' test to identify any extreme outliers in the data set (Grubbs, 1969). I identified four cases of extreme outliers, so these cases were removed from the dataset. Next, I examined the descriptive statistics and correlations (see Tables 6-9). The correlations showed the expected relations between variables based on prior research.

I used confirmatory factor analysis (CFA) to examine the factor structure of the latent constructs by examining multiple similar scales together and evaluating model fit using the cutoffs recommended by Hu and Bentler (1999). Specifically, a model was deemed to be acceptable if the Confirmatory Fit Index (CFI) was greater than .90 and the root mean squared error of approximation (RMSEA) was less than .10. The full CFA results for both timepoints are presented in Table 7. The results indicated that the expected factor structure held for the constructs. Then, I used CFAs to assess multigroup and longitudinal measurement invariance to ensure that the measurements indicated the same underlying constructs across condition and time (Vandenburg & Lance, 2000). Measurement invariance was established if the change in CFI was ≤ 0.01 (Cheung & Rensvold, 2002; Meade et al., 2008). For the purposes of testing RQs 1-3 (primary analysis), it was important to establish at least weak measurement invariance as this is the minimum threshold for comparing regression coefficients across different groups (Meredith, 1993; Widaman & Reise, 1997). Furthermore, for the purposes of the post-hoc ancillary analysis,

a minimum of strong invariance must be established since the focus was on mean comparisons. The results of both types of measurement invariance tests are detailed in Tables 8-10. Strict measurement invariance was established for all of the variables except academic self-efficacy, performance-approach goals, performance-avoidance goals, task value, self-consequating, and efficacy for teaching. Among these variables, strong measurement invariance was established for task value. Weak measurement invariance was established for academic self-efficacy, performance-approach goals, performance-avoidance goals, and self-consequating; thus, these variables could be examined for RQs 1-3, but not for the post-hoc ancillary analyses. Measurement invariance was not established for efficacy for teaching, therefore, it could not be examined for either the primary or post-hoc ancillary analysis. The full results of the measurement testing (i.e., multivariate CFAs, longitudinal measurement invariance, and multigroup measurement invariance) were used to determine how the factor scores should be calculated for the remaining analyses for Study 1 as the SEM path analyses used observed variables due to power constraints. The results of the measurement testing indicated that several of the scales[7] needed to have items removed from them when specifying the factor scores including: self-efficacy for self-regulated learning (items: 3, 6, 8), implicit theories of willpower: strenuous mental activity (items: 1, 3, 5), implicit theories of willpower: resisting temptations (items: 3, 5, 6), motivational regulation of value (item: 5), motivational regulation of performance goals (item: 2), self-consequating (item: 4), environmental structuring (item: 3), motivational regulation of interest (item: 1), and regulation of mastery goals (item: 3).

I also conducted ANOVA tests to examine whether the participants were equivalent based on their condition assignment on the focal measures on the pre-survey (i.e., motivational

[7] The full scales are included in Appendix C.

beliefs and motivational regulation strategy use). The results of these tests indicated that the participants were equivalent across the intervention and control conditions across all measures, with the exception of regulation of mastery goals (see Table 11; F (1, 234) = 5.88, p = .02). In the case of regulation of mastery goals, the students in the control condition had significantly higher mean levels for the baseline measure. This finding highlighted the need to control for pretest measures in the primary analyses, as planned. I additionally used chi-square tests to evaluate whether the samples were equivalent in terms of demographics. These tests indicated that there were no significant differences in demographics across the conditions (race: χ^2 = 2.39, p = .88; gender : χ^2 = 2.37, p = .79; first generation status: χ^2 = 0.01, p = .94; preservice teacher status: χ^2 = 1.80, p = .18).

Similarly to examine attrition from T1 to T2, I also conducted ANOVA tests to examine whether the participants were equivalent based on the focal measures on the pre-survey (i.e., motivational beliefs and motivational regulation strategy use). Of the 256 students that completed the survey at T1, 220 completed the T2 survey (86%). Additionally, among self-reported pre-service teachers, 90 of 109 participants completed both the T1 and T2 surveys (83%). The results of the ANOVA tests that were used to compare participants with complete data on both time points to those that only completed the pre-test showed that the two groups were equivalent across all measures with the exception of self-efficacy for self-regulated learning (see Table 12; F (1, 218) = 6.84, p = .01). The results indicated that the participants with complete data on both timepoints had significantly higher mean levels of self-efficacy for self-regulated learning at baseline compared to those that did not complete the post-survey. The results of the chi-square tests indicated that there were some difference in terms of survey

completion in terms of demographics. Specifically, there were more responses from female students ($\chi^2 = 13.69$, $p = .02$) and white students ($\chi^2 = 20.11$, $p < .01$) than expected.

Primary Analysis. To answer my first research question, I used a structural equation modeling (SEM) path analysis (see Figure 2 for path diagram) using observed variables calculated using the factor scores based on the findings from the measurement analyses. This analysis allowed me to test the main effects of the intervention and evaluate whether the main effect depended on students' status as preservice teachers (interaction). I included relevant covariates in the model in order to specifically evaluate the effect of the intervention. The covariates included: Time 1 measures of motivational regulation strategy use, Time 1 measures of motivational beliefs, modality of course instruction (online v. in-person), and section focus (learning or teaching)[8]. The full results of the path analyses are detailed in Table 13. The results indicated that there were no significant relations of condition or preservice teacher status with motivational regulation strategy use.

To address my second research question, I used a path analysis (see Figure 3 for a path diagram) to examine the relation of intervention with the teaching outcome variables and whether the relation was mediated by students' motivational regulation strategy use (indirect effect). Since RQ 2 is focused on teaching-related outcome variables, the analyses only included individuals who self-reported they were members of the preservice teacher education program. The models included control variables for Time 1 motivational regulation strategy use, Time 1 motivational beliefs, course modality, and section focus for all the analyses conducted for RQ 2. Similar to the findings for RQ 1, there were no significant relations between condition and

[8] I included course section as a covariate for the quantitative analysis to account for potential variance due to instances where there are students in the learning-focused sections planning to be teachers and vice versa.

motivational regulation strategy use or teaching beliefs. However, increases in motivational regulation of situational interest during the unit were associated with increases in both types of teaching-related competence beliefs[9]. Specifically, motivational regulation of situational interest was positively associated with efficacy for supporting student motivation (see Table 14; β = .266, p = .003) and responsibility for student motivation (see Table 15; β = .276, p = .003). Motivational regulation of value was positively associated with efficacy for supporting student motivation (β = .244, p = .007). Motivational regulation of performance goals was also positively associated with efficacy for supporting student motivation (β = .181, p = .044). Environmental structuring had similar relations and was positively associated with efficacy for supporting student motivation (β = .209, p = .024). Finally, motivational regulation of mastery goals was positively associated with teacher responsibility for student motivation (β = .301, p = .001). There were no significant relations for the teaching career intentions model (see Table 16). Taken together, the findings from the second research question suggest that while there was no effect of the intervention on students' (specifically preservice teachers) motivational regulation strategy use or teaching beliefs, that motivational strategy use was associated with teaching beliefs.

To answer my third research question, I also conducted a SEM path analysis (see Figure 4 for a path diagram) to evaluate whether the intervention was associated with motivational regulation strategy use, and in turn, implicit theories of willpower (IToW). Similar to RQs 1 and 2, I controlled for Time 1 motivational regulation strategy use, Time 1 motivational beliefs, course modality, and section focus in the SEM model. A final set of path analyses were

[9] Efficacy for teaching beliefs were not examined as part of the analysis since measurement invariance was not established.

conducted to address the third research question (see Tables 17-18). Similar to the first two research questions, there were no significant relations of condition with motivational regulation strategy use or students' implicit theories of willpower (IToW). Nevertheless, motivational regulation strategy use did relate to IToW, but differentially depending on whether the focus was on strenuous mental activity or resisting temptations. Motivational regulation of situational interest and mastery goals were positively associated with IToW: strenuous mental activity (regulation of situational interest: $\beta = .304$, $p < .001$; regulation of mastery goals: $\beta = .251$, $p = .004$). In contrast, motivational regulation of situational interest and self-consequating were negatively associated with IToW: resisting temptations (regulation of situational interest: $\beta = -.271$, $p = .023$; self-consequating: $\beta = -.278$, $p = .004$). These findings suggest that regulation of motivation may be positively associated with the implicit theory that doing activities that require strenuous mental activity can be sustained, but negatively associated with the theory that resisting temptations is unlimited.

Post-Hoc Ancillary Analysis. Since the findings of the primary analysis indicated there were no significant effects of the motivational regulation intervention, I was interested in examining whether simply taking a unit on motivation theories was associated with changes in students' motivational beliefs and motivational regulation strategy use. To investigate this, I used a series of repeated measures mixed ANOVAs to examine change over time. Due to the large number of analyses conducted and the post-hoc nature of the analyses, I used the Bonferroni method to adjust the *p*-value for statistical significance, resulting in a p-value of < .006. The results of these ANOVAs are detailed in Table 19 and showed a significant mean-level increase in growth mindset beliefs ($F = 15.91$, $p < .001$) and regulation of situational interest ($F = 19.09$, $p < .001$). These results indicated that the motivation unit may have supported the development

of some forms of motivation and motivational regulation, but that there was no added benefit of the motivational regulation intervention.

Brief Discussion: Study 1a

There were several notable findings from Study 1a. First, the motivational regulation intervention did not have an effect on students' reported motivational regulation strategy use, regardless of whether a student planned to become a teacher or not. This finding was not aligned with my initial hypothesis regarding the effectiveness of the motivational regulation intervention, but provided valuable information that could be followed up on as part of the next phase (Study 1b and Study 2) of the design and development process (McKenney & Reeves, 2014). Second, the findings suggested that preservice teachers' reported motivational regulation strategy use was positively associated with teaching self-efficacy for supporting student motivation and responsibility for supporting student motivation. These findings were aligned with my hypothesis and prior literature about the influence of teachers' motivational regulation on their ability to support their students' motivation (i.e., dual model of self-regulation; Kramarski & Kohen, 2017; Kramarski, 2018). Therefore, the need to further investigate how to effectively support preservice teachers' development of motivational regulation was affirmed. Third, I found that the relations between students' reported motivational regulation strategy use and their implicit theories of willpower were not straightforward. I was surprised to find that there were differential relations between students' reported motivational regulation strategy use and implicit theories of willpower depending on whether it was about strenuous mental activity or resisting temptations. This finding is somewhat different than prior research that suggested there is a positive association among implicit theories of willpower and self-regulation (Job et al., 2015), which may be due to the increased level of specificity of the types of motivational regulation

strategies included in the present study (versus general self-regulated behavior). This finding suggests that the relation of self-regulation with implicit theories may be more nuanced than originally suggested in the literature (Job et al., 2010; Job et al., 2015), but there is a need to further investigate this hypothesis.

Finally, as part of the post-hoc ancillary analysis, I found some initial evidence that teaching motivation theories may be beneficial to students' own motivation and motivation regulation, which in turn may also help to support pre-service teachers' teaching-related competence beliefs. Given that students' optimal motivational beliefs are found to decline over time (e.g., Corpus et al., 2020; Kosovich et al., 2017; Robinson et al., 2022), and that declining motivation may be exacerbated by the COVID-19 pandemic (e.g., Usher et al., 2022), I was encouraged to find that students' growth mindset beliefs and regulation of situational interest increased. This finding suggests that direct instruction about motivational theories, in this case growth mindset and interest development and/or expectancy value theory, may provide a new avenue to supporting student motivation and extends prior research on growth mindset interventions (see Dweck & Yeager, 2019 for a review). Nevertheless, these findings should be interpreted with caution since this is an initial exploratory study that entailed conducting a large number of significance tests with few significant results. Thus, there is a need to replicate this study driven by specific hypotheses based on these initial findings. Replicating this study is particularly important since the findings are contrary to prior research showing that students' typically have declining patterns of motivation. Furthermore, since there was no effect of the intervention, but a positive relation between preservice teachers' use of motivational regulation with teaching efficacy and responsibility for student motivation was confirmed, there is a need to better understand how to effectively support the development of motivational regulation.

Study 1b

The goals of Study 1b were developed following evaluation of the results from Study 1a. Since there were no effects of the motivational regulation instructional intervention, I was interested in identifying factors that may increase the effectiveness of it. This process is aligned with a design-based research approach, which prioritizes iterating on an original design to make improvements to it (McKenney & Reeves, 2014). Additionally, since I found there may be positive benefits to learning about motivation theories on students' growth mindset beliefs and regulation of situational interest, I sought to triangulate these findings by investigating how students characterized their motivational beliefs and regulation strategies.

Research Question

Research Question 4: How do students that were taught about motivation theories (control and intervention condition) describe their motivational beliefs and regulation strategy use and what factors do they identify as important to shaping their beliefs and strategies? The final research question for the first study sought to understand students' experiences learning about motivation theories, regardless of whether they were in the intervention condition and received additional instruction about motivational regulation strategy use. This question was generated following an initial quantitative investigation of the first three research questions, as well as ancillary analyses that examined the influence of being taught about motivation theories (both control and intervention conditions). Following a design-based research study design, the aim of the fourth research question was to characterize students' beliefs and regulation strategy use after learning about motivation theories (RQ 4a) and identify which aspects of the motivation unit they perceived as being most effective (RQ 4b). I did not

make specific hypotheses for this research question because I expected to find emergent themes based on the qualitative data.

Method

In this section, I detail the qualitative methods I used answer the research question for Study 1b. Aligned with a sequential mixed methods approach (Creswell & Plano Clark, 2018), precise research question and methods were informed by the quantitative phase of the study.

Setting and Participants. Qualitative data were collected from a purposive subsample selected from the analytic quantitative sample. All qualitative data were collected during the summer of 2022, following the quantitative data collection semester. A subsample of $n = 12$ current or recently graduated students that took the focal course from Study 1 were interviewed (82% female, 9% male, 9% transgender male; 90% White, 10% Black). See Table 20 for a detailed overview of interview participants. Based on the quantitative results, I selected a subsample of participants that experienced a positive change (mean difference) in their motivational beliefs or regulation strategies (50%) and those that did not (50%). Additionally, I selected participants that represented both conditions (intervention: 42% and control: 58%), a mix of preservice teachers (58%) and non-preservice teachers (42%), and a range of course modality (face-to-face synchronous: 50%, online occasionally synchronous: 33%, online asynchronous: 17%). The qualitative sample had more participants that identified as women compared to the analytic sample, but was similar in terms of racial identification. Additionally, the qualitative sample had slightly more preservice teachers than the analytic sample and a greater proportion of students from face-to-face courses.

Of the 48 participants eligible to participate in an interview, I invited 22 to interview based on their indicated interest in additional study participation (on the Time 2 survey). I

received interest from 13, and interviewed 12 students. To recruit participants for the interview, I sent a series of emails and text messages using the contact information they provided on the survey. I contacted potential participants a total of up to four times (3 times via email and 1 time via text message; see Appendix C for email and text message language). I provided each participant with a $50 Amazon gift card for their participation in an approximately one-hour interview.

It is important to note that the participants were recruited using information about whether their motivational beliefs or motivational regulation strategies changed or not as a result of taking the focal course, therefore, I was not blind to this information as I conducted the interviews. Due to this, there is a potential that I may have been unconsciously biased in conducting the interviews, but did make an effort to adhere closely to the protocol to reduce any influence on how I conducted the interviews.

Interview Procedures. The interview procedures were designed with a focus on triangulating the survey data and validating the quantitative findings and to develop more detailed characterizations of students experiences in the focal course and how and why it may have influenced their motivational beliefs or regulation strategies (Greene et al., 1989). Due to many students living off-campus during the summer term, the interviews were conducted online and recorded using the Zoom platform. The audio recording of the interview was transcribed to facilitate the qualitative coding and data analysis. I conducted all interviews, so they were conducted by a White cisgender female instructor of the focal course. Of the interview participants, 2 were students I taught in the previous semester, and 10 were taught by other graduate student instructors. In an effort to minimize the potential impact of my role as an instructor on students' interview responses, I began each interview by encouraging the

participants to be honest and critical in their assessment of the course and to not worry about offending me as an instructor of the course. I emphasized that critical feedback is important to identifying how the course could be improved for future students.

Interview Protocol. Aligned with the sequential mixed methods approach (QUANTITATIVE → qualitative), the interview questions were developed after the quantitative data analysis was completed. Based on the quantitative findings, my goal for the interviews was to gain an understanding of what students in both conditions learned about motivation, the implications of this for their motivational regulation, and what factors contributed to their learning. By doing so, I aimed to gather more detailed information that could be used to redesign aspects of the motivational regulation intervention. The interview questions were written to be general enough so that a single protocol could be used to interview all students regardless of whether or not they experienced changes in their motivational belief or regulation strategies.

I used semi-structured interviews similar to those used in prior motivation (e.g., De Groot, 2002) research (e.g., Järvelä & Salovaara, 2004). The semi-structured interview protocol included a series of open-ended questions that were organized around focus areas. The interview protocol to included four focus areas: (1) students' understanding of motivation theories; (2) students' use of motivational regulation strategies; (3) students' impressions of the motivation unit and learning activities; and, (4) fidelity dosage check. Additionally, each interview began with introductions, an explanation of the overall goal of the interview (i.e., to improve the course), and emphasizing the need to provide feedback on both what was good and bad about the course. The full interview protocol can be found in Appendix C.

Analytic Plan. To answer my fourth research question, I used an iterative coding process to analyze the interview transcripts. My first step was to conduct an inductive review of the

transcripts (Nowell et al., 2017). Next, I identified themes in the data, which were used to generate a codebook (Morse et al., 2002; Saldaña, 2021). To do this, I generated descriptors for different key passages from each interview transcript, which were then exported from the transcript documents and added to interactive Miro boards to facilitate categorization. In doing so, the focus of the coding was on common themes across the cases, rather than within each case. Using the Miro boards, the themes were then categorized separately by two coders (myself and an undergraduate student researcher) and inconsistencies were discussed until we arrived at a consensus on the final codes. We identified four broad categories that were captured within the codebook: (1) students' motivational beliefs, (2) students' motivational regulation strategy use, and, (3) class structures, (4) learning activities (see Tables 24 to 27). The coding categories were used to identify key themes from the interview data and quantify the number of mentions across the 12 interviews and are detailed in the results.

Results

Using the qualitative codebooks generated during the thematic analysis process, I was able to answer my fourth research question. The research question had two distinct parts: the first part characterizes students' motivational beliefs and strategy use and the second part was focused on students' perspectives on how to potentially improve the instructional intervention below. I present the findings for each part in order below.

Themes: Motivational Beliefs and Regulation Strategy Use. The total mentions of different types of motivational beliefs described by students in response to questions about what beliefs make them motivated are detailed in Table 21. Of the various responses, students most frequently cited value beliefs as contributing to their motivation for academic tasks or coursework (n = 18). For example, one participant described that they are motivated when they

are "seeing value in what they're doing and just seeing the purpose for behind why it's important". It is important to note that mentions of personal interest were categorized within the value category. The second most frequently mentioned belief that supported students' motivation was growth mindset (*n* = 12). For example, a student described that to motivate themselves they have "been trying to transition to that growth mindset and really just be more focused on learning not to shut down when I [they] don't know something." The least frequently mentioned motivational belief was performance goals (*n* = 1). Additionally, it is notable that students did not mention belonging as something that supported their motivation for academic tasks, even though this was covered as part of the motivation unit (i.e., self-determination theory, need for relatedness; Ryan & Deci, 2017). Furthermore, students reported having autonomy needs met as important for their motivation, but this was not measured by the surveys used in the present study.

To understand students' reported motivational regulation strategy use, we used a similar process of coding and counting the total mentions of a particular strategy being used. Table 22 includes detailed frequencies by strategy. Of the strategies that students reported using to regulate their motivation (response to interview question 4: "Can you tell me about a time recently where you needed to motivate yourself to do something you didn't want to do?"), the most frequently mentioned strategy was regulation of value (*n* = 21). For example, a student described that to motivate themselves, they said that "a big part of me motivating myself is relating stuff back to my personal life." The second most frequently mentioned strategy was self-consequating (*n* = 16), followed by regulation of mastery goals (*n* = 9). It was notable that students self-reported using strategies that were not captured by the survey measures of motivational regulation used in the present study, but that are included in conceptualizations of

metamotivation and motivational regulation (Miele & Scholer, 2018). Specifically, students reported using efficacy management strategies and personal goal setting to regulate their motivation.

Themes: Effective Instructional Aspects of Motivation Unit. To answer the second part of the fourth research question related to identifying aspects of the motivation unit, and in some cases the motivational regulation intervention, that students perceived as helpful to their learning, I identified two broad categories of codes: class level structures and more specific learning activities. These codes emerged as themes if they were mentioned in interviews among at least two different participants. The class structures are detailed in Table 23 and include five broad subsets: (1) rigor (n = 2); (2) motivational supports (n = 33); (3) supports for collaborative work (n = 17); (4) instructor characteristics (n = 7); and, (5) variety of activities (n = 2). It is notable that two of the three motivational supports that arose as themes are aligned with self-determination theory (Ryan & Deci, 2017) – need for autonomy and need for belonging, even though need for belonging did not emerge as a theme in the analysis of students' motivational beliefs (see above). Collaborative work was another theme that arose in the coding, which was not surprising given the level of variability in the amount of opportunities for students to work together across the different sections and modalities of the course. Instructor quality and perceptions of instructor motivation was another emergent theme of potential aspects that were important for student learning. As these aspects were not measured as part of Study 1, it was not possible to investigate the potential effects of instructor quality or motivation on students' motivation and motivational regulation. In addition to these higher level recommendations related to the class as a whole, students also had several specific recommendations related to learning activities (see Table 24). The learning activities that emerged as themes included: using

multiple examples (n = 2), having students write motivational messages to others (n = 2), including more check-ins for accountability (n = 3), designing a motivation plan (n = 3), and including more review activities (n = 4). Taken together, there were several important implications for the redesigned motivational regulation intervention, which I incorporated into Study 2.

Brief Discussion: Study 1b

There were several key findings from Study 1b. First, value beliefs were the most frequently cited motivational belief and regulation strategy mentioned by students, which was somewhat surprising because this was not found to be significantly different from pre- to post-test in Study 1a. However, the overall mean levels of value beliefs and regulation of value were moderate-high on the survey measures (value beliefs: M_{T1} = 4.04, M_{T2} = 3.98; regulation of value: M_{T1} = 3.82, M_{T2} = 3.86 out of 5), so that did somewhat triangulate the findings. Additionally, growth mindset beliefs were the second most frequently mentioned belief students cited as underpinning motivation and regulation of mastery goals also a frequently mentioned strategy. This finding was particularly notable because growth mindset significantly increased following motivation unit, and growth mindset beliefs are positively associated with mastery goals in prior literature (e.g., Blackwell et al., 2007; Cury et al., 2006; Haimowitz et al., 2011; Hong et al., 1999; Mueller & Dweck, 1998). Therefore, the qualitative findings provided additional evidence that students' growth mindset beliefs may have been positively influenced by learning about motivation theories. There were also motivational beliefs (i.e., need for autonomy) and motivational regulation strategies (i.e., personal goal setting and efficacy management) that were found as potentially important for students' motivation, and influenced by taking a unit on motivation theories, but were not captured in quantitative measures. Finally,

Study 1b provided evidence about students' perceptions of what class structures and instructional activities could be changed to better support their learning during the motivation unit, which could inform potential changes to the motivational regulation instructional intervention. For example, the redesigned version of the intervention (detailed in Chapter 4) included having students complete a detailed motivation plan over the course of the unit, more explicit modeling of motivational regulation strategy use by instructors, an increased emphasis on the relevance of motivational regulation strategies, and greater opportunities for collaborative work.

Discussion

Study 1 provided detailed information that could be used for Study 2. First, I found that there was not an effect of the instructional intervention on students' reported motivational regulation strategy use, but did find some evidence that the motivation unit, regardless of the condition assignment, may have influenced students' motivational beliefs (i.e., growth mindset) and motivational regulation strategy use (i.e., regulation of situational interest). Therefore, Study 2 focuses, in part, on evaluating the potential effect of teaching about motivation theories on students' motivation, in addition to testing a redesigned motivational regulation intervention. Second, Study 1 provided new information about students' perceptions of the intervention that could be used to redesign aspects of the instructional intervention. These design implications are detailed in Chapter 4. Furthermore, Study 1 presented new information about the potential importance of students' perceptions of their instructor's motivation for their learning during the motivation unit. Due to this, students' perceptions of instructor motivation are included as a focal variable in Study 2. Finally, the findings of Study 1 indicated that motivational regulation strategy use may be important for teaching motivational beliefs, so this hypothesis is tested a second time in Study 2.

Chapter 4:

Study 2

The second study of this dissertation research had several aims. First, following the tenets of design-based research (McKenney & Reeves, 2018; Yeager et al., 2016), a primary purpose of Study 2 was to examine whether a redesigned motivational regulation intervention was more effective than the first prototype. Second, another goal of Study 2 was to investigate whether taking a course that covers theories of motivation was associated with positive changes in students' motivational beliefs and regulation strategies regardless of whether students received the motivation regulation intervention, since this was a tentative finding from Study 1. Third, an insight from the qualitative portion of Study 1 was that students' perceptions of their instructor may influence how a unit on motivation theories and a motivational regulation intervention is associated with changes in students' motivational beliefs and regulation strategies. Therefore, in Study 2, I examined the relations of students' perceptions of their instructor with changes in motivational beliefs and regulation strategies, as well as a potential interaction of these perceptions with the motivational regulation intervention. The final aim of Study 2 was to investigate whether learning about motivation theories and regulation strategies was beneficial for preservice teachers[10], teaching-related competence beliefs and career intentions. To situate Study 2 within the extant literature, I first provide an overview of the theoretical basis for the changes to the motivational regulation intervention. I then review prior literature on teaching about motivation and students' perceptions of their instructor. I do not include a literature review related to teaching-related competence beliefs since this was a focus of the introduction to the full set of studies (see Chapter 2: *Self-Regulation Interventions for Pre-Service Teachers*).

[10] Preservice teachers were identified using students' self-reported major as teacher education.

Redesigned Intervention Guided by Theory

Aligned with prior design-based education intervention research (e.g., Yeager et al., 2016), to redesign the motivational regulation intervention and make it more effective, I examined the themes that emerged from the qualitative strand and evaluated whether the key recommendations were aligned with extant theory and literature. In other words, the changes that were implemented in the second version of the intervention were guided by both the qualitative findings and theory.

The second version of the intervention included having students make a detailed motivation plan over the course of the motivation unit, rather than completing separate reflections at the end of each class (see Appendix C for a sample plan). The idea of a motivation plan was mentioned three times in the interviews (see Table 27). Having students engage in an ongoing process of reflecting on how they can apply different motivational regulation strategies to their own learning is aligned with prior research on strategies that promote deeper learning as students are able to incrementally build connections between content and their own lives (Bitter & Loney, 2015; Mthethwa-Kunene et al., 2022).

In addition to providing students with a single document where they could make connections between different regulation strategies, the motivation plans also included a prompt to have students reflect on a long-term goal that is personally important to them. For example, students set goals related to their career aspirations. According to prior research, adding a goal to the motivation plan should spur students to develop their own rationale for why the different motivational regulation strategies are important, which is found to increase students' sense that the content is relevant and valuable (Hulleman et al., 2010). Furthermore, goal setting is an important element of self-regulation (Locke & Latham, 2019). Increasing students' perceived

value of the motivational regulation strategy content was identified as an important aspect of the redesigned intervention since this was the most frequently mentioned motivational belief by students interviewed (see Table 24). The motivation plans also prompted students to set short-term goals (e.g., study for an upcoming exam) that provided a specific context for them to use a specific motivational regulation strategy. The inclusion of short-term goal setting was guided by goal-setting theory (GST; Locke, 1968; Locke & Latham, 1990, 2013), which suggests planning and strategizing underpins self-regulation. Short-term goal setting and planning was a frequently mentioned motivational regulation strategy in the interviews (see Table 25). Nevertheless, simply writing out long- and short-term goals is not found to increase motivation and achievement; it is also important to share these goals and plans with others (Schippers et al., 2020). Therefore, the motivation plans also included a section where students were prompted to share their plans with other members of a small group of students that they collaborated with across the semester (i.e., "base groups"). Providing students with increased opportunities to share with their peers was also aligned to a theme from the interviews – there were 14 mentions of collaborative work (see Table 26).

The final component that was included in the motivation plans was a prompt that requested students provide their own written definition of each motivational regulation strategy for their instructor to use for teaching future students. Having students add their own definition of each concept was included to serve as a review activity (four mentions in the interviews; see Table 27) and by telling students their definitions would be used to help instructors better teach future students the concept, was meant to promote the "saying-is-believing" phenomenon (Aronson, 1999). Prior research on the "saying-is-believing" phenomenon suggests that having students provide information for others can lead them to convince themselves of the value of the

concept (in this case each motivational regulation strategy) via cognitive dissonance processes (Bem, 1965; Cooper & Fazio, 1984; Yeager et al., 2016). Furthermore, having students write their own definition of each motivational regulation strategy provided an opportunity for instructors to check their understanding of the concepts.

The other primary change to the motivational regulation intervention for the redesigned version was an increased emphasis on having instructors model their own use of motivational regulation strategies. Having increased modeling of motivational regulation was included in the redesigned intervention to address several themes from the interviews, including having multiple examples (see Table 27) and increased instructor quality and motivation (see Table 26). Furthermore, prior theory and research has found strong support for students' learning from observing models (Bandura & Walters, 1963; Bandura, 1977) and modeling can provide an effective scaffold to supporting the development of self-regulated learning (Schunk & DiBenedetto, 2020). To increase the amount and quality of modeling for the redesigned intervention, the online content that students were provided included first person anecdotes from the instructor about how they used a motivational regulation strategy themselves. Additionally, the instructors who taught face-to-face were provided with lecture slides that included prompts to have them share a personal experience using a motivational regulation strategy as part of their presentation of the content. The face-to-face instructors were also provided with time ahead of the intervention to brainstorm ideas together of what they could share for each strategy. Finally, the motivation plan also included quotations from influencers that exemplified each motivation regulation strategy, which has been shown to be an effective method for supporting social learning and promoting attitude and behavior change (Chia et al., 2021). In sum, the redesigned intervention used information gathered in the first study triangulated with prior research and

theory to develop a more comprehensive motivation planning process for students and increased social modeling of motivational regulation strategies.

Potential Role of Students' Perceptions of their Instructor

Another key finding from the first study was that students' perceptions of the quality and motivation of their instructor may be an important factor in the effectiveness of the motivation regulation intervention, and the motivation theories unit more broadly (see Table 26). This emergent finding is aligned with prior research that found instructors may transmit their value for the content to students (Frenzel et al., 2018; Pekrun, 2006; Schifele, 2017). Specifically, students' perceptions of their teachers' teaching enthusiasm and relevance-related teaching practices (e.g., connecting content to real-world examples) influenced students' value beliefs (Parrisius et al., 2020). Importantly, it is students' *perceptions* of their teacher's motivation that underpin their own motivation, which implies that it does not necessarily matter what the teacher's motivation is, what matters is how motivated their students believe them to be. Additionally, by focusing on students' perceptions, these relations can be measured using self-report surveys (Parrisisus et al., 2020). I investigated an additional research question in the second study to understand whether students' perceptions of their instructors' motivation and support for relevance was associated with differences in motivational beliefs and regulation strategies.

Connecting Teaching Motivation Theories to Student Motivation

The post-hoc ancillary analyses in Study 1 suggested that adaptive changes in students' motivational beliefs may be associated with taking a unit that covers motivation theories. Due to this surprising finding, in the second study I sought to replicate these findings. There is very limited prior research that has investigated whether teaching about motivational theories

influences undergraduate students' motivation. Due to this dearth of prior research, identifying potential mechanisms that underpin a relation between teaching about motivation theories and changes in students' motivational beliefs must rely on theoretical work. According to models of metamotivation, instruction about motivation theories may increase students' metamotivational knowledge, and in turn, shift their motivational beliefs (Miele & Scholer, 2018). Therefore, direct instruction about motivation theories may provide an avenue for increasing students' motivation. Another important consideration is how motivation theories are presented within an educational psychology course. Educational psychology courses have been criticized for presenting motivation theories in a disjointed way, therefore using an organizing framework that connects them is important (e.g., "The ABCs of Motivation", Anderman & Leake, 2005). Accordingly, the motivation theories presented in the focal course were connected using an integrated perspective of motivation and two guiding questions (i.e., can I do this? why do I want to do this?; Linnenbrink-Garcia & Wormington, 2019). Additionally, an important prior finding is that having students apply what they learn about motivation theories to real-life situations may promote enduring increased in motivational knowledge (Alderman & Beyeler, 2008). As the instruction of motivation theories included real-life examples and prompts to apply concepts to teaching or professional situations (e.g., think about how you would help a coworker have greater self-efficacy), the course was designed to increase students' metamotivational knowledge, regardless of condition (i.e., intervention or control).

Study 2 Research Aims and Questions

The primary aims of Study 2 were to examine whether there is a relation of teaching motivation theories with changes in students' motivational beliefs and regulation strategies, whether including instruction on motivational regulation strategies (i.e., redesigned intervention)

is associated with greater changes in students' motivational beliefs and regulation strategies, and whether changes in students' motivational beliefs and regulation strategies are associated with perceptions of instructors' motivation and, for preservice teachers, teaching-related competence beliefs. To address these aims, I sought to answer the following questions.

Research Question 1: How do students' motivational beliefs and motivational regulation strategies change during a teacher education course that teaches them about theories of motivation and is the rate of change different for students that receive additional instruction about motivational regulation (intervention) compared to those who do not (control)? Based on the preliminary findings in the first study, I hypothesized that students would have adaptive changes to their motivational beliefs and regulation strategies across both conditions (i.e., as a function of taking a unit on theories of motivation). I also hypothesized that the students in the intervention condition would have greater changes to both their motivational beliefs and motivational regulation strategies than those in the control condition because of the increased emphasis of applying what they were learning to their own learning (Alderman & Beyeler, 2008). Additionally, I hypothesized that there would be an enhancing effect of the intervention even though there were null findings in Study 1 because of the redesigned intervention.

Research Question 2: Is the rate of change in motivational beliefs and motivational regulation strategies associated with students' perceptions of their instructor's motivation and relevance support and does it depend on receiving additional instruction about motivational regulation (intervention)? Since prior research suggests that students' perceptions of their instructor's motivation influences their own motivational beliefs (e.g., Parrisius et al., 2020), I hypothesized that students' perceptions of their instructor's motivation

and supports for relevance would be positively associated with adaptive changes to their motivational beliefs across both conditions. I also hypothesized that there would be a positive relation between students' perceptions of their instructor's motivation and their motivational regulation strategies, even though this has not been examined in prior research.

My second research question also examines the potential that there is an interaction between motivational regulation intervention and students' perceptions of their instructors' motivation. This was also important to investigate because of the inclusion of increased motivational modeling as part of the intervention, which may lead to increased perceptions of the instructor being motivated. Additionally, if students' value for course content is influenced by their perceptions of their instructor's motivation (as prior research suggests; e.g., Frenzel et al., 2018), it follows that they may learn more from the intervention. Due to this, I hypothesized that the rate of change in students' motivational beliefs and regulation strategies in response to the motivational regulation intervention will be greater when they perceive their instructor to be motivated and supportive of relevance.

Research Question 3: Among pre-service teachers only, are changes in motivational beliefs and motivational regulation strategies associated with teaching-related competence beliefs and teaching career intentions? Due to the findings in the first study that motivational beliefs and regulation strategies were positively associated with teaching-related competence beliefs, I hypothesized that students' adaptive changes in motivational beliefs and motivational regulation strategies would be positively associated with teaching-related competence beliefs. Despite null findings in the first study, I also hypothesized that adaptive changes in motivational beliefs and regulation strategies would be positively associated with teaching career intentions.

I provide a detailed method for Study 2 in the next section, followed by results, and a brief discussion.

Method

Setting and Participants. Similar to Study 1, quantitative data were collected from undergraduate students enrolled in a teacher education course (i.e., Reflections on Learning) at a large public university located in the Midwestern U.S. within a single semester (i.e., fall 2022; see Table 25 for study timeline). In contrast to the first semester of data collection, the course was not required for *all* teacher education students, but only for those planning to be elementary or special education teachers. Nevertheless, the course was also taken by students in secondary education degree programs as well as those in other majors as an elective credit. See Study 1 for a detailed description of the course.

During the fall 2022 semester, the course was comprised of 16 sections with 25 students in each section for a total enrollment of 400 students. Similar to Study 1, these sections were taught using multiple modalities by graduate student instructors. Specifically, four sections were fully asynchronous online, five sections were occasionally synchronous online (i.e., included four synchronous zoom class sessions over the semester), and seven sections were fully synchronous face-to-face. I used the same procedure to assign sections to intervention or control condition as in Study 1. All section assignments are detailed in Table 26.

Recruitment and Eligibility. I used the same recruitment procedures for students and instructors as in Study 1. There was broad participation in the study: of the total eligible students for the study, 97% participated in the study at Time 1. Student participants (n = 387) were 74% female and 82% White/European American, 3% Asian/Asian American, 5% Black/African

American, and 3% Hispanic/Latinx. Pre-service teachers made up 60% of the participants in the study. All 14 graduate student instructors participated in the study[11].

Procedure. The sequence of events for this study, including the focal instructional unit and measurement timing, are detailed in Table 25. Study 2 was pre-registered via the Open Science Foundation prior to any statistical analysis (see Appendix C for a copy of the preregistration).

Intervention Procedure. The intervention procedure was similar to Study 1 with one exception. As part of the training on how to implement the motivational regulation intervention for the face-to-face instructors, they were provided with time to develop specific examples of when they used motivational regulation strategies themselves so that they were prepared to share these model examples as part of their instruction.

Motivational Regulation Intervention. I detailed the new components of the redesigned intervention above, but it is also important to map these changes onto the original intervention design (see Table 1). There were no changes to Step 1 (i.e., direct instruction on motivation theory) or Step 2 (i.e., instruction in motivational regulation strategies). For Step 3, modeling of strategy use, instructors were encouraged to provide more personal examples of how they used motivational regulations strategies themselves and the online content included personal anecdotes which were not present in Study 1. For Step 4, collaborative work, students were provided with a more formal mechanism to encourage collaboration via the peer accountability prompt that was included on the motivation plan. Additionally, for the online sections, students were encouraged to contribute to their peers ideas asynchronously. Step 5, self-reflection, had the largest adjustments for the redesigned intervention due to the introduction of the motivation plan

[11] One graduate instructor taught three sections of the course. These sections were counterbalanced across condition.

that connected the different motivation regulation strategies to students' short- and long-term goals across the motivation unit.

Fidelity Checks. To check the fidelity of the intervention and whether the control condition sections covered content that was similar to the motivational regulation intervention, I checked the content that was presented to students. Specifically, for the online sections of the course, I reviewed the course content that was made visible to students via the Desire 2 Learn (D2L) course management system. For the face-to-face sections of the course, I reviewed the google slides that instructors used in their classes. There were only minor revisions made to both sets of content and nothing was identified as interfering with the fidelity of the intervention.

Survey Administration. Students in both conditions completed three surveys: a beginning of semester survey and a pre- and post-survey immediately prior to and following the motivation unit (see Table 25 for a detailed timeline). The survey administration procedures were consistent with Study 1. See Appendix C for additional measures and items used in Study 2 and Tables 27-29 for a construct list, measurement occasions, and scale reliability. The measures were the same as Study 1 with two exceptions. First, Study 2 included two additional scales to measure student-perceived instructional practices, which are described below. Second, students were not asked to provide contact information on the final survey for Study 2 because there were no plans for additional qualitative follow-up interviews.

Student-Perceived Instructional Practices. Items used to assess students' perceived instructional practices used a Likert-type scale with 1 = Strongly disagree to 5 = Strongly agree. I measured two different variables: (1) perceived teacher enthusiasm, and, (2) perceived use of everyday life examples. Both variables were measured using items adapted from scales used in prior research (Parrisius et al., 2020). The scale used to measure perceived teacher enthusiasm

included three items (e.g., “Our [class] instructor really seems to take pleasure in teaching.”). The scale used to measure perceived use of everyday life examples also included three items (e.g., “Our [class] instructor uses examples from daily life to show us why [class] can be useful.”).

Analytic Plan. Table 30 provides an overview of the research questions and planned analyses. I conducted similar preliminary analyses for Study 2 as I did for Study 1. I also used the same statistical software for Study 2 (i.e., SPSS version 24 for preliminary analyses and MPlus Version 8.4 for primary analyses), but I used R to merge the three waves of data together into a single dataset due to the increased complexity from Study 1. All primary analyses used full information maximum likelihood (FIML) estimation to account for missing data (Graham, 2003). I also examined motivational beliefs and motivational regulation strategies using separate univariate models to ensure there were no suppression effects (Schwinger & Steinsmeier-Pelster, 2012; Smit et al., 2017).

Results

Preliminary Analysis. Using Grubbs’ (1969) test, I identified cases of extreme outliers, so these instances were removed from the dataset. Specifically, I removed the scale scores for 22 cases across 18 variables. By removing outliers at the scale score level, no individual participants were removed from the data set. Next, I used confirmatory factor analysis (CFA) to examine the factor structure of the latent constructs by examining multiple similar scales together and evaluating model fit using the Confirmatory Fit Index (CFI) the root mean squared error of approximation (RMSEA). For Study 2, I followed the general guidance of Hu and Bentler (1999) to assess fit indices (i.e., CFI > .90; RMSEA < .10), but was more cautious in evaluating RMSEA for an indicator of fit since it underperforms when models have small degrees of

freedom (Kenny et al., 2015). Due to this, I relied more on CFI as an indicator of model fit when there were low degrees of freedom (e.g., perceived instructional practices). The full CFA results for all three timepoints are presented in Table 31. The results indicated that the expected factor structure held for the constructs.

I also used CFAs to assess multigroup and longitudinal measurement invariance to ensure that the measurements indicated the same underlying constructs across condition and time (Vandenburg & Lance, 2000). Measurement invariance was established if the change in CFI was ≤ 0.01 (Cheung & Rensvold, 2002; Meade et al., 2008). Due to the relatively small degrees of freedom in the models used in this study, CFI was weighed more heavily than RMSEA because RMSEA is highly sensitive to low degrees of freedom (Kenny et al., 2015). Additionally, there were several instances where the measurement invariance models were either saturated or overidentified, which resulted in CFI values of 1.00 and RMSEA values of 0.00. Saturated (or just identified) models occur when there are zero degrees of freedom, indicating that a unique solution to equations is possible and parameters can be estimated, but testing of model fit is not possible (Kenny & Milan, 2012). Whereas, overidentified models have degrees of freedom and occur when there are more equations than unknown parameters in the model, so model fit testing and CFI and RMSEA show good fit because "the differences between input covariances among variables and the covariance implied by the model estimates are minimal" (Wheaton, 1987, p. 118). Therefore, since overidentified models having equivalent fit indices (i.e., CFI = 1.00, RMSEA = .00), the substantive and theoretical meaning of the model and chi-square tests should be considered in model selection (Wheaton, 1987). Additionally, these fit statistics should be interpreted with some degree of caution due to the equivalency of the primary fit indices.

For the purposes of testing all four research questions, I sought to establish at least weak measurement invariance, which indicates that the factor loadings of each item on the latent construct are consistent across time and groups. In other words, weak invariance suggests that the items have the same meaning to participants regardless of when it was measured or what group they are a part of, so it can be used to compare factor variances and covariances (Meredith, 1993; Widaman & Reise, 1997). The results of both types of measurement invariance tests are detailed in Tables 32-35. Strict longitudinal and multigroup measurement invariance was established according to the longitudinal and multigroup models for all of the variables except performance-approach goals, performance-avoidance goals, regulation of value, self-consequating, environmental structuring, regulation of situational interest, perceived teacher enthusiasm, and perceived use of everyday life examples as the change in CFI was ≤ 0.01 (Cheung & Rensvold, 2002; Meade et al., 2008). Weak longitudinal measurement invariance was established for performance-approach goals, performance-avoidance goals, self-consequating, regulation of situational interest, perceived teacher enthusiasm, and perceived use of everyday life examples as the difference in CFI was ≤ 0.01. For regulation of value, strict longitudinal measurement invariance and strong multigroup invariance was established according to CFI. CFI indicated that environmental structuring had strict longitudinal measurement invariance and self-consequating had weak multigroup measurement invariance. Both environmental structuring and regulation of situational interest did not establish the minimum threshold of weak multigroup measurement invariance, therefore these constructs were not included in the models examining differences by condition, but were included in the models examining change over time. The multigroup model for performance-approach goals showed strict measurement invariance based on the CFI. The multigroup models for performance-avoidance goals, perceived teacher

enthusiasm, and perceived use of everyday life examples were overidentified, so model fit was evaluated using improvement in chi-square and substantive reasons. Using these criteria, strict multigroup measurement invariance was established for performance-avoidance goals and perceived use of everyday life examples, and perceived teacher enthusiasm demonstrated strong multigroup measurement invariance. I used the full results of the measurement testing (i.e., multivariate CFAs, longitudinal measurement invariance, and multigroup measurement invariance) to determine how the factor scores should be calculated for the remaining analyses for Study 2 since the growth models used observed variables due to power constraints. Additionally, the results of the measurement testing indicated that the same items should be removed when specifying the factor scores as in Study 1 and that no additional modifications were necessary.

After specifying the observed factor scores for the variables of interest, I conducted ANOVA tests to examine whether the participants were equivalent based on their condition assignment (see Table 36). The results of these tests indicated that the participants were equivalent across the intervention and control conditions across all measures (see Table 36). I additionally used chi-square tests to evaluate whether the samples were equivalent in terms of demographics. These tests indicated that there were no significant differences in demographics across the conditions (race: $\chi^2 = 7.96$, $p = .63$; gender : $\chi^2 = 7.63$, $p = .18$; first generation status: $\chi^2 = 3.91$, $p = .42$; preservice teacher status: $\chi^2 = 0.48$, $p = .49$).

I also examined attrition over time. Of the 378 students that completed the survey at T1, 323 completed the T2 survey (85%), and 268 completed the T3 survey (71%). Additionally, among self-reported pre-service teachers, 197 of 214 participants completed all three surveys (92%); and of the 200 students in the intervention condition, 178 completed all three surveys

(89%). I used ANOVA tests to compare participants with complete data on all three time points to those that only completed the baseline survey (T1). The results of these tests showed that the two groups were equivalent across all measures (see Table 37). Furthermore, the results of the chi-square tests indicated that there were no significant differences in terms of survey completion among different demographic subgroups (race: $\chi^2 = 5.25$, $p = .87$; gender : $\chi^2 = 6.29$, $p = .28$; first generation status: $\chi^2 = 9.31$, $p = .06$; preservice teacher status: $\chi^2 = 1.12$, $p = .29$). Next, I examined the descriptive statistics (see Tables 38-40). The means were within the expected ranges. The last step was to evaluate the correlations. The correlations showed the expected relations between variables based on prior research.

Primary Analysis. To answer my research questions, I used a series of structural equation models (SEM)[12]. Specifically, for research question 1, I tested a series of latent growth curve models to evaluate whether and how motivational beliefs and regulation strategies changed over the course of the semester and whether there were significant differences in the trajectories depending on condition (i.e., multigroup models). For the second and third research questions, I used path analyses to examine how changes in motivational beliefs and regulation strategies related to predictors and outcomes. For all of the primary analyses, I applied the Benjamini-Hochberg procedure to adjust the critical p-values and reduce the potential of a Type-1 error rate (Benjamini & Hochberg, 1995; Benjamini, 2010; Thissen et al., 2002) for all results presented in the primary analysis. The Benjamini-Hochberg procedure resulted in the exclusion of several results that had p-values less than .05, particularly in cases where there were a large number of findings that met this threshold.

[12] I also conducted post-hoc repeated measures analysis of variance (ANOVA) tests to verify the findings of the structural equation models. The results of these tests are detailed in Table 51.

Research Question 1: Relation of Condition with Changes in Motivational Beliefs and Regulation Strategy Use. To answer my first research question, I first evaluated whether condition was related to changes in motivational beliefs and regulation strategy use. To do this, I tested multigroup latent growth curve models (see Figure 5) with observed variables calculated using the factor scores based on the findings from the measurement analyses (i.e., first-order models). The multigroup models allowed for investigation as to whether the grouping variable (i.e., intervention or control condition) accounted for systematic variation in the parameter estimates (i.e., motivational beliefs and regulation strategies patterns of growth, covariances, and residual variances; Jöreskog, 1971; Sörbom, 1974, 1978). This method uses an iterative approach to modeling that begins with a completely invariant model that assumes the two groups are equivalent on all parameters and progressively frees constraints in the model to see if it significantly improves model fit. For the purposes of this study, I tested three different models for each construct to examine different potential trajectories in motivational beliefs and regulation strategies: (1) a no growth, intercept-only model; (2) a linear growth model (assumes linear change from T1 to T3); and, (3) a latent-basis growth model (accounts for non-linear change between the three time points). Specifying three different types of growth curve models allowed me to evaluate whether no growth, linear, or latent basis models best fit the growth trajectories. Linear models specify that the motivational beliefs or regulation strategies changed at a consistent rate across the semester, whereas the latent basis models allow for different rates of change from T1 to T2 and T2 to T3. Specifically, for this study, the linear growth models set the loadings at 0, 0.71[13], and 1. For the latent basis models, the first and last loadings of the latent growth estimate (T1 and T3) were fixed to 0 and 1, respectively, and the T2 coefficient was

[13] A loading of 0.71 was used for T2 because it fell at week 10 of a 14 week time period in the study (i.e., 10/12 = .71).

freely estimated (Bollen & Curran, 2006; McArdle, 1988; Ram & Grimm, 2007). The intercept represents the initial mean, the slope indicates the estimated change from the first to last occasion, and the second basis coefficient, which was estimated, represents the percentage of overall change up to T2 (see Figures 5-6). In other words, the slope estimates the total change in a particular construct from the first week in the semester to the week the post-test was taken (14 weeks total) and the latent basis coefficient estimates the proportion of change from T1 (week 1) to T2 (week 10; or 71% of the semester). All of the specified models were unconditional, meaning that there were no predictors or outcomes included in them since these relations were assessed using path analyses.

For the multigroup models, I evaluated whether model fit significantly improved, according to chi-square difference test, for the following progressive relaxations (latent factor means, factor variances and covariances, latent basis coefficients, and residual variances). If the multigroup models showed statistically significant improvement in chi-square according to difference tests, a multigroup model would be selected for evaluation of growth trajectories in motivational beliefs and/or regulation strategies. The chi-square difference tests were not significant for any of the models (see Tables 41-42), which indicated that there were no differences in the changes in students' motivational beliefs and regulation strategy use due to the condition. Therefore, I concluded that changes in students' motivational beliefs and regulation strategies were not affected by the motivational regulation instructional intervention.

After determining that no multigroup models would be used, I evaluated the fit indices for the full sample latent growth curve models (see Tables 43-44). To select the final model for interpretation, I used a different approach than the multigroup models, since the goal was not to assess statistically significant improvement as parameters were unconstrained, but rather to find

which trajectory best fit the data. Specifically, I first assessed whether there was improved model fit according to CFI and RMSEA. If there were any instances where CFI and RMSEA showed conflicting information (e.g., CFI increased and RMSEA increased vs. decreased), then I weighed CFI more due to the sensitivity of RMSEA to low degrees of freedom (Kenny et al., 2015). Specifically, I assessed whether there was at least a .10 or greater improvement in CFI (Bentler, 1990). I also used substantive reasons to select a model, which was particularly important when the fit indices were equal due to overidentified or saturated models. This meant that I evaluated whether the latent basis models indicated that the rate of change was significantly different from a linear slope as indicated by a significant Wald test statistic (i.e., generalized likelihood ratio test; Ke & Wang, 2015). The Wald test statistic can be used to indicate that the rate of change significantly differed over the course of the semester as evidenced by a latent basis coefficient being significantly different from the linear loadings (i.e., .71) at T2. A statistically significant Wald test statistic would provide evidence that motivational beliefs varied at different rates over the course of semester, which could be due in part to the motivation unit[14]. I used this additional step for model selection to test my hypothesis that the rate of change in motivational beliefs and regulation strategies would be influenced by the motivation unit resulting in a non-linear rate of change.

[14] Prior research suggests that students have greater changes in their motivational beliefs early in the semester (e.g., Lee et al., 2017), so it is possible that a greater rate of change could occur in the first or latter parts of the semester.

All models that were selected for motivational beliefs had good fit[15] (CFI values = .955 to 1.000; RMSEA values = .000 to .105[16]; see Table 43). Nearly all of the intercept-only – no growth – models had worse fit (i.e., lower CFI values and higher chi-square and RMSEA values) than those that specified either growth in the constructs across the three time points (i.e., linear or latent basis). I selected linear models for all of the motivational beliefs, except performance-avoidance goals (no-growth model), as these models had better fit according to CFI and non-significant Wald tests, which evaluated whether the rates of change differed significantly from the linear specifications. Since the results of all the Wald tests were not significant, I concluded that for the motivational beliefs that significantly changed over the course of the semester, the rates of change did not significantly differ from a linear trajectory. This suggests that the rate of change in students' motivational beliefs did not shift differently as a function of the motivation unit.

Table 44 shows the full set of parameter estimates for motivational beliefs and model-implied trajectories are visualized in Figure 7. Academic self-efficacy and self-efficacy for self-regulated learning had significant negative linear slope estimates (academic self-efficacy: -0.09, *SE* = .03, *p* = .003; self-efficacy for self-regulation: -.13, *SE* = .03, *p* <.001), which suggests that students had significantly decreasing academic self-efficacy and self-efficacy for self-regulated learning beliefs from T1 to T3. In contrast, there were significant positive slope estimates for

[15] It is important to note that similar to the measurement invariance models, there were several instances where the latent growth curve models were either saturated or overidentified, which resulted in CFI values of 1.00 and RMSEA values of 0.00. These instances are not necessarily evidence of perfect fit and should be interpreted with caution (Wheaton, 1987). Due to the potential that these models may not have actually fit the data well, I conducted post-hoc ancillary analyses to confirm the findings for all significant results using another method (repeated measures ANOVAs). The repeated measures ANOVA tests demonstrated similar findings as those found for the growth models presented in the primary analysis for RQs 1-3, and therefore, confirmed the accuracy of these findings.

[16] Two of the models did not meet the recommended threshold for RMSEA (i.e., <.100): self-efficacy for self-regulated learning and regulation of mastery goals, but had significant improvement to chi-square and met the threshold for CFI (i.e., > .90). Due to the sensitivity to RMSEA to low degrees of freedom (Kenny et al., 2015), these models were still included for interpretation.

performance-approach goals (0.14, *SE* = .03, $p < .001$), fixed mindset beliefs (.11, *SE* = .03, $p < .001$), growth mindset beliefs (.09, *SE* = .04, $p = .016$), and implicit theories of willpower: strenuous mental activity (0.17, *SE* = .03, $p < .001$). These findings were mixed since both adaptive motivational beliefs had both increasing (i.e., growth mindset beliefs, implicit theories of willpower: strenuous mental activity) and decreasing trajectories (i.e., academic self-efficacy)[17].

Next, I assessed whether there were significant changes in motivational regulation strategies, and if so, what the rate of change was whether it varied during the motivation unit. I used the same model selection process for the motivational regulation strategies as the motivational beliefs. All models that were selected for motivational regulation strategies had good fit (CFI values = .964 to 1.000; RMSEA values = .000 to .115; see Table 45). I selected linear models for regulation of value, regulation of performance goals, and regulation of situational interest. In contrast to the motivational beliefs, there were three types of motivational regulation strategies that had better model fit for the latent basis models (i.e., > .10 CFI improvement) and significant Wald tests. Therefore, latent basis models were selected for self-consequating, environmental structuring, and regulation of mastery goals. Since the Wald tests indicated that the freely estimated latent basis coefficients were significantly different from the linear specification, it can be concluded that the rates of change for these constructs differed from a linear trajectory over the course of the semester. Table 46 shows the full set of parameter estimates for motivational regulation strategies and Figure 8 shows the model-implied trajectories. Regulation of performance goals had a significant negative slope estimate (-0.11, *SE* = .03, $p = .001$), which suggests that students had significantly decreasing regulation of

[17] Performance-approach goals are associated with mixed outcomes (Midgley et al., 2001), so I did not classify them as either adaptive or maladaptive.

performance goals across the semester. In contrast, self-consequating and regulation of mastery goals had significant positive slope estimates (self-consequating: 0.15, *SE* = .04, $p < .001$; regulation of mastery goals: 0.11, *SE* = .04, $p = .009$). This suggests that students' use of motivational regulation strategies changed over the course of the semester; specifically, that on average students relied more on self-consequating and regulation of mastery goals and less on regulation of performance goals.

Additionally, the estimated latent basis coefficients for self-consequating, environmental structuring, and regulation of mastery goals significantly differed from the linear specified T2 coefficients according to the Wald test (self-consequating: 4.22, $p = .040$; environmental structuring: 5.76, $p = .016$; regulation of mastery goals: 4.38, $p = .036$), which indicates there was unequal change in the trajectory from measurement occasion to measurement occasion among these constructs. The model-estimate latent basis coefficients for T2 showed that a majority of the change occurred prior to the motivation unit. For environmental structuring, the latent basis coefficient indicated that 100% percent of the non-significant and very minimal change occurred prior to the motivation unit (*SE* = .12, $p < .001$). Both self-consequating and regulation of mastery goals had significant positive slopes (.15, *SE* = .04, $p < .001$; .11, *SE* = .04, $p = .009$, respectively). The latent basis coefficients were both greater than .71 (i.e., linear T2 coefficient) which suggests that the majority of the change took place in the first 10 weeks of the semester. Specifically, 91% of the change in regulation of mastery goals (*SE* = .09, $p < .001$), and 90% of the change in self-consequating (*SE* = .09, $p < .001$) occurred prior to the motivation unit.

In sum, the findings for the first research question showed that there was not a significant difference in the change in students' motivational beliefs or regulation strategies due to the motivational regulation intervention. Furthermore, the rate of change in students' motivational

and regulation strategies did not significantly shift during the motivation unit, and in the case of self-consequating and regulation of mastery goals, the opposite was true – the majority of the increases happened in the first 10 weeks of the semester prior to the motivation unit. However, the findings also showed that even though there were some declines in students' motivational beliefs and regulation strategies (i.e., academic self-efficacy, self-efficacy for self-regulation, and motivational regulation of performance goals), there were also increases (i.e., performance approach goals, fixed mindset, growth mindset, implicit theories of willpower: strenuous mental activity, self-consequating, and regulation of mastery goals).

Research Question 2: Relation of Student-Perceived Instructional Practices and Condition with Changes in Motivational Beliefs and Regulation Strategy Use. To answer my second research question, I used SEM path analysis to examine whether students' perceptions of teacher enthusiasm and use of everyday life examples (i.e., a relevance supportive instructional practice) were associated with changes in students' motivational beliefs and regulation strategies at the end of the motivation unit, controlling for pre-motivation unit levels (see Figure 9 for a path diagram), and whether perceived instructional practices changed the effect of the intervention. For ease of interpretation, I used mean-centered factor scores for the student-perceived instructional practices in the models. To test the interaction between perceived instructional practices and the intervention condition on changes in motivation beliefs and regulation strategies use during the unit, I specified two interaction terms in the path analysis models using the dichotomously coded condition variable and mean-centered factor scores for student-perceived instructional practices. The results of these analyses are presented in Tables 47 and 48.

In contrast to my hypothesis, there were no significant relations between student-perceived instructional practices and motivational regulation strategies. There was, however, one significant interaction for perception of instruction by intervention condition. Specifically, the interaction of condition with perceived teacher enthusiasm was positively associated with growth mindset beliefs (.14, *SE* = .07, *p* = .043). To understand this interaction, I estimated the simple slopes and examined them in graphical form (see Figure 10). This revealed that when students had higher perceptions that their instructor was enthusiastic, the motivational regulation intervention had a greater positive association with increased growth mindset beliefs during the motivation unit. This finding was aligned with the hypotheses that the intervention would be more effective when students perceived their instructor to be enthusiastic.

Research Question 3: Relation of Changes in Motivational Beliefs and Regulation Strategy Use with Teaching-Related Competence Beliefs and Career Intentions. To answer my third research question, I ran a series of SEM path analysis models for the preservice teacher sample (i.e., only included those participants that indicated they planned to graduate with a teacher education degree on the surveys). Since the focus of the third research question was on teaching-related beliefs and career intentions, it did not make sense to use the full sample of students. Figure 11 shows the path analysis that was used. Similar to the other models, a separate model was used for each type of motivational belief and regulation strategy. Time 2 levels of the motivational beliefs, regulation strategies, and teaching related competence beliefs and career intentions were controlled for in each model.

Table 49 shows the full set of parameter estimates for motivational beliefs among preservice teachers. Similar to the approach for research question 3, I used mean-centered factor scores for the outcome measures used in the models. Every type of motivational belief, with the

exception of self-efficacy for self-regulation, at T3 were found to be positively associated with efficacy for supporting student motivation and teacher responsibility for supporting student motivation, controlling for T2 levels (βs =.156 to .605, *SE*s = .045 to .098, *p*s = .005 to <.001). This was also the case for efficacy for teaching, with two exceptions, changes in both types of implicit theories of willpower were not significant predictors of efficacy for teaching beliefs. The findings for motivational regulation strategies were very similar (see Table 50). Specifically, efficacy for teaching at T3 was significantly associated with every type of motivational regulation strategy controlling for T2 levels (βs =.224 to .464, *SE*s = .055 to .075, *p*s <.001). Each type of motivational regulation strategy was positively associated with efficacy and teacher responsibility for supporting student motivation, except for regulation of performance goals and self-consequating (βs =.240 to .468, *SE*s = .070 to .092, *p*s = .009 to <.001). Not a single motivational belief or regulation strategy at T3 was significantly associated with teaching career intentions.

Brief Discussion

The findings of Study 2 were mixed. Contrary to my hypothesis, the redesigned motivational regulation intervention was not significantly associated with changes in motivational beliefs or motivational regulation strategies. However, there is one exception, where students' perceptions of their instructor's enthusiasm enhanced the relation of the motivational regulation intervention with growth mindset beliefs. In addition to testing a redesigned motivational regulation intervention, an aim of Study 2 was to understand if there are benefits to taking a unit on motivation theories for students' motivational beliefs and regulation strategy use. These findings were also null – the growth models for both motivational beliefs and regulation strategies suggested that there changes across the semester, but that the rates of

change did not significantly shift during the motivation unit. Furthermore, the changes in motivation were mixed as there was evidence of both increases in both adaptive (e.g., growth mindset, implicit theories of willpower: strenuous mental activity) and maladaptive (e.g., fixed mindset) beliefs over the course of the semester. The significant changes in motivation observed over the course of the semester suggest that there may be factors influencing student motivation that are not accounted for in this study. Nevertheless, by examining longitudinal trajectories of motivational regulation strategies, the present study makes an important contribution to the extant literature, since the prior literature has not frequently employed longitudinal modeling. Another aim of Study 2 was to understand whether student-perceived instructional practices of their instructors were associated with changes in motivational beliefs and regulation strategies and whether these perceived instructional practices altered the effectiveness of the intervention. There was only evidence of a single interaction: students in the intervention condition with higher perceptions of instructor enthusiasm had higher growth mindset beliefs. Finally, I considered whether changes in students' motivational beliefs and regulation strategies during the unit were associated with teaching-related competence beliefs and career intentions among the sub-sample of participants who were pre-service teachers. There was evidence of strong associations between preservice teachers' end-of-semester motivational beliefs and regulation strategies with teaching-related competence beliefs, which suggests that supporting preservice teacher motivation may be important to their future teaching motivation. Chapter 5 includes a more detailed exploration of the theoretical and practical implications of these findings.

Chapter 5:

Discussion

There is a pressing need to ensure that teachers have adaptive motivational beliefs and the ability to regulate their motivation as they face complex and unpredictable challenges in their jobs (McLean et al., 2019; Richardson & Watt, 2010). Furthermore, it is increasingly important for educators to have an understanding of how to support their students' motivation following the COVID-19 pandemic disruptions (Chiu et al., 2021). One way to potentially address both of these needs – supporting both teacher and student motivation – is to ensure that college students who are planning to become teachers (i.e., preservice teachers) learn how to better regulate their own motivation as learners, because this may increase their ability to support their future students' motivation (Kramarski, 2018; Lauermann & Karabenick, 2013). However, there is limited prior research that has investigated how to support the development of preservice teachers' motivational regulation in the context of a teacher education course despite the potential benefits of doing so. Additionally, there is a dearth of research that has examined how teaching students about motivation theories may influence their achievement motivation, and whether the teaching of motivation is beneficial, even though this is a topic commonly covered in educational psychology courses (Patrick et al., 2011).

To address this gap in the prior literature, and more importantly, understand whether teaching about motivation theories and motivational regulation is a potential solution for increasing teacher and student motivation, I conducted a series of two studies using mixed methods aligned with a design-based research approach to test a novel motivational regulation intervention as part of a unit of motivation theories in a teacher education course. As part of testing the effectiveness of a motivational regulation intervention, I also examined potential

interaction effects with preservice teacher status (Study 1) and perceived instructor motivation (Study 2) and the relations of motivational beliefs and regulation strategies with teaching-related outcomes (both studies). Since the intervention took place as part of a unit on motivation theories, I also investigated the potential benefits of learning about motivation as part of an ancillary post-hoc analysis in Study 1 and the primary analysis in Study 2.

Main Effects of Intervention

The primary aim of this series of studies was to test a novel motivational regulation intervention. To this end, I tested two versions of the intervention following a design-based research approach. Despite my hypothesis that there would be a main effect of the motivational regulation intervention on students' motivational regulation strategy use (Studies 1 and 2), and also potentially on their motivational beliefs (Study 2), there were no significant effects of the intervention as tested in the present study. There is a potential that the intervention influenced motivational beliefs and/or regulation strategies in a way that was not captured by the present study. For example, motivational regulation strategies were assessed using self-report survey measures, which may not have adequately captured the dynamic nature of motivational regulation strategy use and may be better assessed using approaches such as experience-sampling method (Csikszentmihalyi et al., 2014) or behavioral trace data (Bernacki, 2017). Furthermore, there is a potential that the intervention influenced beliefs, emotions, or behaviors that were not the focus of the present investigation at all, and are left undiscovered. Nevertheless, it is important to examine potential reasons for the null findings in the present investigation.

First, even though I developed the intervention using approaches similar to those found to be effective in prior research (i.e., professional development model for supporting teachers' "triple SRL-SRT processes"; Kramarski & Heaysman, 2021), there were some important

differences in my approach which may have influenced the effectiveness of it. The triple SRL-SRT training model was developed for in-service teachers rather than preservice teachers and emphasizes the importance of having teachers be able to apply what they learn about self-regulated learning to both themselves as learners (i.e., self-regulated learning; SRL) and as teachers (i.e., self-regulated teaching; SRT). Kramarski and Heaysman (2021) hypothesize that a key aspect of their intervention is having teachers be able to see how self-regulation is beneficial to their multiple roles as learners and teachers and that this sets in motion a positive recursive process or spiral. Therefore, adapting the intervention for preservice teachers entails the absence of opportunities to apply what they learn about motivational regulation to teaching since they are not teachers yet, which prevents the hypothesized recursive process from happening. This immediate application to teaching may be a critical component to the overall effectiveness of the intervention and was absent from the adapted approach used for this study. Another important difference between the original triple SRL-SRT training model and the intervention used in this study is the focus on motivational regulation for the latter. Since the triple SRL-SRT training model was focused on helping teachers develop behavioral and cognitive self-regulated learning, it was not clear whether this approach could be used to support increased motivational regulation. Finally, the empirical findings that provide evidence of the effectiveness of the triple SRL-SRT training model tested an intervention that had a total of 30 contact hours over five months (Kramarksi & Heaysman, 2021), whereas the present intervention had a total of 12 contact hours over four weeks. Therefore, the total dosage and duration were quite a bit a lower for the intervention tested in this study, which may have buffered its effectiveness.

Second, the intervention tested in this study used explicit instruction of self-regulation, which has been found to be successful in prior self-regulated learning interventions (e.g., Butler

& Winne, 1995; Dignath et al., 2008), but contradicts other research on psychological interventions that suggest implicit and subtle messages are effective (Walton & Wilson, 2018). These "wise interventions" are inspired by cognitive dissonance theory (Festinger & Carlsmith, 1959) and are designed on the premise that messages are more likely to influence a person's beliefs if they are structured in a way that allows them to draw a conclusion on their own, rather than being told what the "right" conclusion is. In the redesign of the intervention for Study 2, I added in a component to the intervention (i.e., writing definitions of key ideas in your own words for future students) that attempted to more subtly shift students' beliefs about the potential applicability of motivational regulation strategies, and in turn their behaviors (i.e., strategy use). This approach draws from cognitive dissonance theory. However, this small change was added to a general approach that used an explicit approach to teaching students about motivational regulation, and therefore, may not have been effective.

Third, another factor that may have influenced the effectiveness of the intervention is that the control condition may have not been a clean comparison group due to motivation theories being discussed across both conditions. It is possible that instructors may have used examples from their own lives about how different motivation theories have benefited them (e.g., having a mastery orientation to receiving feedback during the peer review process), which may have served to model motivational regulation strategies for students. Further, students in both conditions completed reflection assignments that directed them to apply motivation theories to real-world contexts. In the control condition, these reflections were focused on applying motivation theories to help others (e.g., future students or colleagues) be more motivated, whereas, in the intervention condition, the reflections were focused on helping themselves be more motivated as students by using motivational regulation strategies. The similar emphasis on

application of motivation theories may have served to further contaminate the control condition. The findings of this study showed some evidence that students across both conditions experienced positive shifts in motivational beliefs and motivational regulation strategy use, which supports the idea that the comparison group did not represent a "clean" control group. Additionally, the instructors in the intervention condition attended a single one-hour meeting that covered how they could teach the motivation unit with an emphasis on motivational regulation. This training session may not have been adequate to prepare them to meaningfully shift their instruction to be more supportive of students' development of motivational regulation, as prior research suggests teachers need to be trained over a long period of time to become more motivationally supportive (Turner et al., 2014). Thus, even though intervention instructors were provided with content for instruction that emphasized application of motivation theories for motivational regulation strategy use, they may not have been sufficiently trained to support students' development of motivational regulation.

Fourth, another reason the intervention may not have been effective is that students may not have needed to apply what they learned about motivational regulation strategies to the focal course. The focal course for this intervention was an introductory course that students shared in the qualitative interviews lacked rigor. Students may not have seen a need to use motivational regulation strategies for the course because of the perception that it was an "easy" class. The perception that the course was not challenging may have resulted in students having high self-efficacy for the class, but also potentially lower value for it as students may perceive rigor to be an indicator of importance (Eccles & Wigfield, 1995). Thus, students would not have immediately applied the regulation strategies, which is important for their development (Hattie et al., 1996). Due to this potential lack of immediate application, a recursive process where students

could see the benefit of using motivational regulation strategies, may not have occurred further deteriorating the effectiveness of the intervention (Garcia & Cohen, 2013; Walton & Cohen, 2011; Walton, 2014).

Finally, another potential explanation for the null findings of the intervention is that motivational regulation strategy use does not change. However, this explanation is refuted by the ancillary findings of this study, which showed that students' motivational regulation strategy use did change over the course of the semester, despite the potential shortcomings of the measures used. Thus, the present study highlights that motivational regulation strategy use can and does change, so investigating the potential of other interventions for supporting students' development of motivational regulation is an important area of future research.

Interaction Effects of Intervention

The second aim of this study was to examine whether there were particular factors that enhanced the effectiveness of the intervention. Specifically, for Study 1, I tested whether the effect of the intervention depended on students' plans to become teachers . Contrary to my hypotheses, the intervention was not more effective for students that planned to become teachers for Study 1. There are a few potential reasons for these null findings. First, the majority of preservice teachers take the focal course in their first or second year of college, which may make it difficult for them to see the potential application of the content for their future roles as teachers (Darling-Hammond et al., 2005). Thus, the assumption that the motivational regulation intervention content would be more relevant for preservice teachers may have been inaccurate, as the intervention was designed to have students apply what they learned about motivational regulation strategies to their lives as students, with minimal emphasis on the potential longer term applications to teaching. Additionally, since nearly half of the students taking the teacher

education course were not preservice teachers, it is likely that the class discussions (both online and in-person) emphasized how the content could be applied to broader situations than classroom teaching. These discussions of broad application of motivation theories and motivational regulation may have been beneficial to students generally, but could have prevented preservice teachers from having enhanced relevance since they may not have seen a direct connection to their future careers (Harackiewicz et al., 2016; Hulleman et al., 2010).

Since there were null effects for preservice teacher status in Study 1, and due to the findings from the qualitative analysis where students' emphasized the importance of their instructor appearing to be motivated, Study 2 examined whether students' perceptions of their instructor's motivation boosted the intervention. For Study 2, there was evidence of one interaction effect. Specifically, the findings suggested that students who received additional instruction on motivational regulation and perceived their instructor to be enthusiastic had a greater belief that intelligence is malleable compared to those who did not receive the intervention and perceived their instructor to be less enthusiastic. This finding adds new information to the prior research that has investigated interventions to increase students' mindset beliefs (e.g., messages that the brain can grow through practice; Yeager et al., 2019). Specifically, this finding suggests that when an enthusiastic instructor models motivational regulation strategies and provides information about how students can use them to increase their own motivational regulation, it may cause to students to have increased growth mindset. The notion that growth mindset beliefs and self-regulation are connected is aligned with prior research. Notably, Mrazek and colleagues (2018) conducted a series of experimental studies and found that students who participated in a self-regulation training that included information about growth mindset theory had increased self-regulation. These authors concluded that altering

students' growth mindsets may be an important antecedent to shifting their self-regulation because of the underlying belief that exerting effort will lead to increased abilities (Hong et al., 1999; Miele et al., 2011; Miele & Molden, 2010). The present study extends this research by suggesting that self-regulation and growth mindsets may reinforce each other, as students who learned about motivational regulation strategies, from an instructor they perceived as enthusiastic, reported greater increased growth mindset beliefs than those that did not learn about motivational regulation strategies. Nevertheless, the finding that the effectiveness of the motivational regulation intervention was enhanced by students' perceptions that their instructor was enthusiastic should be interpreted with some caution as the finding was marginally significant and the mean differences were minimal, so there is a need to replicate this finding. Furthermore, , these relations seem to be complex and may be influenced by other constructs that are implicated in perceived teacher enthusiasm such as students' affective experiences [e.g., interest (Lazarides et al., 2019), reduced boredom (Cui et al., 2017), and perceptions of a supportive classroom environment (Patrick et al., 2003)]. Since the findings for all other interaction effects were null, this interaction should be interpreted with caution, especially since interaction effects may be challenging to replicate (Iso-Ahola, 2020). There may be a systematic reason that the effectiveness of the intervention for increasing students' motivational beliefs and regulation strategy use generally did not depend on students' perceptions of how enthusiastic their instructor was and their use of real-world examples including factors discussed above related to the null finds for the main effect of the intervention. Additionally, there is the potential that there was a positive response bias on the measures used for students' perceptions of their instructor, since the survey was administered prior to the end of the semester by their instructor. Even though students were reassured that their instructor would not see their survey responses

and they would be full deidentified, students may have been inclined to rate their instructor positively (Macfadyen et al., 2016).

Potential Benefits of the Teaching of Educational Psychology

The findings from both Study 1 and Study 2 suggest that taking an educational psychology course may be beneficial to students' motivation, but that a unit on motivation theories is not uniquely valuable. The most marked finding was that there was evidence that students' growth mindset beliefs increased across both studies, which is striking because students' adaptive motivational beliefs typically decline over the course of a semester (e.g., Corpus et al., 2020; Kosovich et al., 2017; Robinson et al., 2022). Specifically, in Study 1, I found that students' belief that their abilities could be improved through increased effort (i.e., growth mindset) was greater at the end of the motivation unit than when prior to it according to students' self-report surveys and interviews. In Study 2, I found additional evidence that students' beliefs that their abilities could be changed , not only over the course of the motivation unit itself, but over the course of the semester[18]. Additionally, students' goals to avoid being unfavorably compared to others (i.e., performance-avoidance goals) did not significantly change over the course of the semester (Study 2), which was a notable finding since prior research suggests that students' performance-avoidance goals increase over a semester (Corker et al., 2013; Lee et al., 2017). Furthermore, regulation of performance goals significantly declined, while regulation of mastery goals significantly increased over the course of the semester. Taken together, these findings suggest that students may have shifted their focus toward intraindividual learning and improvement (i.e., a mastery orientation) versus interpersonal comparison (i.e., a

[18] Note that growth mindset beliefs in the second study showed a statistically significant interaction that showed the intervention was associated with increased growth mindset beliefs for students that had high perceived teacher enthusiasm.

performance orientation). Having an increased focus on personal improvement over time (i.e., mastery goals) is found to be associated with positive outcomes, such as decreased dropout intentions (Kryshko et al., 2020), so these findings suggest that students may have benefitted from taking an educational psychology course. Furthermore, since a mastery orientation is associated with growth mindset beliefs (e.g., Blackwell et al., 2007; Cury et al., 2006; Hong et al., 1999; Mueller & Dweck, 1998), these findings taken together served to triangulate the findings for growth mindset. However, it should be noted that students' goals to be favorably compared to others (i.e., performance-approach goals) did significantly increase over the course of the semester (Study 2), which somewhat complicates these findings since performance-approach goals are found to be associated with mixed outcomes (Midgley et al., 2001) and are thought to develop from fixed mindsets (Cury et al., 2006; Dweck & Leggett, 1988). These findings suggest that teaching motivation theories may not lead to greater benefits to students' motivation above and beyond taking an educational psychology course, but that taking this type of course may a complementary approach for promoting students' growth mindset beliefs to the current interventions used that rely on more indirect messages about brain development as a way to promote the idea that intelligence is malleable (see Dweck & Yeager, 2019 for a review). Furthermore, the findings support the notion that students' motivational beliefs and regulation strategies can *and* do change (Wolters, 2011).

Nevertheless, there is a need to further study precisely what aspects of the course may have served to increase students' motivation. For example, there was a one-week module on brain development that emphasized brain plasticity (i.e., the ability for the brain to change across the lifespan), which is very similar to some of the mindset interventions found to be successful in prior research (e.g., the *Brainology* program, Dweck, 2008; MindsetWorks, 2012; Schmidt et al.,

2017). Alternatively, another potential topic that could have influenced students' motivational regulation, specifically self-consequating, was the one-week module on behaviorism. This module included information about habit formation and information on how students could use ideas related to rewards to form positive habits. There may also be factors outside of the course that influenced students' motivational beliefs and regulation strategies, so these findings should be interpreted with caution. For example, it could be that students used more self-consequating strategies over the course of the semester because their course demands likely increased in tandem.

The present study also investigated potential predictors of implicit theories of willpower, which adds to prior research that has focused on outcomes of implicit theories of willpower (e.g., Allen et al., 2023; Job et al., 2016). Study 1 revealed that motivational regulation strategies were differentially related to different types of implicit theories of willpower for strenuous mental activity versus resisting temptations. Specifically, students' reported use of strategies to increase situational interest (i.e., regulation of situational interest) and focus on learning (i.e., regulation of mastery goals) were associated with increased beliefs that strenuous mental activity can be maintained (i.e., implicit theories of willpower for strenuous mental activity). Whereas students' reported use of strategies to boost situational interest and use of external rewards or consequences (i.e., self-consequating) were associated with lower beliefs that the ability to resist temptations could be sustained (i.e., implicit theories of willpower for resisting temptations).

Relations of Motivational Beliefs and Regulation Strategy Use with Teaching Beliefs

A final aim of this study was to understand how teaching about motivation theories, and in particular, motivational regulation may support preservice teachers and prepare them to be motivated and successful when they enter a very challenging profession (Kyriacou, 2011;

Skaalvik & Skaalvik, 2017). Ensuring that new teachers are motivationally-prepared is perhaps more important now than ever before as schools face unprecedented challenges following the COVID-19 pandemic (Baker et al., 202l). Therefore, this study also reflects the recent "teacher turn" in educational psychology (Lauermann & Butler, 2021) by using rigorous analytical methods (i.e., structural equation modeling) to investigate the relation of preservice teachers' motivational regulation strategies with their teaching-related competence beliefs. Across both studies, the findings suggest that preservice teachers' self-reported motivational regulation strategy use was associated with teaching-related competence beliefs. For example, using strategies to increase beliefs about the value of a task (i.e., motivational regulation of value) and focus on how one compares to others (i.e., regulation of performance goals) were found to be positively associated with preservice teachers' beliefs about their ability to effectively support their future students' motivation (i.e., teacher efficacy for supporting student motivation) across both studies. Additionally, in Study 2, motivational beliefs and motivational regulation strategies were found to be positively associated with all three types of teaching-related competence beliefs included in this investigation (teacher efficacy for supporting student motivation, efficacy for teaching, and responsibility for student motivation). Therefore, these findings suggest that supporting preservice teachers' development of motivational regulation and broader motivational beliefs may be beneficial to self-efficacy for teaching generally and for supporting their students' motivation. However, it is important to note that the present findings are not causal, so further investigation is warranted. Since "teaching-related competence beliefs play an important role in the instructional process" and are associated with well-being and persistence in the profession (Lauermann & Ten Hagen, 2021, p. 279), identifying new ways to support preservice teachers

development of motivational regulation strategies, and in turn foster their teaching-related competence beliefs, may be an important new area of study.

It is notable that there were no significant relations with motivational beliefs or regulation strategies with teaching career intentions. One potential explanation is that there may be a "ceiling effect" on this scale (Wang et al., 2008). The mean scores for teaching career intentions were near the top of the scale (Study 1: 9.04 to 9.22; Study 2: 9.17 - 9.39; out of a 10 point maximum) and the students were identified as preservice teachers using a single self-report question, which may have served to confound these results.

Implications

The present study provides a model for a mixed methods design-based research approach completed within a relatively short-time frame. Due to this approach, the present study sought to have "certain characteristics of innovativeness, responsiveness to evidence, connectivity to basic science, and dedication to continual improvement" (Bereiter, 2002, p. 321). Aligned to this approach, Study 2 was conceptualized following review of the results from Study 1, so that it could be responsive to the emerging evidence and was focused on improvement to both the intervention under investigation and the methods used to test it. Another quality of design-based research is having a dual focus on theoretical and practical implications (McKenney & Reeves, 2018). Educational psychology has a rich tradition of research that makes theoretical contributions and is of practical significance, but there is a persistent research-practice gap within this field (Neal et al., 2019). A design-based research approach, such as the one used in this study, is one potential avenue for closing this gap (Sandoval & Bell, 2004). Even though the intervention that was the focus of the present study was not found to be effective, the design-

based research approach used showed promise for conducting research that provides both theoretical and practical implications.

The present study has implications motivational regulation theory. This study investigated whether students' exposed to an explicit instructional intervention on motivational regulation strategy use as part of a unit on theories of motivation would increase their self-reported motivational regulation strategy use via increased metamotivational knowledge. To this end, the present study tested a theory of metamotivation developed by Miele and colleagues (Miele & Scholer, 2018; Miele et al., 2020) and hypotheses put forth by Wolters (2011) that motivational regulation strategies can change with outside intervention. The findings of the present study do not provide support for the notion that explicitly teaching students about motivation theories as tested will increase their motivational beliefs and regulation strategies. However, the present study did not test whether students gained increased metamotivational knowledge, so this question of whether the motivational regulation intervention used in this study served to increase students' metamotivational knowledge still remains largely unanswered. Furthermore, the measures used in the present study may not have adequately captured smaller, or momentary, shifts in students' motivational beliefs or regulation strategy use such as other methods like experience sampling methods (Csikszentmihalyi et al., 2014) or behavioral data might (Arizmendi et al., 2022), so it cannot be wholly concluded that the intervention did not work. Additionally, while the motivation unit and motivational regulation intervention were not significantly related to changes in students' reported motivational beliefs or regulation strategies as measured in the present study, there were some findings that add to prior evidence about how motivational beliefs and motivational regulation strategies may change in tandem. For example, students reported using strategies to focus on learning more and social comparison less (i.e.,

increased regulation of mastery goals and decreased regulation of performance goals), which may be explained in part by increased belief that their abilities can change through effort (i.e., growth mindset beliefs). Therefore, the present study provides further support for the hypothesis that motivational beliefs underpin the motivational regulation strategies students use (Wolters & Benzon, 2013) and that students' mindset beliefs may underpin their achievement goals (Dweck & Leggett, 1988).

An additional theoretical framework that was tested as part of this study is the triple SRL-SRT processes model (Kramarski & Heaysman, 2021). This framework posits that teachers' ability to be self-regulated in their professional roles is predicted by their self-regulation as learners. The present study did not test this exact hypothesis, since the focus was on preservice teachers, but it did examine the potential relation of self-regulation as learners with teaching motivation (i.e., teaching-related competence beliefs). To this end, the present study found some preliminary support for this hypothesis, as preservice teachers' self-reported motivational regulation strategy was associated with their teaching-related competence beliefs.

There are also practical implications of the present study. First, the findings tentatively suggest that taking an educational psychology course may be beneficial for students' achievement motivation, which has implications for the teaching of educational psychology. The importance of educational psychology in teacher education has been disputed over the years (Patrick et al., 2011), but this study provides promising evidence for the value of educational psychology content not just for preservice teachers, but for students more broadly. If confirmed in future research, the finding that this type of course benefits preservice teachers' development of adaptive motivational beliefs, such as growth mindset, would help address the one of the three challenges posed by Patrick and colleagues (2011) for educational psychology in teacher

education: “produce evidence of the benefits of educational psychologists’ involvement in teacher education” (p. 76). This study suggests that there are potentially substantive benefits to taking an educational psychology course for preservice teachers’ motivational beliefs and motivational regulation strategy use, which in turn, are associated with teaching-related competence beliefs. As such, this study provides some initial empirical evidence of the value of educational psychology for teacher education. Nevertheless, there is a need for further investigation to confirm these findings, as well as refine the approach to teaching of educational psychology and motivation since that was not a focus of the present study since the primary aim of the study was to test a motivational regulation intervention. For example, Anderman and Leake (2005) suggest a different approach for teaching motivation theories than was used in the present study, which may be worth considering for future empirical investigation of the teaching of motivation within teacher education courses.

Beyond the implications for teacher education, the positive association between taking an educational psychology course with motivational beliefs (particularly growth mindset) was not specific to preservice teachers, but was also found for college students in other majors ranging from biology to business. The finding that growth mindset shifted is aligned to prior work showing that “light touch” interventions are effective in increasing students’ beliefs that abilities are malleable (e.g., Yeager et al., 2019). Additionally, the present study adds to prior research that demonstrated that undergraduates taking a “learning to learn” course that covers topics including goal setting, time management, and study strategies had increased growth mindset and motivational regulation (Wolters et al., 2023). Thus, the present study suggests that there may be benefits to *all* students to take courses that cover educational psychology theories, not just those students who are enrolled in learning to learn courses that serve a greater proportion of students

that have lower GPAs, identify as male, and are from historically underserved or excluded racial/ethnic groups. In sum, despite the primary intervention studied for this dissertation research resulting in null findings, there were important implications identified from the secondary focus on the potential benefits of taking a course on motivation theories for students generally, and preservice teachers in particular.

Limitations

This dissertation research had several limitations that impact the conclusions that can be drawn from the results. First, the sample sizes were relatively small and may have made it difficult to detect significant effects given that effect sizes in education research can be quite small (Kraft, 2020). Even though the minimum sample size required for all the SEM models used in both studies was met, the models were relatively complex, with a lot of parameters, which further limits the conclusions that can be drawn from the analysis due to limited power (Wolf et al., 2013). Second, several of the measurement models and latent growth curve models in Study 2 were either just-identified (i.e., saturated) or overidentified, so the fit indices indicated perfect fit (i.e., RMSEA = 0.000, CFI = 1.000) and could not be used to make inferences about model fit (Wheaton, 1987). Therefore, there is a need to replicate these findings. Third, the latent growth curve models for Study 2 included only 3 time points, which was enough for linear and latent basis models to be specified, but does not allow for estimation of a quadratic model (Preacher, 2018). Testing a quadratic growth curve model would have facilitated a more nuanced understanding of the precise changes in students' motivational beliefs and regulation strategies over the course of the semester, and thus, would have provided a better understanding of the rates of change. Additionally, having more measurement occasions may be particularly important for capturing motivational regulation strategy use as the need to use regulation

strategies changes in response to situational demands (Wolters, 2003), which may not have been reflected in the three timepoints included in the present study. Furthermore, self-report measures of motivational regulation strategy use may be inadequate, as these processes largely unfold beneath consciousness (Friese et al., 2008).

The present study had strong external validity, but this resulted in not having a clean control group for testing the intervention. Due to threats to internal validity, such as potential contamination effects between the instruction of intervention and control groups, finding an effect of the intervention (if there was one) may have been more difficult (Campbell & Stanley, 1963; Creswell & Creswell, 2018). Nevertheless, this study adhered to a design-based research process which is inherently "messy" but has the potential to derive meaningful insights for education policy and practice (Hanghøj et al., 2022). As the focus of the present study was on filling a pragmatic need in teacher education, using a design-based research approach with high external validity was prioritized over experimental controls, which may have decreased the internal validity. Furthermore, the findings of the present study suggest that there a positive association between taking an educational psychology course and students' motivation, but these findings are very tentative due to not having a control group for the full semester. Thus, there is a need for future research to use a quasi-experimental of randomized controlled trial design to more fully examine whether an educational psychology course positively effects students' motivation.

An fourth limitation of this study is that there may have been bias introduced due to my own involvement as an instructor of the course. For example, due to being an instructor, I have close relationships with the other instructors, which may have influenced their instructional behaviors. Additionally, I may have paid closer attention to certain aspects of the results due to

biases about what aspects of the course that I have personally preferred over others. In this way, the present study is aligned with teacher action research which positions teachers as the drivers of empirical inquiry and is focused on solving problems of practice (Baumann & Duffy, 2001). As Souto-Manning (2012) put it, "it was only natural to me that as a teacher educator, I would engage in systematically researching my own practice in order to improve it – focusing on and living the process as part of my pedagogy" (p. 54). So, while there is a limitation to the conclusions that can be drawn from the results due to the potential bias introduced by having the research conducted by an instructor of the course, my role also contributed contextual understanding to the empirical investigation.

It should not go unstated as part of a discussion on the limitations of the present study that all constructs were self-reported (Conway & Lance, 2010). Thus, the results can only provide information about students' *perceived* motivational regulation strategy usage. Since motivational regulation strategies are largely unobservable and related to students' thought processes regarding a particular task, using self-report survey measures is the only viable option for studying them (with possible exceptions being self-consequating and environmental structuring). Due to this limitation, the inferences that could be drawn from the results of the present study could be strengthened by including observable correlates of increased motivational regulation such as engagement or achievement indicators, or using additional methods such as interviews (e.g., Study 1) and daily diaries.

A final limitation of the present study is that metamotivational knowledge was not measured, therefore, an assumption is made that students did gain increased understanding about motivation theories from taking the motivation unit. New assessments that can be used to assess metamotivational knowledge have been developed after this dissertation research began and

could be considered to better capture this phenomenon in future investigations. For example, Nguyen and colleagues (2022) developed an assessment to measure students' metamotivational knowledge of the normative benefits of high-level versus low-level construal for matching the right motivational state to the task (i.e., task-motivation fit). Additionally, Yu and colleagues (2022) designed a measurement to assess students' metamotivational knowledge of self-determination theory. Using measures such as these to assess whether students actually gained increased metamotivational knowledge from taking a unit on motivation theories would strengthen the findings that can be inferred from the present study and may provide a fruitful avenue for future research.

Future Directions

Several new questions arose from this study, which provide ideas for potential future directions of this research. First, since the motivational regulation intervention was not effective, there is a need to continue to iterate and improve the design of the intervention. One element that could be considered for a redesigned intervention would be to use an implicit approach to support students' development of motivational regulation strategies, since this has been shown to work well in other psychological interventions (Walton & Wilson, 2018). Furthermore, there is a need to replicate the findings of this study that suggest taking a unit on motivation theories benefits students' motivational beliefs, and in doing so, add in a test of students' metamotivational knowledge. It could also be worthwhile to expand the testing of the intervention to include practicing teachers via professional learning programs, so that they would be able to more readily apply what they learn about motivational regulation not only to their learning, but also to their teaching (Kramarski & Heaysman, 2021). Relatedly, since prior investigation of the triple SRL-SRT model has been focused on cognitive and behavioral self-

regulated learning (Kramarski, 2018), it would be beneficial to examine whether there is evidence of these reciprocal relations for motivational regulation strategy use. A final area of investigation that could be beneficial would be to examine how changes in specific types of motivational beliefs may associated with changes in and directionality of motivational regulation strategies (e.g., bivariate dual change models that pair theoretically related beliefs with strategies such as growth mindset and regulation of mastery goals). Investigating whether and how these constructs change together would reveal insights about which mechanism is most important to seek to influence: students' motivational beliefs or motivational regulation strategies.

Conclusion

As new teachers face unprecedented challenges when they enter the classroom (Chiu et al., 2021), it is imperative that we find better ways to ensure they are motivationally-prepared (Kramarski, 2018; Lauermann & Karabenick, 2013). To this end, the primary aim of my dissertation research was to test a novel intervention targeting preservice teachers' motivational regulation strategy use. I used a design-based research approach to iteratively test this intervention with a focus on pragmatic outcomes for teacher education. This approach allowed me to flexibly adapt my research design in light of findings from the first study, which revealed new insights about the potential of teaching theories of motivation – findings that were not initially a primary focus of my investigation. While I did not find evidence that the motivational regulation intervention as designed and tested in the present study was effective, the results do suggest that taking an educational psychology course may increase certain types of students' motivational beliefs and motivational regulation strategies, which in turn, relate to teaching-related competence beliefs among preservice teachers. Thus, a key practical implication of this research is that taking an educational psychology course as part of teacher education may be

beneficial not only for preservice teachers, but students generally. The findings also support the notion that students' achievement motivation can change and that identifying interventions to support adaptive changes is an important area of investigation. Additionally, this research revealed that students' implicit beliefs about the malleability of willpower are related to the strategies they use to maintain their motivation, making a contribution to a burgeoning area of literature. Furthermore, the null findings for the motivational regulation intervention as designed and tested in this study provides useful information about some factors that should potentially be changed or eliminated from future efforts seeking to help students' develop motivational regulation and highlights the potential shortcomings of using self-report measures for capturing motivational regulation strategy use. Thus, this study provides a wealth of future directions of research related to metamotivation, motivational regulation, and the teaching of educational psychology.

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APPENDIX A. TABLES

Table 1. *Model for teaching motivational regulation*

	Step 1	Step 2	Step 3	Step 4	Step 5
Instructional Activities[1]	Direct instruction on motivation theory	Explicit, specific instruction in motivational regulation strategies	Modeling of strategy use by instructor	Collaborative group work (e.g., collaborative motivation plan, video analysis, sharing reflections, collaborative lesson plan)	Self-reflection exit tickets (questions: what is something I need to do but do not feel motivated to do?; what strategy/ies should I use to increase my motivation?; why should I use this strategy?; when is it suitable to use this strategy?; how can I use this strategy?)
Developmental Levels of Self-Regulation[2]	N/A	Observation	Observation	Emulation/Imitative Self-Control	Self-Regulation
Condition	Both Control and Intervention	Intervention Only	Intervention Only	Intervention Only	Intervention Only

[1]Instructional activities adapted from the SRL-SRT professional development model developed by Kramarski and colleagues (see Kramarski & Heaysman, 2021).

[2]See Schunk & Zimmerman (1997) for detailed developmental model of self-regulation

Table 2. *Study 1 Timeline*

Time	**Activity**
Study 1a	
Spring 2022	
Week 0	Course sections randomly assigned to condition (7 sections per condition)
Week 8	Instructors in the experimental condition received a one-hour training about how to teach the motivation unit and were provided with the instructional materials (e.g., slides, activity organizers)
Week 9	Pre-survey administered (T1)
Week 10	Motivation unit began
Week 11 - 13	Video observations of instructors
Week 14	Motivation unit ended
Week 15	Post-survey administered (T2)
Week 16	End of semester
Post-semester	Interviews with instructors about teaching of motivation unit
Study 1b	
Summer 2022	
Week 4	Preliminary descriptive analysis completed and potential interview participants identified (n = 12)[1]
Week 6	Interviews scheduled
Week 10	Interviews completed

[1] A pool of potential interview participants were selected based on their preliminary descriptive statistics to identify students with adaptive patterns of motivational regulation strategies and beliefs at T2. After identifying the subgroups of participants, they were randomly selected for interviews.

Table 3. *Condition Assignment by Instructor*

Instructor[1]	Modality	Condition	Focus[2]	% of PSTs[3]
A	Face-to-face synchronous	Control	Teaching	68%
H	Online occasionally synchronous	Intervention	Learning	38%
K	Online occasionally synchronous	Intervention	Teaching	47%
L	Online asynchronous	Intervention	Teaching	8%
D	Online occasionally synchronous	Control	Teaching	100%
D	Online occasionally synchronous	Intervention	Teaching	86%
M	Face-to-face synchronous	Control	Learning	36%
M	Face-to-face synchronous	Control	Teaching	84%
M	Face-to-face synchronous	Intervention	Teaching	39%
B	Online asynchronous	Control	Teaching	38%
Z	Face-to-face synchronous	Intervention	Learning	69%
G	Online occasionally synchronous	Control	Teaching	64%
S	Online occasionally synchronous	Intervention	Learning	54%
W	Online asynchronous	Control	Learning	27%

[1] Instructors are identified using letters to deidentify them.

[2] Teaching focused sections were designed specifically for preservice teachers and included targeted reflection questions related to teaching application. Learning focused sections were designed specifically for students in majors not related to teacher education and included targeted reflection questions related to learning application.

[3] PSTs is an abbreviation for pre-service teachers and was generated using students' self-reported major as teacher education.

Table 4. *Study 1a Measurements*

Scale	Sample item	Items	Cronbach α
Motivational Beliefs			
Academic Self-Efficacy[1]	I'm certain I can master the content in the courses I am taking this semester.	5	T1: .78 T2: .83
Self-Efficacy for Self-Regulated Learning[2]	I can concentrate when I am in class.	8	T1: .77 T2: .80
Mastery-Approach Goals[1]	It's important to me that I learn a lot of new concepts in my courses.	5	T1: .84 T2: .86
Performance-Approach Goals[1]	It's important to me that other students think I'm good at academics.	5	T1: .87 T2: .89
Performance-Avoidance Goals[1]	It's important to me that I don't look stupid in my courses.	4	T1: .77 T2: .83
Task Value/Personal Interest[3]	I am very interested in the content areas of my courses.	6	T1: .86 T2: .84
Fixed Mindset[4]	Your intelligence is something about you that you can't change very much.	4	T1: .90 T2: .91
Growth Mindset[4]	You can always substantially change how intelligent you are.	4	T1: .85 T2: .90
IToW: Strenuous Mental Activity[5]	After a strenuous mental activity, you feel energized for further challenging activities.	3	T1: .86 T2: .86
IToW: Resisting Temptations[5]	If you have just resisted a strong temptation, you feel strengthened and you can withstand new temptations.	3	T1: .66 T2: .68

[1] Midgley et al., 2000; [2] Zimmerman et al., 1992; [3] Pintrich, 1991; [4] Dweck, 2000; [5] IToW = Implicit Theories of Willpower; Job et al., 2010

Table 4. *Study 1a Measurements* (*cont'd*)

Scale	Sample item	Items	Cronbach α
Motivational Regulation Strategies			
Regulation of Value[6]	I make an effort to relate what we're learning to my personal interests.	5	T1: .88 T2: .87
Regulation of Performance Goals[6]	I remind myself about how important it is to get good grades.	4	T1: .84 T2: .82
Self-Consequating[6]	I promise myself some kind of a reward if I get my readings or studying done.	4	T1: .85 T2: .83
Environmental Structuring[6]	I make sure I have as few distractions as possible.	3	T1: .75 T2: .76
Regulation of Situational Interest[6]	I try to get myself to see how doing the work can be fun.	4	T1: .82 T2: .79
Regulation of Mastery Goals[6]	I tell myself that I should keep working just to learn as much as I can.	4	T1: .81 T2: .83
Teaching-Related Competence Beliefs			
Efficacy for Student Motivation[7]	I am confident I will be able to get any of my students interested in the subject I teach.	3	T1: .78 T2: .76
Efficacy for Teaching[7]	I am confident I will be able to teach any of my lessons so that it is engaging for students.	3	T1: .84 T2: .89
Responsibility for Student Motivation[7]	I would be personally responsible if a student of mine was not interested in the subject I teach.	3	T1: .79 T2: .87

[6] Wolters & Rosenthal, 2000; [7] Lauermann & Karabenick, 2013

Table 5. *Study 1a Research Questions and Analyses*

Research Question	Data Analyses
Preliminary Analyses	
Data cleaning	Grubbs' test will be used to identify and remove extreme outliers
Measurement properties	CFAs to confirm factor structure of latent variables
Longitudinal measurement invariance	CFAs to confirm factor structure across timepoints (T1 and T2)
Multigroup measurement invariance	CFAs to confirm factor structure across condition at T2
Sample characteristics	ANOVAs comparing experimental and control condition samples at T1; missing data analysis
Research Question #1	
RQ 1a: Relation of condition with T2 motivational regulation strategy use	SEM path analyses to test main effect of condition on regulation strategy use at T2; control for section focus; T1 motivational beliefs; T1 strategy use; modality
RQ 1b: Interaction of condition with preservice teacher status on T2 motivational regulation strategy use	SEM path analyses to test main effect of preservice teacher status and interaction effect on regulation strategy use at T2; control for section focus; T1 motivational beliefs; T1 strategy use; modality
Research Question #2	
RQ 2a: Relation of condition with T2 teaching outcomes for preservice teachers (PSTs)	SEM path analyses to test relation of condition on teaching outcomes for preservice teachers only; control for section focus; T1 motivational beliefs; T1 strategy use; modality
RQ 2b: Motivational regulation strategy use as a mediator of relation between condition and T2 teaching outcomes for PSTs	SEM path analyses to test relation of condition on motivational regulation strategy use and in turn, teaching beliefs for preservice teachers only; control for section focus; T1 motivational beliefs; T1 strategy use; modality
Research Question #3	
RQ 3a: Relation of condition on implicit theories of willpower (IToW) at T2	SEM path analyses to test relation of condition on IToW; control for control for section focus; T1 motivational beliefs; T1 strategy use; modality
RQ 3b: Motivational regulation strategy use as a mediator of relation between condition and T2 IToW	SEM path analyses to test relation of condition on motivational regulation strategy use and in turn, IToW; control for section focus; T1 motivational beliefs; T1 strategy use; modality
RQ 3c: Interaction of condition with preservice teacher status on T2 IToW	SEM path analyses to test main effect of PST status and interaction effect on IToW; control for section focus; T1 motivational beliefs; T1 strategy use; modality
Post-Hoc Ancillary Analysis	
Effect of teaching motivation on motivational beliefs and regulation strategy use	Repeated-measures ANOVAs

Note. T1 = Time 1, T2 = Time 2, IToW = Implicit Theories of Willpower, PSTs = preservice teachers; CFAs = confirmatory factor analysis; SEM = structural equation model; ANOVA = analysis of variance

Table 6. *Study 1a Descriptive Statistics*

Scale	Mean (SD)	*N*
Academic Self-Efficacy (T1)	4.00 (.54)	236
Academic Self-Efficacy (T2)	3.93 (.56)	220
Self-Efficacy for Self-Regulated Learning (T1)	3.81 (.54)	233
Self-Efficacy for Self-Regulated Learning (T2)	3.81 (.55)	217
Mastery-Approach Goals (T1)	3.93 (.58)	236
Mastery-Approach Goals (T2)	3.90 (.58)	219
Performance-Approach Goals (T1)	3.19 (.88)	233
Performance-Approach Goals (T2)	3.21 (.90)	217
Performance-Avoidance Goals (T1)	3.40 (.81)	236
Performance-Avoidance Goals (T2)	3.33 (.87)	217
Task Value/Personal Interest (T1)	4.02 (.56)	236
Task Value/Personal Interest (T2)	3.96 (.51)	218
Fixed Mindset (T1)	2.47 (.94)	231
Fixed Mindset (T2)	2.49 (1.01)	215
Growth Mindset (T1)	3.70 (.68)	229
Growth Mindset (T2)	3.87 (.67)	214
IToW: Strenuous Mental Activity (T1)	2.62 (.99)	238
IToW: Strenuous Mental Activity (T2)	2.76 (.99)	220
IToW: Resisting Temptations (T1)	2.66 (.70)	236
IToW: Resisting Temptations (T2)	2.63 (.73)	217
Regulation of Value (T1)	3.84 (.64)	230
Regulation of Value (T2)	3.86 (.66)	216
Regulation of Performance Goals (T1)	4.09 (.67)	236
Regulation of Performance Goals (T2)	4.04 (.61)	219
Self-Consequating (T1)	3.94 (.70)	236
Self-Consequating (T2)	3.97 (.64)	219
Environmental Structuring (T1)	3.84 (.61)	230
Environmental Structuring (T2)	3.85 (.64)	215
Regulation of Situational Interest (T1)	3.32 (.77)	237
Regulation of Situational Interest (T2)	3.52 (.70)	220
Regulation of Mastery Goals (T1)	3.41 (.71)	231
Regulation of Mastery Goals (T2)	3.48 (.71)	215
Efficacy for Student Motivation (T1)	3.61 (.68)	99
Efficacy for Student Motivation (T2)	3.60 (.72)	90
Efficacy for Teaching (T1)	4.07 (.56)	99
Efficacy for Teaching (T2)	4.06 (.64)	90
Responsibility for Student Motivation (T1)	2.83 (.82)	99
Responsibility for Student Motivation (T2)	2.94 (.94)	90
Teaching Career Intentions (T1)	9.22 (1.81)	99
Teaching Career Intentions (T2)	9.04 (1.82)	90

Note. IToW = implicit theories of willpower

Table 7. *Confirmatory Factor Analysis*

	Time 1				*Time 2*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Motivational regulation	447.97	237	.061	.923	428.96	237	.061	.923
Teaching mot. beliefs	34.52	24	.044	.988	75.14	24	.010	.948
Implicit theories of willpower	21.59	15	.084	.973	20.76	15	.085	.974
Achievement goals	170.15	61	.087	.927	165.19	61	.088	.937
Mindsets	53.26	19	.088	.968	44.39	19	.078	.978
Self-efficacy beliefs	89.65	34	.083	.923	85.17	34	.083	.938
Task value/interest	103.54	34	.088	.915	14.44	10	.064	.987

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation.

Table 8. *Measurement Invariance for Motivational Beliefs*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Acad. self-efficacy								
Configural	92.18	34	.081	.923	14.24	10	.062	.987
Weak	101.81	38	.080	.916	**17.14**	**14**	**.045**	**.990**
Strong	107.08	42	.077	.913	26.29	19	.059	.978
Strict	**108.07**	**43**	**.076**	**.914**	27.21	20	.057	.978
Self-efficacy self-reg								
Configural	103.54	34	.088	.915	14.44	10	.064	.987
Weak	110.19	38	.085	.911	18.78	14	.056	.986
Strong	119.05	43	.082	.907	20.05	19	.022	.997
Strict	**119.53**	**44**	**.081**	**.907**	**22.10**	**20**	**.031**	**.994**
Mastery-approach goals								
Configural	98.35	34	.085	.938	14.72	10	.066	.990
Weak	104.20	38	.081	.936	19.97	14	.062	.987
Strong	114.12	42	.081	.930	29.79	19	.072	.976
Strict	**114.21**	**43**	**.079**	**.931**	**30.20**	**20**	**.068**	**.978**
Performance-appr. goals								
Configural	164.55	34	.121	.907	29.54	10	.133	.967
Weak	**166.47**	**38**	**.113**	**.908**	29.98	14	.102	.973
Strong	183.92	42	.113	.899	34.72	19	.087	.973
Strict	184.37	43	.112	.899	**37.50**	**20**	**.089**	**.970**
Performance-avoid goals								
Configural	11.60	8	.041	.993	0	0	.000	1.00
Weak	**18.76**	**10**	**.058**	**.982**	0.54	2	.000	1.00
Strong	33.93	13	.077	.958	5.83	5	.039	.996
Strict	37.88	14	.081	.951	**6.80**	**6**	**.035**	**.996**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; 0 *df* indicates a saturated model. Bolding indicates the level of measurement invariance achieved.

Table 8. *(cont'd)*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Task value								
Configural	74.99	30	.075	.957	4.01	6	.000	1.00
Weak	81.56	34	.073	.954	14.04	10	.061	.989
Strong	90.46	38	.072	.949	**20.23**	**15**	**.056**	**.986**
Strict	**91.87**	**39**	**.072**	**.949**	26.61	16	.078	.972
Fixed mindset								
Configural	68.98	19	.101	.962	10.92	4	.126	.988
Weak	70.75	22	.092	.963	14.36	7	.098	.988
Strong	75.43	25	.088	.961	23.47	11	.102	.979
Strict	**77.89**	**26**	**.088**	**.960**	**29.21**	**12**	**.115**	**.971**
Growth mindset								
Configural	39.25	19	.064	.980	8.96	4	.107	.990
Weak	44.76	22	.063	.978	10.65	7	.070	.990
Strong	52.35	25	.065	.973	12.10	11	.031	.998
Strict	**52.49**	**26**	**.063**	**.974**	**12.97**	**12**	**.027**	**.998**
IToW: Strenuous mental activity								
Configural	40.30	8	.124	.960	0	0	.000	1.00
Weak	40.53	10	.108	.963	1.40	2	.000	1.00
Strong	47.22	12	.105	.957	2.24	5	.000	1.00
Strict	**47.27**	**13**	**.069**	**.953**	**2.37**	**6**	**.000**	**1.00**
IToW: Resisting temptations								
Configural	21.13	8	.079	.962	0	0	.000	1.00
Weak	23.75	10	.072	.960	3.88	2	.092	.988
Strong	28.13	12	.071	.953	6.30	5	.049	.991
Strict	**29.15**	**13**	**.069**	**.953**	**8.85**	**6**	**.066**	**.981**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; 0 *df* indicates a saturated model. Bolding indicates the level of measurement invariance achieved.

Table 9. *Measurement Invariance for Motivational Regulation Strategies*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Reg. of value								
Configural	61.80	34	.056	.977	20.88	10	.099	.979
Weak	66.71	38	.053	.976	29.66	14	.101	.970
Strong	82.00	42	.060	.967	39.21	19	.098	.962
Strict	**82.01**	**43**	**.059**	**.968**	**40.21**	**20**	**.096**	**.962**
Reg. of performance goals								
Configural	44.71	19	.072	.968	5.74	4	.063	.994
Weak	49.95	22	.069	.965	7.13	7	.013	1.00
Strong	60.06	25	.073	.957	8.81	11	.000	1.00
Strict	**63.03**	**26**	**.073**	**.954**	**10.14**	**12**	**.000**	**1.00**
Self-consequating								
Configural	55.44	19	.085	.957	1.66	4	.000	1.00
Weak	**60.52**	**22**	**.081**	**.954**	2.13	7	.000	1.00
Strong	75.92	25	.088	.939	8.20	11	.000	1.00
Strict	78.26	26	.087	.938	**8.75**	**12**	**.000**	**1.00**
Environmental structuring								
Configural	14.90	8	.058	.983	0	0	.000	1.00
Weak	16.96	10	.052	.983	2.51	2	.048	.997
Strong	19.52	12	.049	.982	3.52	5	.000	1.00
Strict	**19.53**	**13**	**.044**	**.984**	**3.54**	**6**	**.000**	**1.00**
Reg. of situational interest								
Configural	56.66	19	.087	.943	12.77	4	.141	.965
Weak	61.29	22	.082	.941	13.33	7	.091	.975
Strong	62.98	25	.076	.943	19.35	11	.083	.967
Strict	**66.55**	**26**	**.077**	**.939**	**19.80**	**12**	**.077**	**.969**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; 0 *df* indicates a saturated model. Bolding indicates the level of measurement invariance achieved.

Table 9. *(cont'd)*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Reg. of mastery goals								
Configural	51.75	19	.081	.957	2.06	4	.000	1.00
Weak	54.36	22	.075	.958	2.69	7	.000	1.00
Strong	54.83	25	.067	.961	11.20	11	.013	.999
Strict	**54.83**	**26**	**.065**	**.962**	**11.40**	**12**	**.000**	**1.00**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved.

Table 10. *Measurement Invariance for Teaching Motivation*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Efficacy for student motivation								
Configural	19.28	8	.074	.973	0	0	.000	1.00
Weak	21.23	10	.066	.973	0.78	2	.000	1.00
Strong	21.72	12	.056	.977	3.86	5	.000	1.00
Strict	**24.09**	**13**	**.058**	**.973**	**6.91**	**5**	**.038**	**.995**
Efficacy for teaching[1]								
Configural	17.22	8	.067	.984	0	0	.000	1.00
Weak	28.02	10	.074	.969	6.05	2	.137	.983
Strong	28.73	12	.074	.971	14.86	5	.136	.959
Strict	28.74	13	.069	.973	14.87	6	.118	.963
Responsibility for student motivation								
Configural	28.53	8	.099	.971	0	0	.000	1.00
Weak	30.61	10	.090	.970	4.48	2	.114	.992
Strong	32.30	12	.081	.971	6.66	5	.056	.995
Strict	**34.80**	**13**	**.081**	**.969**	**8.68**	**6**	**.065**	**.992**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; 0 *df* indicates a saturated model. Bolding indicates the level of measurement invariance achieved.
[1]Measurement invariance was not achieved for this measure.

Table 11. *Study 1 Analysis of Variance for Baseline Measures by Condition*

Measure	Intervention		Control		*F* (1, 234)	*p*
	M	*SD*	*M*	*SD*		
Motivational Beliefs						
Academic Self-Efficacy	4.03	0.52	3.98	0.57	0.36	.55
Self-Efficacy for Self-Regulated Learning	3.82	0.50	3.79	0.57	0.25	.62
Mastery-Approach Goals	3.98	0.54	3.87	0.62	2.34	.12
Performance-Approach Goals	3.31	0.90	3.09	0.85	3.79	.05
Performance-Avoidance Goals	3.46	0.84	3.35	0.79	1.15	.28
Task Value/Personal Interest	4.00	0.57	4.04	0.54	0.18	.67
Fixed Mindset	2.59	0.99	2.35	0.88	4.05	.05
Growth Mindset	3.69	0.72	3.71	0.64	0.07	.79
IToW: Mental activity	2.60	0.99	2.63	0.99	0.05	.82
IToW: Temptations	2.63	0.71	2.69	0.69	0.40	.53
Motivational Regulation Strategies						
Regulation of Value	3.88	0.63	3.80	0.65	0.90	.35
Regulation of Performance Goals	4.08	0.72	4.10	0.63	0.06	.81
Self-Consequating	4.03	0.59	3.86	0.79	3.35	.07
Environmental Structuring	3.81	0.62	3.87	0.60	0.71	.40
Regulation of Situational Interest	3.40	0.73	3.25	0.79	2.35	.13
Regulation of Mastery Goals	3.52	0.66	3.90	0.74	**5.88**	.02

Note. IToW: Mental activity = implicit theories of willpower for strenuous mental activity, IToW: Temptations = implicit theories of willpower for resisting temptations

Table 12. *Study 1 Analysis of Variance for Baseline Measures by Attrition Status*

Measure	Data complete		Data missing		*F* (1, 218)	*p*
	M	*SD*	*M*	*SD*		
Motivational Beliefs						
Academic Self-Efficacy	3.94	0.55	3.84	0.67	0.62	.430
Self-Efficacy for Self-Regulated Learning	3.85	0.52	3.54	0.68	**6.84**	.010
Mastery-Approach Goals	3.90	0.57	3.93	0.69	0.05	.830
Performance-Approach Goals	3.21	0.92	3.26	0.81	0.08	.774
Performance-Avoidance Goals	3.33	0.88	3.33	0.77	0.00	.993
Task Value/Personal Interest	3.97	0.51	3.91	0.50	0.31	.578
Fixed Mindset	2.49	1.03	2.25	0.84	0.02	.881
Growth Mindset	3.89	0.67	3.67	0.65	2.01	.139
IToW: Mental activity	2.77	0.99	2.65	0.95	0.38	.541
IToW: Temptations	2.64	0.75	2.51	0.60	0.65	.420
Motivational Regulation Strategies						
Regulation of Value	3.85	0.67	3.83	0.59	0.04	.850
Regulation of Performance Goals	4.03	0.61	4.05	0.60	0.02	.879
Self-Consequating	3.98	0.63	3.91	0.72	0.23	.598
Environmental Structuring	3.86	0.64	3.76	0.59	0.60	.438
Regulation of Situational Interest	3.54	0.70	3.33	0.68	1.92	.168
Regulation of Mastery Goals	3.47	0.72	3.51	0.69	0.06	.815

Note. IToW: Mental activity = implicit theories of willpower for strenuous mental activity, IToW: Temptations = implicit theories of willpower for resisting temptations

Table 13. *Standardized Effects of Condition and Preservice Status on Motivational Regulation Strategy Use*

	Condition			Pre-Service Teacher Status			Cond X PST		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.002	.080	.985	.148	.176	.400	-.208	.185	.261
Mot. Reg. of Performance Goals	-.045	.080	.575	.137	.178	.440	-.105	.187	.575
Self-consequating	-.145	.104	.165	-.113	.236	.631	.133	.146	.362
Environmental Structuring	-.131	.111	.238	-.220	.248	.376	.151	.153	.323
Mot. Reg. of Situational Interest	-.004	.119	.971	-.049	.264	.854	.002	.163	.989
Mot. Reg. of Mastery Goals	-.034	.081	.674	-.037	.177	.836	-.019	.186	.917

Note. Cond X PST: Condition with preservice teacher status interaction term. These analyses included the full sample (n = 256).

Table 14. *Standardized Effects of Condition on Motivational Regulation Strategy Use and Teacher Efficacy for Student Motivation*

	Cond → Mot Reg Str			Cond → Tch Eff for S Mot			Mot Reg Str → Tch Eff for S Mot			Cond → Mot Reg Str → Tch Eff for S Mot		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.062	.078	.430	-.075	.095	.429	**.244**	.091	.007	-.015	.020	.448
Mot. Reg. of Perf Goals	-.087	.086	.309	-.068	.096	.479	**.181**	.090	.044	-.016	.017	.363
Self-consequating	.030	.113	.792	-.129	.141	.361	.055	.111	.620	.001	.005	.816
Environmental Structuring	.001	.093	.988	-.104	.095	.272	**.209**	.093	.024	.000	.019	.988
Mot. Reg. of Sit. Interest	.021	.091	.816	-.090	.093	.337	**.266**	.090	.003	.011	.049	.817
Mot. Reg. of Mastery Goals	-.049	.093	.599	-.075	.098	.441	.157	.096	.103	-.008	.015	.616

Note. These path analyses used a subsample of students that were self-reported preservice teachers (*n* = 109).
Cond = condition, Mot Reg Str = motivation regulation strategy, Tch Eff for S Mot = teacher efficacy for student motivation.

Table 15. *Standardized Effects of Condition on Motivational Regulation Strategy Use and Teacher Responsibility for Student Motivation*

	Cond → Mot Reg Str			Cond → Tch Resp for S Mot			Mot Reg Str → Tch Resp for S Mot			Cond → Mot Reg Str → Tch Resp for S Mot		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.062	.078	.430	.013	.097	.894	.173	.096	.072	-.011	.015	.469
Mot. Reg. of Perf Goals	-.088	.086	.304	-.005	.099	.963	-.027	.097	.779	.002	.009	.786
Self-consequating	.023	.087	.791	-.002	.098	.982	-.019	.100	.853	.000	.003	.880
Environmental Structuring	.001	.093	.988	-.008	.096	.935	.145	.097	.133	.000	.013	.988
Mot. Reg. of Sit. Interest	.021	.091	.816	.002	.094	.979	**.276**	.093	.003	.006	.025	.817
Mot. Reg. of Mastery Goals	-.049	.093	.599	.042	.094	.658	**.301**	.090	.001	-.015	.028	.603

Note. These path analyses used a subsample of students that were self-reported preservice teachers (n = 109). Cond = condition, Mot Reg Str = motivation regulation strategy, Tch Resp for S Mot = teacher responsibility for student motivation.

Table 16. *Standardized Effects of Condition on Motivational Regulation Strategy Use and Teacher Career Intentions*

	Cond → Mot Reg Str			Cond → Tch Car Int			Mot Reg Str → Tch Car Int			Cond → Mot Reg Str → Tch Car Int		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.062	.078	.430	-.036	.055	.515	.041	.054	.441	-.003	.005	.581
Mot. Reg. of Perf Goals	-.088	.086	.303	-.037	.056	.508	.008	.052	.880	-.002	.016	.882
Self-consequating	.023	.087	.791	-.036	.055	.510	.078	.059	.187	.002	.007	.796
Environmental Structuring	.001	.093	.988	-.045	.056	.429	.063	.059	.285	.000	.020	.988
Mot. Reg. of Sit. Interest	.021	.091	.817	-.036	.055	.509	-.056	.055	.308	-.004	.018	.821
Mot. Reg. of Mastery Goals	-.049	.093	.599	-.033	.056	.550	.043	.055	.432	-.007	.016	.661

Note. These path analyses used a subsample of students that were self-reported preservice teachers (*n* = 109). Cond = condition, Mot Reg Str = motivation regulation strategy, Tch Car Int = teacher career intentions.

Table 17. *Standardized Effects of Condition on Motivational Regulation Strategy Use and Implicit Theories of Willpower: Mental Activity*

	Cond → Mot Reg Str			Cond → IToW			Mot Reg Str → IToW			Cond → Mot Reg Str → IToW		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.060	.078	.442	-.015	.083	.861	.081	.084	.336	-.010	.016	.545
Mot. Reg. of Perf Goals	-.089	.086	.301	-.015	.084	.854	.041	.085	.631	-.007	.017	.666
Self-consequating	.023	.087	.791	-.025	.085	.771	-.060	.087	.491	-.001	.006	.805
Environmental Structuring	.004	.093	.963	-.026	.083	.752	.109	.086	.205	.001	.020	.963
Mot. Reg. of Sit. Interest	.021	.091	.816	-.017	.080	.827	**.304**	.080	<.001	.012	.053	.817
Mot. Reg. of Mastery Goals	-.043	.093	.649	.010	.083	.903	**.251**	.086	.004	-.020	.045	.650

Note. These path analyses used the full sample of students (n = 256). Cond = condition, Mot Reg Str = motivation regulation strategy, IToW = implicit theories of willpower (i.e., strenuous mental activity).

Table 18. *Standardized Effects of Condition on Motivational Regulation Strategy Use and Implicit Theories of Willpower: Temptations*

	Cond → Mot Reg Str			Cond → IToW			Mot Reg Str → IToW			Cond → Mot Reg Str → IToW		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Mot. Reg. of Value	-.062	.078	.430	.149	.100	.136	.029	.101	.771	-.003	.010	.785
Mot. Reg. of Perf Goals	-.190	.098	.312	.128	.099	.196	-.190	.098	.052	.024	.026	.370
Self-consequating	.023	.087	.791	.129	.097	.185	**-.278**	.095	.004	-.009	.035	.793
Environmental Structuring	.001	.093	.988	.152	.099	.126	-.081	.100	.422	.000	.011	.988
Mot. Reg. of Sit. Interest	.021	.091	.817	.137	.098	.163	**-.221**	.098	.023	-.007	.029	.818
Mot. Reg. of Mastery Goals	-.049	.093	.599	.159	.100	.111	.092	.101	.363	-.006	.014	.648

Note. These path analyses used the full sample of students (*n* = 256). Cond = condition, Mot Reg Str = motivation regulation strategy, IToW = implicit theories of willpower (i.e., strenuous mental activity).

Table 19. *Study 1 Repeated Measures Analysis of Variance*

Measure	Pre-Test (T1)		Post-Test (T2)		*F* (1, 184)	*p*	η^2
	M	*SD*	*M*	*SD*			
Motivational Beliefs							
Academic Self-Efficacy[1]	3.99	0.54	3.95	0.54	2.22	.14	.01
Self-Efficacy for Self-Regulated Learning	3.82	0.54	3.84	0.52	0.08	.78	.00
Mastery-Approach Goals	3.92	0.58	3.90	0.57	0.29	.59	.00
Performance-Approach Goals[1]	3.21	0.86	3.22	0.91	0.10	.75	.00
Performance-Avoidance Goals[1]	3.42	0.81	3.34	0.88	2.28	.13	.01
Task Value/Personal Interest	4.04	0.54	3.98	0.51	4.99	.03	.03
Fixed Mindset	2.46	0.94	2.49	1.04	0.86	.35	.01
Growth Mindset	3.69	0.68	3.89	0.68	**15.91**	<.001	.08
IToW: Mental activity	2.63	1.01	2.78	0.99	6.46	.01	.03
IToW: Temptations	2.69	0.71	2.64	0.75	0.74	.39	.00
Motivational Regulation Strategies							
Regulation of Value	3.82	0.65	3.86	0.67	1.09	.30	.01
Regulation of Performance Goals	4.11	0.68	4.04	0.61	2.55	.11	.01
Self-Consequating[1]	3.98	0.68	3.98	0.63	0.18	.67	.00
Environmental Structuring	3.85	0.64	3.88	0.63	0.62	.43	.00
Regulation of Situational Interest	3.31	0.78	3.54	0.70	**19.09**	<.001	.09
Regulation of Mastery Goals	3.42	0.71	3.48	0.72	2.36	.13	.01

Note. We used the Bonferroni method to adjust the p-value for statistical significance based on the number of tests for each related set of constructs. We used an adjusted p-value of .006 for both motivational beliefs and motivational regulation strategies.

[1] Only weak measurement invariance was established for these measures, so mean comparisons should be interpreted with caution.

Table 20. *Overview of Interview Participants*

Participant	Modality	Condition	Motivation Δ	PST Status	Race	Gender
1011	Face-to-face synchronous	Control	Increasing	PST	White	Woman
1012	Face-to-face synchronous	Control	Flat	PST	White	Woman
1025	Face-to-face synchronous	Control	Increasing	PST	White	Man
1032	Face-to-face synchronous	Control	Increasing	PST	White	Woman
1041	Face-to-face synchronous	Control	Increasing	PST	White	Transgender man
1080	Face-to-face synchronous	Intervention	Flat	Non-PST	White	Woman
1097	Online occasionally synchronous	Intervention	Flat	Non-PST	Black	Woman
1139	Online occasionally synchronous	Intervention	Flat	Non-PST	-	-
1183	Online asynchronous	Control	Increasing	Non-PST	White	Woman
1192	Online asynchronous	Control	Flat	PST	White	Woman
1195	Online occasionally synchronous	Intervention	Flat	Non-PST	-	Woman
1240	Online occasionally synchronous	Intervention	Increasing	PST	White	Woman

Note. PST = self-reported status as a pre-service teacher

Table 21. *Motivational beliefs codes*

Code	Total mentions	Example interview excerpt	Theoretical connections
Value	18	"The higher the value the task is the more likely you will be to, or the more likely you'll be motivated to get it done."	Expectancy-Value Theory (Eccles et al., 1983); Personal Interest (Renninger & Hidi, 2016)
Growth mindset	12	"I've been trying to transition to that growth mindset and really just be more focused on learning not to shut down when I don't know something."	Implicit Theories of Intelligence (Dweck, 2000)
Self-efficacy	6	"If I think I can do it, I can."	Social Cognitive Theory (Bandura, 1986); Expectancy-Value Theory (Eccles et al., 1983)
Mastery goals	4	"Something that stood out was to not base all of your success off of how you're performing in comparison to other people."	Achievement Goal Theory (Ames, 1992; Dweck & Leggett, 1988)
Autonomy	2	"It is important for us to set our own goals."	Self-Determination Theory (*need for autonomy*; Ryan & Deci, 2017)
Performance goals	1	"I guess a drive would be looking at my environment around me and then how that correlates to me, how I'm different, how I'm the same, and if that's good or bad thing."	Achievement Goal Theory (Ames, 1992; Dweck & Leggett, 1988)

Table 22. *Motivational regulation strategies codes*

Code	Total mentions	Example interview excerpt	Exemplar references
Regulation of value	21	"A big part of [motivation is] me relating stuff back to my personal life."	Wolters & Rosenthal, 2000
Self-consequating	16	"I've gotten the work done that I need to do for the day. Now I can play video games."	Graham et al., 1998
Regulation of mastery goals	9	"Rather than thinking about the grade you're going to get afterward or how this is going to look to other people. Just do your thing and just focus on that. Just focus on learning."	Wolters, 1998
Efficacy management	6	"It's a lot of encouragement, helping myself to see that it is something I can do and get done."	Wolters, 1998
Goal setting and planning	6	"You can do baby goals to get to where you want to be."	Zimmerman & Martinez-Pons, 1986
Regulation of situational interest	4	"I've tried making studying into some type of a game."	Sansone et al., 1999
Environmental structuring	3	"Just making sure that I have things available for me to make the better choice and make it easier to make the better choice."	Zimmerman & Martinez-Pons, 1986
Regulation of performance goals	1	"I'm going to do my best to keep up with them or go above and beyond and beat them."	Wolters, 1998

Table 23. *Class structures codes*

Category	Total mentions	Implications for intervention
Rigor	2	Develop questioning that can be used to engage students in critical thinking
Motivational supports: Autonomy	2	Include choices as part of class activities and reflections
Motivational supports: Belonging	4	Include a time in class for students and the instructor to share about themselves
Motivational supports: Value/Relevance	27	Incorporate activities for the students to relate the content back to their own lives Incorporate activities for students to apply the content their desired future career
Collaborative work: Small group work	7	Include more activities where the students can work in small groups
Collaborative work: Miscellaneous	3	Include more time in class for students to interact with their classmates
Collaborative work: Balance	3	Plan activities in a way where there is a good mix of group work and individual work
Collaborative work: Other perspectives	4	Incorporate more activities that allow for discussion and sharing of ideas
Instructor quality	3	Include a time in class for instructors to share and check in with students
Instructor motivation	4	Encourage instructors to be enthusiastic and motivated about teaching
Variety	2	Plan and implement a variety of activities weekly

Table 24. *Learning activities codes*

Category	Total mentions	Implications for intervention
Multiple examples	2	Include multiple examples when teaching each concept
Motivational messages	2	Include an activity for students to create motivational messages
Check-ins	3	Include a time in class to anonymously check in with students
Motivation plan	3	Include an activity for students to create a motivational plan tied to their goals
Review activities	4	Include an activity at the end of every unit where students utilize games or competitions for reviewing the content

Table 25. *Study 2 Timeline*

Time	**Activity**
Fall 2022	
Week 0	Course sections randomly assigned to condition
Week 1	Baseline survey administered (T1)
Week 8	Instructors in the experimental condition completed a one-hour training about how to teach the motivation unit and were provided with the instructional materials (e.g., slides, activity organizers)
Week 9	Pre-survey administered (T2)
Week 10	Motivation unit begins
Week 11 - 13	Observations of student assignments
Week 14	Motivation unit ends
Week 15	Post-survey administered (T3)
Week 16	End of semester

Note. T1 = Time 1, T2 = Time 2, T3 = Time 3

Table 26. *Condition Assignment by Instructor*

Instructor[1]	Modality	Condition	Focus[2]	% of PSTs[3]
G	Face-to-face synchronous	Intervention	Learning	65%
M	Online occasionally synchronous	Control	Learning	54%
S	Face-to-face synchronous	Control	Learning	64%
L	Online occasionally synchronous	Control	Learning	42%
M	Online occasionally synchronous	Intervention	Teaching	65%
M	Online occasionally synchronous	Control	Teaching	68%
T	Face-to-face synchronous	Control	Teaching	58%
E	Face-to-face synchronous	Intervention	Teaching	62%
B	Online occasionally synchronous	Control	Teaching	41%
K	Face-to-face synchronous	Intervention	Teaching	81%
N	Face-to-face synchronous	Control	Teaching	75%
A	Face-to-face synchronous	Intervention	Teaching	88%
R	Online asynchronous	Intervention	Teaching	11%
E	Online asynchronous	Control	Learning	54%
Y	Online asynchronous	Intervention	Learning	33%
C	Online asynchronous	Intervention	Learning	28%

[1] Instructors are identified using letters to deidentify them.

[2] The learning focus sections did not include an emphasis on teaching application for written reflection assignments.

[3] PSTs are preservice teachers.

Table 27. *Study 2 Motivational Beliefs Measurements*

Scale	Sample item	Items	Cronbach's α
Motivational Beliefs			
Academic Self-Efficacy[1]	I'm certain I can master the content in the courses I am taking this semester.	4	T1: .78 T2: .81 T3: .82
Self-Efficacy for Self-Regulated Learning[2]	I can concentrate when I am in class.	4	T1: .78 T2: .82 T3: .83
Mastery-Approach Goals[1]	It's important to me that I learn a lot of new concepts in my courses.	5	T1: .82 T2: .82 T3: .88
Performance-Approach Goals[1]	It's important to me that other students think I'm good at academics.	5	T1: .87 T2: .90 T3: .90
Performance-Avoidance Goals[1]	It's important to me that I don't look stupid in my courses.	3	T1: .73 T2: .83 T3: .85
Task Value/Personal Interest[3]	I am very interested in the content areas of my courses.	5	T1: .83 T2: .82 T3: .85
Fixed Mindset[4]	Your intelligence is something about you that you can't change very much.	4	T1: .93 T2: .91 T3: .93
Growth Mindset[4]	You can always substantially change how intelligent you are.	4	T1: .86 T2: .88 T3: .89
IToW: Strenuous Mental Activity[5]	After a strenuous mental activity, you feel energized for further challenging activities.	3	T1: .83 T2: .86 T3: .87
IToW: Resisting Temptations[5]	If you have just resisted a strong temptation, you feel strengthened and you can withstand new temptations.	3	T1: .70 T2: .78 T3: .77

[1] Midgley et al., 2000; [2] Zimmerman et al., 1992; [3] Pintrich, 1991; [4] Dweck, 2000; [5] IToW = Implicit Theories of Willpower; Job et al., 2010

Table 28. *Study 2 Motivational Regulation Strategies Measurements*

Scale	Sample item	Items	Cronbach's α
Motivational Regulation Strategies[1]			
Regulation of Value	I make an effort to relate what we're learning to my personal interests.	5	T1: .82 T2: .85 T3: .88
Regulation of Performance Goals	I remind myself about how important it is to get good grades.	4	T1: .83 T2: .84 T3: .86
Self-Consequating	I promise myself some kind of a reward if I get my readings or studying done.	4	T1: .80 T2: .82 T3: .83
Environmental Structuring	I make sure I have as few distractions as possible.	3	T1: .68 T2: .74 T3: .74
Regulation of Situational Interest	I try to get myself to see how doing the work can be fun.	4	T1: .78 T2: .80 T3: .86
Regulation of Mastery Goals	I tell myself that I should keep working just to learn as much as I can.	4	T1: .81 T2: .83 T3: .83

[1] Wolters & Rosenthal, 2000

Table 29. *Study 2 Teaching Competence Beliefs & Perceived Instructional Practices Measurements*

Scale	Sample item	Items	Cronbach's α
Teaching-Related Competence Beliefs[1]			
Efficacy for Student Motivation	I am confident I will be able to get any of my students interested in the subject I teach.	3	T1: .83 T2: .83 T3: .85
Efficacy for Teaching	I am confident I will be able to teach any of my lessons so that it is engaging for students.	3	T1: .83 T2: .87 T3: .87
Responsibility for Student Motivation	I would be personally responsible if a student of mine was not interested in the subject I teach.	3	T1: .84 T2: .85 T3: .89
Student-Perceived Instructional Practices			
Perceived Teacher Enthusiasm[2]	Our [class] instructor really seems to take pleasure in teaching.	3	T2: .89 T3: .90
Perceived Use of Everyday Life Examples[2]	Our [class] instructor uses examples from daily life to show us why [class] can be useful.	3	T2: .84 T3: .92

[1] Lauermann & Karabenick, 2013; [2] Parrisius et al., 2020

Table 30. *Study 2 Research Questions and Analyses*

Research Question	Data Analyses
Preliminary Analyses	
Data cleaning	Grubbs' test will be used to identify and remove extreme outliers
Measurement properties	CFAs to confirm factor structure of latent variables
Longitudinal measurement invariance	CFAs to confirm factor structure across timepoints (T1,T2, T3)
Multigroup measurement invariance	CFAs to confirm factor structure across condition at T3
Sample characteristics	ANOVAs comparing experimental and control condition and missing data at T1
Research Question #1	
Relation of condition with changes in motivational beliefs and regulation strategy use	Multigroup latent growth curve models for motivational beliefs and regulation strategies using latent basis specifications and condition as a grouping variable; if multigroup models do not result in significantly improved fit, latent growth curve models for the full sample will be used
Research Question #2	
Relation of student-perceived instructional practices with changes in motivational beliefs and regulation strategy use	SEM path analysis examining the relation of T3 motivational beliefs and regulation strategies with student-perceived instructional practices and the interaction term of student-perceived instructional practice and condition as predictors, controlling for T2 motivational beliefs and regulation strategy use
Research Question #3	
Relation of changes in motivational beliefs and regulation strategies with teaching-related competence beliefs and career intentions	SEM path analysis (among preservice teachers only) examining the relation of T3 motivational beliefs and regulation strategies with teaching-related competence beliefs and career intentions as outcomes, controlling for T2 motivational beliefs and regulation strategy use

Table 31. *Confirmatory Factor Analysis*

	Time 1				*Time 2*				*Time 3*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Motivational regulation	519.81	237	.059	.914	567.84	237	.067	.904	593.15	237	.075	.901
Teaching mot. beliefs	104.57	24	.099	.952	96.12	24	.099	.952	70.03	24	.085	.085
Implicit theories of willpower	12.85	7	.049	.991	4.28	7	.000	1.00	24.21	7	.096	.978
Achievement goals	179.05	61	.075	.944	171.41	61	.076	.950	164.38	61	.080	.953
Mindsets	39.79	19	.056	.989	15.13	19	.000	1.00	37.24	19	.060	.987
Self-efficacy beliefs	21.89	19	.021	.997	33.45	19	.049	.986	52.12	19	.081	.964
Perceived inst. practices	--	--	--	--	71.30	8	.077	.994	21.97	8	.081	.992

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 32. *Measurement Invariance for Motivational Beliefs*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Academic self-efficacy								
Configural	186.18	51	.083	.909	13.73	4	.136	.979
Weak	192.04	57	.078	.910	19.42	7	.116	.973
Strong	198.50	63	.075	.909	21.55	11	.085	.977
Strict	**200.21**	**65**	**.074**	**.909**	**22.01**	**12**	**.080**	**.978**
Self-efficacy for self-regulation								
Configural	170.58	51	.078	.926	3.99	4	.000	1.000
Weak	174.08	57	.073	.927	10.77	7	.064	.990
Strong	194.80	63	.074	.918	11.25	11	.013	.999
Strict	**217.12**	**65**	**.078**	**.905**	**13.39**	**12**	**.030**	**.996**
Mastery-approach goals								
Configural	203.74	87	.059	.942	12.64	10	.045	.996
Weak	208.99	95	.056	.944	14.40	14	.015	.999
Strong	228.27	103	.056	.938	19.24	19	.000	1.000
Strict	**230.08**	**105**	**.056**	**.938**	**24.37**	**20**	**.041**	**.993**
Performance-appr. goals								
Configural	338.09	87	.087	.918	49.63	10	.173	.952
Weak	**348.58**	**95**	**.083**	**.917**	55.84	14	.150	.949
Strong	447.76	103	.093	.887	61.31	19	.130	.948
Strict	447.88	105	.092	.888	**61.34**	**20**	**.125**	**.949**
Performance-avoid goals								
Configural	115.49	24	.100	.930	0.00	0	.000	1.000
Weak	**128.60**	**28**	**.097**	**.922**	0.69	2	.000	1.000
Strong	204.70	32	.119	.867	3.38	5	.000	1.000
Strict	209.96	34	.116	.864	**3.69**	**6**	**.000**	**1.000**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 32. *(cont'd)*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Interest value								
Configural	211.32	81	.065	.938	9.42	6	.065	.994
Weak	223.96	89	.063	.936	11.57	10	.034	.997
Strong	245.16	97	.063	.930	15.60	15	.017	.999
Strict	**248.17**	**99**	**.063**	**.929**	**17.86**	**16**	**.030**	**.997**
Fixed mindset								
Configural	111.95	51	.056	.980	15.27	4	.146	.987
Weak	116.30	57	.052	.980	23.06	7	.132	.982
Strong	120.57	63	.049	.981	31.02	11	.117	.977
Strict	**124.32**	**65**	**.049**	**.980**	**31.41**	**12**	**.111**	**.978**
Growth mindset								
Configural	73.61	51	.034	.989	4.90	4	.041	.998
Weak	89.56	57	.039	.984	8.99	7	.046	.997
Strong	95.80	63	.037	.984	10.93	11	.000	1.000
Strict	**97.09**	**65**	**.036**	**.985**	**10.93**	**12**	**.000**	**1.000**
IToW: Mental activity								
Configural	45.25	24	.048	.986	0.00	0	.000	1.000
Weak	52.89	28	.048	.983	1.01	2	.000	1.000
Strong	56.51	32	.045	.984	5.30	5	.021	.999
Strict	**61.98**	**34**	**.046**	**.981**	**6.26**	**6**	**.018**	**.999**
IToW: Temptations								
Configural	63.40	24	.065	.957	0.00	0	.000	1.000
Weak	68.03	28	.061	.956	0.70	2	.000	1.000
Strong	72.03	32	.057	.956	2.73	5	.000	1.000
Strict	**76.35**	**34**	**.057**	**.954**	**3.04**	**6**	**.000**	**1.000**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 33. *Measurement Invariance for Motivational Regulation Strategies*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Reg. of value								
Configural	212.46	87	.061	.943	15.81	10	.066	.992
Weak	224.28	95	.059	.941	27.35	14	.085	.982
Strong	239.29	103	.059	.938	**31.15**	**19**	**.070**	**.982**
Strict	**239.37**	**105**	**.058**	**.939**	39.79	20	.087	.971
Reg. of performance goals								
Configural	132.47	51	.064	.956	13.73	4	.136	.979
Weak	135.21	57	.060	.958	19.42	7	.116	.973
Strong	160.74	63	.063	.947	21.55	11	.085	.977
Strict	**161.30**	**65**	**.062**	**.948**	**22.01**	**12**	**.080**	**.978**
Self-consequating								
Configural	126.79	51	.062	.951	7.90	4	.086	.990
Weak	**133.29**	**57**	**.059**	**.951**	**14.07**	**7**	**.087**	**.982**
Strong	173.79	63	.068	.929	23.33	11	.092	.969
Strict	178.97	65	.067	.927	23.84	12	.086	.970
Environmental structuring								
Configural	58.72	24	.061	.956	0.00	**0**	**.000**	**1.000**
Weak	63.55	28	.057	.955	15.18	2	.223	.937
Strong	73.06	32	.058	.948	15.60	5	.127	.949
Strict	**73.15**	**34**	**.055**	**.950**	15.92	6	.112	.953

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 33. *(cont'd)*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Reg. of situational interest								
Configural	123.99	51	.061	.952	**18.44**	**4**	**.165**	**.971**
Weak	**133.48**	**57**	**.059**	**.950**	28.01	7	.151	.958
Strong	159.09	63	.063	.937	29.09	11	.112	.964
Strict	160.19	65	.062	.938	29.56	12	.105	.965
Reg. of mastery goals								
Configural	125.93	51	.062	.956	10.80	4	.113	.984
Weak	133.63	57	.059	.955	15.05	7	.093	.981
Strong	148.24	63	.059	.950	15.64	11	.057	.989
Strict	**149.17**	**65**	**.058**	**.950**	**17.75**	**12**	**.060**	**.986**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 34. *Measurement Invariance for Teaching Motivation*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Efficacy for student motivation								
Configural	38.11	24	.039	.989	0.00	0	.000	1.000
Weak	39.94	28	.033	.991	1.37	2	.000	1.000
Strong	46.97	32	.035	.988	1.75	5	.000	1.000
Strict	**47.83**	**34**	**.033**	**.989**	**2.44**	**6**	**.000**	**1.000**
Efficacy for teaching								
Configural	51.40	24	.055	.981	0.00	0	.000	1.000
Weak	60.66	28	.055	.977	0.55	2	.000	1.000
Strong	64.20	32	.051	.977	9.35	5	.081	.989
Strict	**64.96**	**34**	**.049**	**.978**	**9.35**	**6**	**.065**	**.991**
Responsibility for student motivation								
Configural	45.57	24	.049	.985	0.00	0	.000	1.000
Weak	52.86	28	.048	.983	1.92	2	.000	1.000
Strong	58.38	32	.047	.982	4.38	5	.000	1.000
Strict	**60.54**	**34**	**.045**	**.982**	**4.73**	**6**	**.000**	**1.000**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 35. *Measurement Invariance for Perceptions of Instructor*

	Longitudinal				*Multigroup*			
	χ^2	*df*	RMSEA	CFI	χ^2	*df*	RMSEA	CFI
Perceived Teacher Enthusiasm								
Configural	13.69	8	.046	.995	0.00	0	.000	1.000
Weak	**17.29**	**10**	**.046**	**.994**	1.22	2	.000	1.000
Strong	92.65	12	.141	.930	**5.37**	**5**	**.024**	**.999**
Strict	94.84	13	.136	.929	12.93	6	.094	.987
Perceived Use of Everyday Life Examples								
Configural	34.84	8	.099	.977	0.00	0	.000	1.000
Weak	**35.32**	**10**	**.086**	**.978**	0.95	2	.000	1.000
Strong	119.90	12	.163	.908	4.64	5	.000	1.000
Strict	120.18	13	.156	.909	**4.88**	**6**	**.000**	**1.000**

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. Bolding indicates the level of measurement invariance achieved. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 36. *Study 2 Analysis of Variance for Baseline Measures by Condition*

Measure	Control		Intervention		*F* (1, 345)	*p*
	M	*SD*	*M*	*SD*		
Motivational Beliefs						
Academic Self-Efficacy	4.09	.58	4.14	.57	0.82	.367
Self-Efficacy for Self-Regulated Learning	4.20	.54	4.16	.58	0.54	.463
Mastery-Approach Goals	4.03	.45	3.99	.48	0.83	.363
Performance-Approach Goals	3.37	.43	3.45	.48	2.65	.104
Performance-Avoidance Goals	3.29	.87	3.47	.88	3.38	.067
Task Value/Personal Interest	3.67	.38	3.70	.40	0.37	.542
Fixed Mindset	3.44	.42	3.46	.50	0.22	.643
Growth Mindset	3.78	.56	3.61	.62	0.30	.585
IToW: Mental activity	2.53	.88	2.66	.99	1.78	.186
IToW: Temptations	3.41	.78	3.51	.74	1.46	.228
Motivational Regulation Strategies						
Regulation of Value	3.87	.65	3.87	.67	0.00	.961
Regulation of Performance Goals	4.21	.63	4.19	.63	0.08	.777
Self-Consequating	3.78	.78	3.85	.68	0.90	.345
Environmental Structuring	3.83	.63	3.80	.69	0.18	.672
Regulation of Situational Interest	3.76	.40	3.78	.42	0.39	.531
Regulation of Mastery Goals	3.44	.80	3.38	.72	0.43	.511

Table 37. *Study 2 Analysis of Variance for Post-Test Measures by Attrition Status*

Measure	Data complete		Data missing		*F* (1, 347)	*p*
	M	*SD*	*M*	*SD*		
Motivational Beliefs						
Academic Self-Efficacy	4.13	0.56	4.05	0.67	0.69	.406
Self-Efficacy for Self-Regulated Learning	4.19	0.56	4.08	0.57	1.33	.249
Mastery-Approach Goals	4.01	0.47	4.00	0.45	0.02	.895
Performance-Approach Goals	3.41	0.45	3.40	0.50	0.01	.922
Performance-Avoidance Goals	3.38	0.87	3.43	0.96	0.13	.719
Task Value/Personal Interest	3.69	0.39	3.68	0.41	0.02	.884
Fixed Mindset	3.45	0.45	3.45	0.51	0.00	.964
Growth Mindset	3.59	0.56	3.60	0.77	0.00	.980
IToW: Mental activity	2.59	0.92	2.70	1.09	0.52	.471
IToW: Temptations	3.59	0.75	3.44	0.76	1.40	0.24
Motivational Regulation Strategies						
Regulation of Value	3.88	0.65	3.80	0.75	0.43	.515
Regulation of Performance Goals	4.20	0.64	4.21	0.51	0.01	.935
Self-Consequating	3.82	0.72	3.80	0.77	0.02	.890
Environmental Structuring	3.83	0.65	3.66	0.76	2.23	.136
Regulation of Situational Interest	3.77	0.41	3.76	0.40	0.02	.898
Regulation of Mastery Goals	3.41	0.76	3.38	0.76	0.04	.833

Table 38. *Study 2 Motivational Beliefs Descriptive Statistics*

Scale	Mean (SD)	*N*
Academic Self-Efficacy (T1)	4.12 (.57)	347
Academic Self-Efficacy (T2)	4.06 (.61)	315
Academic Self-Efficacy (T3)	4.03 (.60)	266
Self-Efficacy for Self-Regulated Learning (T1)	4.18 (.56)	346
Self-Efficacy for Self-Regulated Learning (T2)	4.07 (.69)	313
Self-Efficacy for Self-Regulated Learning (T3)	4.10 (.64)	266
Mastery-Approach Goals (T1)	4.01 (.47)	347
Mastery-Approach Goals (T2)	3.95 (.48)	313
Mastery-Approach Goals (T3)	3.97 (.53)	266
Performance-Approach Goals (T1)	3.41 (.46)	346
Performance-Approach Goals (T2)	3.46 (.53)	313
Performance-Approach Goals (T3)	3.59 (.54)	266
Performance-Avoidance Goals (T1)	3.39 (.88)	346
Performance-Avoidance Goals (T2)	3.32 (.91)	313
Performance-Avoidance Goals (T3)	3.35 (.92)	266
Task Value/Personal Interest (T1)	3.69 (.39)	347
Task Value/Personal Interest (T2)	3.68 (.45)	315
Task Value/Personal Interest (T3)	3.74 (.47)	266
Fixed Mindset (T1)	3.45 (.46)	346
Fixed Mindset (T2)	3.49 (.51)	312
Fixed Mindset (T3)	3.59 (.51)	266
Growth Mindset (T1)	3.59 (.59)	341
Growth Mindset (T2)	3.60 (.57)	307
Growth Mindset (T3)	3.71 (.58)	266
IToW: Strenuous Mental Activity (T1)	2.60 (.94)	347
IToW: Strenuous Mental Activity (T2)	2.74 (1.00)	314
IToW: Strenuous Mental Activity (T3)	2.97 (1.01)	266
IToW: Resisting Temptations (T1)	3.46 (.76)	347
IToW: Resisting Temptations (T2)	3.47 (.80)	313
IToW: Resisting Temptations (T3)	3.47 (.79)	266

Table 39. *Study 2 Motivational Regulation Strategies Descriptive Statistics*

Scale	Mean (SD)	*N*
Regulation of Value (T1)	3.87 (.66)	347
Regulation of Value (T2)	3.86 (.64)	314
Regulation of Value (T3)	3.95 (.64)	266
Regulation of Performance Goals (T1)	4.20 (.63)	347
Regulation of Performance Goals (T2)	4.12 (.64)	314
Regulation of Performance Goals (T3)	4.10 (.62)	266
Self-Consequating (T1)	3.82 (.73)	347
Self-Consequating (T2)	3.94 (.63)	315
Self-Consequating (T3)	3.98 (.63)	266
Environmental Structuring (T1)	3.81 (.66)	346
Environmental Structuring (T2)	3.87 (.66)	312
Environmental Structuring (T3)	3.87 (.63)	266
Regulation of Situational Interest (T1)	3.77 (.41)	347
Regulation of Situational Interest (T2)	3.75 (.46)	315
Regulation of Situational Interest (T3)	3.80 (.48)	266
Regulation of Mastery Goals (T1)	3.41 (.76)	347
Regulation of Mastery Goals (T2)	3.46 (.76)	315
Regulation of Mastery Goals (T3)	3.62 (.72)	266

Table 40. *Study 2 Teaching Competence Beliefs & Perceived Instructional Practices Descriptive Statistics*

Scale	Mean (SD)	*N*
Efficacy for Student Motivation (T1)	3.37 (.77)	195
Efficacy for Student Motivation (T2)	3.46 (.72)	175
Efficacy for Student Motivation (T3)	3.52 (.73)	148
Efficacy for Teaching (T1)	3.89 (.54)	195
Efficacy for Teaching (T2)	3.89 (.57)	175
Efficacy for Teaching (T3)	3.91 (.51)	148
Responsibility for Student Motivation (T1)	3.50 (.60)	195
Responsibility for Student Motivation (T2)	3.56 (.64)	175
Responsibility for Student Motivation (T3)	3.62 (.64)	148
Teaching Career Intentions (T1)	9.17 (1.36)	196
Teaching Career Intentions (T2)	9.23 (1.25)	174
Teaching Career Intentions (T3)	9.39 (1.07)	148
Perceived Teacher Enthusiasm (T2)	4.41 (.67)	307
Perceived Teacher Enthusiasm (T3)	4.37 (.73)	265
Perceived Use of Everyday Life Examples (T2)	4.28 (.71)	307
Perceived Use of Everyday Life Examples (T3)	4.39 (.70)	265
Perceived Relevance Support (T3)	4.44 (.66)	265

Table 41. *Model Fit Indices for Motivational Beliefs Growth Curve Models*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
Academic self-efficacy															
Full invariance	19.80	15	--	.041	.982	7.13	12	--	.000	1.000	6.91	11	--	.000	1.000
Free factor means	19.15	14	0.65	.044	.980	5.47	10	1.66	.000	1.000	5.26	9	1.65	.000	1.000
Free factor vars/covar	19.14	13	0.01	.049	.977	5.07	7	0.40	.000	1.000	4.78	6	0.48	.000	1.000
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	4.26	5	0.52	.000	1.000
Free residual vars	19.12	12	0.02	.055	.973	5.06	6	0.01	.000	1.000	4.22	4	0.04	.017	.999
Self-efficacy for self-regulation															
Full invariance	52.52	15	--	.114	.847	22.69	12	--	.068	.956	14.26	11	--	.039	.987
Free factor means	52.52	14	0.00	.119	.843	14.90	10	7.79	.080	.950	14.04	9	0.22	.054	.979
Free factor vars/covar	52.33	13	0.19	.125	.840	19.32	7	-4.42	.096	.950	12.27	6	1.77	.074	.974
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	11.59	5	0.68	.083	.973
Free residual vars	47.35	12	4.98	.124	.856	14.81	6	4.51	.087	.964	4.33	4	7.26	.021	.999
Mastery-approach goals															
Full invariance	35.15	15	--	.083	.905	10.18	12	--	.000	1.000	9.53	11	--	.000	1.000
Free factor means	35.14	14	0.01	.088	.900	9.01	10	1.17	.000	1.000	8.37	9	1.16	.000	1.000
Free factor vars/covar	33.73	13	1.41	.091	.902	6.98	7	2.03	.000	1.000	6.63	6	1.74	.023	.997
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	3.83	5	2.80	.000	1.000
Free residual vars	32.87	12	0.86	.095	.901	6.49	6	0.49	.020	.998	2.61	4	1.22	.000	1.000

Table 41. *(cont.)*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
Performance-approach goals															
Full invariance	65.66	15	--	.132	.769	16.55	12	--	.044	.979	15.26	11	--	.045	.981
Free factor means	62.79	14	2.87	.134	.777	13.02	10	3.53	.040	.986	11.57	9	3.69	.038	.988
Free factor vars/covar	60.54	13	2.25	.138	.783	9.95	7	3.07	.047	.987	8.58	6	2.99	.047	.988
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	8.05	5	0.53	.056	.986
Free residual vars	59.55	12	0.99	.143	.783	9.55	6	0.40	.055	.984	7.79	4	0.26	.070	.983
Performance-avoidance goals															
Full invariance	19.99	15	--	.042	.984	17.60	12	--	.049	.982	15.59	11	--	.047	.985
Free factor means	16.76	14	3.23	.032	.991	14.10	10	3.50	.046	.986	10.74	9	4.85	.032	.994
Free factor vars/covar	16.61	13	0.15	.038	.988	9.63	7	4.47	.044	.991	6.56	6	4.18	.022	.998
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	6.43	5	0.13	.038	.995
Free residual vars	15.66	12	0.95	.040	.988	8.90	6	0.73	.050	.990	4.54	4	1.89	.026	.998
Interest value															
Full invariance	48.37	15	--	.107	.886	16.92	12	--	.046	.983	16.73	11	--	.052	.980
Free factor means	47.33	14	1.04	.111	.886	15.85	10	1.07	.055	.980	15.67	9	1.06	.062	.977
Free factor vars/covar	46.43	13	0.90	.115	.886	13.26	7	2.59	.068	.979	12.97	6	2.70	.077	.976
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	12.95	5	0.02	.091	.973
Free residual vars	41.35	12	5.08	.112	.900	8.33	6	4.93	.045	.992	8.30	4	4.65	.075	.985

Table 41. *(cont.)*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
Fixed mindset															
Full invariance	48.63	15	--	.108	.834	18.11	12	--	.051	.970	18.10	11	--	.058	.965
Free factor means	48.15	14	0.48	.112	.831	17.62	10	0.49	.063	.962	17.61	9	0.49	.070	.957
Free factor vars/covar	44.13	13	4.02	.111	.846	8.80	7	8.82	.037	.991	8.43	6	9.18	.046	.988
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	6.91	5	1.52	.044	.991
Free residual vars	41.03	12	3.10	.112	.856	8.76	6	0.04	.049	.986	6.73	4	0.18	.059	.986
Growth mindset															
Full invariance	36.07	15	--	.086	.876	17.32	12	--	.048	.969	15.12	11	--	.044	.976
Free factor means	35.53	14	0.54	.090	.873	16.64	10	0.68	.059	.961	14.52	9	0.60	.057	.968
Free factor vars/covar	34.71	13	0.82	.093	.872	13.79	7	2.85	.071	.960	8.41	6	6.11	.046	.986
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	9.40	5	-0.99	.068	.974
Free residual vars	32.11	12	2.60	.093	.882	13.13	6	0.66	.079	.958	6.67	4	2.73	.059	.984
ITOW: Mental activity															
Full invariance	59.80	15	--	.124	.824	16.41	12	--	.044	.983	15.63	11	--	.047	.982
Free factor means	58.60	14	1.20	.128	.825	14.75	10	1.66	.050	.981	14.07	9	1.56	.054	.980
Free factor vars/covar	55.63	13	2.97	.130	.833	10.08	7	4.67	.048	.988	9.39	6	4.68	.054	.987
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	6.80	5	2.59	.043	.993
Free residual vars	53.09	12	2.54	.133	.839	8.77	6	1.31	.049	.989	6.76	4	0.04	.060	.989

Table 41. *(cont.)*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
ITOW: Temptations															
Full invariance	15.01	15	--	.002	1.000	7.66	12	--	.000	1.000	7.65	11	--	.000	1.000
Free factor means	12.40	14	2.61	.000	1.000	5.07	10	2.59	.000	1.000	4.77	9	2.88	.000	1.000
Free factor vars/covar	12.31	13	0.09	.000	1.000	3.84	7	1.23	.000	1.000	3.50	6	1.27	.000	1.000
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	3.18	5	0.32	.000	1.000
Free residual vars	12.02	12	0.29	.003	1.000	2.93	6	0.91	.000	1.000	2.18	4	1.00	.000	1.000

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution. No models are bolded because a multigroup model was not selected. According to the chi-square difference tests, no model significantly improved; if any of the chi-square difference tests were significant, it would be indicated by an *.

Table 42. *Model Fit Indices for Motivational Regulation Strategies Growth Curve Models*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
Regulation of Value															
Full invariance	34.26	15	--	.081	.912	18.82	12	--	.054	.970	17.19	11	--	.054	.972
Free factor means	33.74	14	0.52	.085	.910	16.00	10	2.82	.056	.973	14.40	9	2.79	.056	.975
Free factor var	31.78	13	1.96	.086	.914	11.29	7	4.71	.056	.980	10.33	6	4.07	.061	.980
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	10.33	5	0.00	.074	.976
Free residual vars	30.03	12	1.75	.088	.917	9.22	6	2.07	.053	.985	7.43	4	2.90	.067	.984
Regulation of performance goals															
Full invariance	23.58	15	--	.054	.970	7.32	12	--	.000	1.000	7.23	11	--	.000	1.000
Free factor means	23.15	14	0.43	.058	.968	4.97	10	2.35	.000	1.000	4.93	9	2.30	.000	1.000
Free factor var	22.96	13	0.19	.063	.965	4.16	7	0.81	.000	1.000	4.14	6	0.79	.000	1.000
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	3.95	5	0.19	.000	1.000
Free residual vars	22.91	12	0.05	.069	.962	2.92	6	1.24	.000	1.000	2.56	4	1.39	.000	1.000
Self-consequating															
Full invariance	57.25	15	--	.121	.805	15.98	12	--	.041	.982	10.87	11	--	.000	1.000
Free factor means	56.15	14	1.10	.125	.805	14.76	10	1.22	.050	.978	9.47	9	1.40	.016	.998
Free factor var	56.07	13	0.08	.131	.801	8.55	7	6.21	.034	.993	2.97	6	6.50	.000	1.000
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	2.75	5	0.22	.000	1.000
Free residual vars	55.74	12	0.33	.137	.798	8.53	6	0.02	.047	.988	2.68	4	0.07	.000	1.000

Table 42. *(cont.)*

	No growth					*Linear*					*Latent Basis*				
	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI	χ^2	*df*	$\Delta\chi^2$	RMSEA	CFI
Regulation of mastery goals															
Full invariance	58.35	15	--	.122	.847	26.24	12	--	.078	.950	21.38	11	--	.070	.963
Free factor means	58.11	14	0.24	.128	.845	24.00	10	2.24	.085	.951	17.54	9	3.84	.070	.970
Free factor var	58.08	13	0.03	.134	.841	19.84	7	4.16	.097	.955	17.31	6	0.23	.099	.960
Free basis coeffs	--	--	--	--	--	--	--	--	--	--	11.73	5	5.58	.083	.976
Free residual vars	55.88	112	2.20	.137	.846	18.91	6	0.93	.105	.955	11.67	4	0.06	.100	.973

Note. CFI = comparative fit index; RMSEA = root-mean-square error of approximation. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution. No models are bolded because a multigroup model was not selected. According to the chi-square difference tests, no model significantly improved; if any of the chi-square difference tests were significant, it would be indicated by an *.

Table 43. *Fit statistics for motivational belief full sample latent growth curve models*

Model	Free params	χ^2 (df)	CFI	RMSEA	$\Delta\chi^2$	Wald test
Academic self-efficacy						
No growth	3	15.90 (6)	.963	.065	--	--
Linear	**6**	**3.24 (3)**	**.999**	**.014**	**12.66**	**--**
Latent basis	7	3.02 (2)	.996	.036	0.22	0.27
Self-efficacy for self-regulation						
No growth	3	40.83 (6)	.856	.123	--	--
Linear	**6**	**11.01 (3)**	**.967**	**.083**	**29.82***	**--**
Latent basis (did not converge)	--	--	--	--	--	--
Mastery-approach goals						
No growth	3	27.34 (6)	.900	.096	--	--
Linear	**6**	**2.37 (3)**	**1.000**	**.000**	**24.97***	**--**
Latent basis	7	1.73 (2)	1.000	.000	0.64	0.75
Performance-approach goals						
No growth	3	57.56 (6)	.772	.149	--	--
Linear	**6**	**8.45 (3)**	**.976**	**.069**	**49.01***	**--**
Latent basis	7	7.16 (2)	.977	.082	0.12	1.30
Performance-avoidance goals						
No growth	**3**	**7.21 (6)**	**.996**	**.023**	**--**	**--**
Linear	6	4.82 (3)	.994	.029	2.39	--
Latent basis	7	2.80 (2)	.997	.032	2.02	3.42
Task Value/Personal Interest						
No growth	3	34.27 (6)	.903	.110	--	--
Linear	**6**	**2.82 (3)**	**1.000**	**.000**	**31.45***	**--**
Latent basis	7	2.63 (2)	.998	.029	0.19	0.16
Fixed Mindset						
No growth	3	38.28 (6)	.845	.118	--	--
Linear	**6**	**7.77 (3)**	**.977**	**.064**	**30.51***	**--**
Latent basis	7	7.76 (2)	.972	.086	0.01	0.01
Growth Mindset						
No growth	3	29.47 (6)	.864	.101	--	--
Linear	**6**	**10.72 (3)**	**.955**	**.105**	**18.75***	**--**
Latent basis	7	8.52 (2)	.962	.092	2.20	2.05
IToW: Mental Activity						
No growth	3	49.25 (6)	.830	.136	--	--
Linear	**6**	**5.87 (3)**	**.989**	**.050**	**43.38***	**--**
Latent basis	7	5.09 (2)	.988	.063	0.78	0.77
IToW: Resisting Temptations						
No growth	2	8.93 (6)	.987	.036	--	--
Linear	**6**	**1.58 (3)**	**1.000**	**.000**	**7.35**	**--**
Latent basis	17	1.27 (2)	1.000	.000	0.31	0.26

Note. CFI = Confirmatory Fit Indices; RMSEA = Root Mean Square Error Approximation. Bolding indicates the selected model. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 44. *Univariate motivational beliefs latent growth curve models unstandardized estimates with predictors*

Model	Intercept mean (SE)	*p*	Slope mean (SE)	*p*
Acad. self-efficacy	**4.12 (.03)**	**<.001**	**-0.09 (.03)**	**.003**
Self-efficacy for SRL	**4.18 (.0.)**	**<.001**	**-0.13 (.03)**	**<.001**
Mastery-appr goals	**4.01 (.03)**	**<.001**	-0.06 (.03)	.050
Perf-appr goals	**3.40 (.02)**	**<.001**	**0.14 (.03)**	**<.001**
Perf-avoid goals	**3.38 (.05)**	**<.001**	-0.03 (.05)	.539
Task value	**3.68 (.02)**	**<.001**	0.02 (.02)	.373
Fixed mindset	**3.44 (.02)**	**<.001**	**0.11 (.03)**	**<.001**
Growth mindset	**3.58 (.03)**	**<.001**	**0.09 (.04)**	**.016**
IToW: Mental activity	**2.59 (.05)**	**<.001**	**0.30 (.05)**	**<.001**
IToW: Resist tempt	**3.46 (.04)**	**<.001**	0.00 (.05)	.933

Note. The Benjamini-Hochberg procedure was used to identify the largest p-value that was less than the critical value ($p < .05$) for the repeated tests, therefore, there are some instances when there were a large number of p-values less than the critical value that were not evaluated as being statistically significant. IToW = implicit theories of willpower, PTE = perceived teacher enthusiasm, PLE = perceived used of everyday life examples, Cond = condition.

Table 45. *Fit statistics for motivational regulation univariate latent growth curve models*

Model	Free params	χ^2 (df)	CFI	RMSEA	$\Delta\chi^2$	Wald Test
Regulation of Value						
No growth	3	21.74 (6)	.930	.082	--	--
Linear	**6**	**6.31 (3)**	**.985**	**.053**	**15.43**	**--**
Latent basis	7	4.68 (2)	.988	.059	7.85	1.47
Regulation of Performance Goals						
No growth	3	17.70 (6)	.959	.071	--	--
Linear	**6**	**1.45 (3)**	**1.000**	**.000**	**16.25**	**--**
Latent basis	7	1.36 (2)	1.000	.000	0.09	0.11
Self-Consequating						
No growth	3	46.48 (6)	.812	.132	--	--
Linear	6	5.21 (3)	.990	.044	18.16*	--
Latent basis	**7**	**0.10 (2)**	**1.000**	**.000**	**5.11**	**4.22***
Environmental Structuring						
No growth	3	23.37 (6)	.914	.087	--	--
Linear	6	9.14 (3)	.969	.073	14.23	--
Latent basis	**7**	**1.84 (2)**	**1.000**	**.000**	**7.30**	**5.76***
Regulation of Situational Interest						
No growth	3	23.47 (6)	.937	.087	--	--
Linear	**6**	**2.17 (3)**	**1.000**	**.000**	**21.3***	**--**
Latent basis	7	2.17 (2)	.999	.015	0.00	0.01
Regulation of Mastery Goals						
No growth	3	49.16 (6)	.848	.119	--	--
Linear	6	17.04 (3)	.951	.110	17.04*	--
Latent basis	**7**	**12.18 (2)**	**.964**	**.115**	**4.86**	**4.38***

Note. CFI = Confirmatory Fit Indices; RMSEA = Root Mean Square Error Approximation. Bolding indicates the selected model. When RMSEA = .000 and CFI = 1.00 and there are > 0 degrees of freedom this indicates that the model is overidentified; when degrees of freedom = 0, it indicates the model is saturated; for both cases, the fit indices should be interpreted with caution.

Table 46. *Univariate motivation regulation latent growth curve models unstandardized estimates with predictors*

Model	Intercept mean (SE)	*p*	Slope mean (SE)	*p*	T2 basis coeff. (SE)	*p*
Reg. of value	**3.86 (.03)**	**<.001**	.04 (.04)	.278	--	--
Reg. of perf goals	**4.20 (.03)**	**<.001**	**-.11 (.03)**	**.001**	--	--
Self-consequating	**3.81 (.04)**	**<.001**	**.15 (.04)**	**<.001**	**.90 (.09)**	**<.001**
Environmental structuring	**3.81 (.04)**	**<.001**	.03 (.04)	.384	**1.00 (.12)**	**<.001**
Reg. of interest	**3.76 (.02)**	**<.001**	.01 (.03)	.968	--	--
Reg. of mastery goals	**3.41 (.04)**	**<.001**	**.11 (.04)**	**.009**	**.91 (.09)**	**<.001**

Note. The Benjamini-Hochberg procedure was used to identify the largest p-value that was less than the critical value ($p < .05$) for the repeated tests, therefore, there are some instances when there were a large number of p-values less than the critical value that were not evaluated as being statistically significant. PTE = perceived teacher enthusiasm, PLE = perceived used of everyday life examples, Cond = condition.

Table 47. *Standardized Effects of Condition and Instructor Perceptions on Motivational Beliefs*

	Condition (Cond)			Teacher Enthusiasm (PTE)			Cond X PTE			Use of Life Examples (PLE)			Cond X PLE		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Acad. self-efficacy	.011	.053	.842	.025	.069	.719	.042	.069	.541	.053	.074	.470	-.009	.070	.902
Self-efficacy for SRL	.037	.052	.482	.076	.068	.268	.009	.068	.268	.056	.073	.441	-.016	.069	.814
Mastery-appr goals	.033	.053	.530	.056	.070	.426	.050	.070	.471	.103	.075	.171	.022	.071	.759
Perf-appr goals	.022	.051	.672	.092	.066	.164	.040	.068	.558	.117	.070	.095	.020	.070	.774
Perf-avoid goals	-.010	.053	.850	.035	.067	.606	.123	.067	.069	.058	.071	.416	.110	.070	.114
Task value	.034	.048	.471	.050	.062	.425	.045	.064	.480	.080	.066	.228	.015	.065	.818
Fixed mindset	.009	.052	.869	.100	.067	.136	.036	.068	.602	.119	.072	.096	.016	.071	.823
Growth mindset	-.025	.053	.641	.004	.069	.949	**.143**	**.070**	**.043**	.005	.073	.942	.120	.072	.095
IToW: Mental activity	.036	.050	.472	-.008	.065	.898	.081	.064	.207	.006	.069	.926	.084	.068	.216
IToW: Resist tempt	-.007	.053	.901	.030	.068	.662	.048	.069	.491	.048	.073	.513	.040	.072	.575

Note. The models used time 3 motivational beliefs as the outcome, controlling for time 2 motivational beliefs. Bolding indicates statistically significant results.

Table 48. *Standardized Effects of Condition and Instructor Perceptions on Motivational Regulation Strategy Use*

	Condition			Teacher Enthusiasm (PTE)			Cond X PTE			Use of Life Examples (PLE)			Cond X PTE		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Reg. of Value	-.028	.052	.585	.054	.067	.421	.038	.067	.578	.060	.071	.396	.005	.069	.944
Reg. of Perf Goals	.041	.050	.412	.088	.066	.185	-.026	.064	.680	.068	.071	.332	-.008	.066	.903
Self-consequating	.094	.050	.062	.095	.065	.145	.033	.066	.617	.111	.070	.111	.012	.068	.859
Reg. of Mastery Goals	-.009	.046	.844	.072	.059	.223	.053	.059	.364	.075	.063	.235	.037	.061	.546

Note. The models used time 3 motivational regulation strategies as the outcome, controlling for time 2 motivational regulation strategies. Regulation of situational interest and environmental structuring were not included in this set of models because multigroup measurement invariance was not achieved.

Table 49. *Standardized Effects of Changes in Motivational Beliefs on Teaching Beliefs and Career Intentions*

	Efficacy for Supporting Student Motivation			Efficacy for Teaching			Teacher Responsibility for Student Motivation			Teaching Career Intentions		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Acad. self-efficacy	**.277**	**.103**	**.007**	**.371**	**.066**	**<.001**	**.253**	**.089**	**.005**	.124	.147	.398
Self-efficacy for SRL	.186	.090	.039	**.236**	**.058**	**<.001**	.202	.077	.009	-.054	.126	.670
Mastery-appr goals	**.359**	**.115**	**.002**	**.406**	**.074**	**<.001**	**.420**	**.097**	**<.001**	.021	.158	.894
Perf-appr goals	**.644**	**.092**	**<.001**	**.378**	**.064**	**<.001**	**.583**	**.078**	**<.001**	-.097	.139	.483
Perf-avoid goals	**.278**	**.052**	**<.001**	**.135**	**.037**	**<.001**	**.263**	**.044**	**<.001**	-.036	.076	.639
Task value	**.708**	**.118**	**<.001**	**.536**	**.077**	**<.001**	**.701**	**.098**	**<.001**	-.044	.170	.793
Fixed mindset	**.631**	**.101**	**<.001**	**.412**	**.067**	**<.001**	**.605**	**.084**	**<.001**	-.125	.147	.398
Growth mindset	**.419**	**.095**	**<.001**	**.320**	**.062**	**<.001**	**.404**	**.081**	**<.001**	.011	.136	.937
IToW: Mental activity	**.180**	**.051**	**<.001**	.066	.036	.064	**.156**	**.045**	**<.001**	-.015	.073	.837
IToW: Resist tempt	**.223**	**.067**	**.001**	.095	.046	.039	**.180**	**.058**	**.002**	-.037	.095	.699

Note. The models used time 3 motivational beliefs as the outcome, controlling for time 2 motivational beliefs. Bolding indicates statistically significant results. The Benjamini-Hochberg correction was applied so several results that had a p-value of < .05 are not marked as significant.

Table 50. *Standardized Effects of Changes in Motivational Regulation Strategies on Teaching Beliefs and Career Intentions*

	Efficacy for Supporting Student Motivation			Efficacy for Teaching			Teacher Responsibility for Student Motivation			Teaching Career Intentions		
	β	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*	*β*	*SE*	*p*
Reg. of value	**.240**	**.092**	**.009**	**.357**	**.057**	**<.001**	**.315**	**.078**	**<.001**	-.002	.131	.991
Reg. of perf goals	.085	.083	.305	**.319**	**.075**	**<.001**	.151	.082	.067	.046	.067	.495
Self-consequating	.205	.090	.023	**.224**	**.060**	**<.001**	.243	.078	.002	.015	.127	.905
Environmental structuring	**.326**	**.085**	**<.001**	**.267**	**.055**	**<.001**	**.342**	**.071**	**<.001**	-.056	.121	.643
Reg. of interest	**.404**	**.070**	**<.001**	**.464**	**.065**	**<.001**	**.468**	**.064**	**<.001**	-.005	.062	.934
Reg. of mastery goals	**.384**	**.071**	**<.001**	**.325**	**.072**	**<.001**	**.457**	**.064**	**<.001**	-.035	.061	.560

Note. The models used time 3 motivational regulation strategies as the outcome, controlling for time 2 motivational regulation strategies. Bolding indicates statistically significant results. The Benjamini-Hochberg correction was applied so several results that had a p-value of $< .05$ are not marked as significant.

Table 51. Results of Post-Hoc Repeated Measures Analysis of Variance Tests for Study 2

	Time		Time * Condition	
	Linear F	*Quad F*	*Linear F*	*Quad F*
Motivational Beliefs				
Academic Self-Efficacy	7.48*	0.00	0.59	1.81
Self-Efficacy for Self-Regulated Learning	9.08*	1.10	0.20	1.60
Mastery-Approach Goals	2.23	0.48	1.63	0.19
Performance-Approach Goals	34.90*	0.17	0.05	0.03
Performance-Avoidance Goals	0.35	0.05	1.05	2.07
Task Value/Personal Interest	2.04	0.07	0.03	0.53
Fixed Mindset	21.93*	0.02	0.05	0.01
Growth Mindset	8.01*	0.97	0.70	0.02
IToW: Mental activity	25.89*	0.01	0.08	0.29
IToW: Temptations	0.02	0.45	0.12	0.42
Motivational Regulation Strategies				
Regulation of Value	0.91	1.09	0.96	1.39
Regulation of Performance Goals	11.43*	0.60	1.28	0.01
Self-Consequating	10.27*	6.16*	--	--
Environmental Structuring	1.16	3.09	0.01	0.60
Regulation of Situational Interest	0.21	0.10	--	--
Regulation of Mastery Goals	12.31*	0.47	2.23	1.65

Note. Significant results are bolded. Regulation of situational interest and self-consequating were not included in the ANOVA tests examining the time*condition interaction since these constructs did not have multigroup measurement invariance.

APPENDIX B. FIGURES

Figure 1. Schematic of mixed methods design

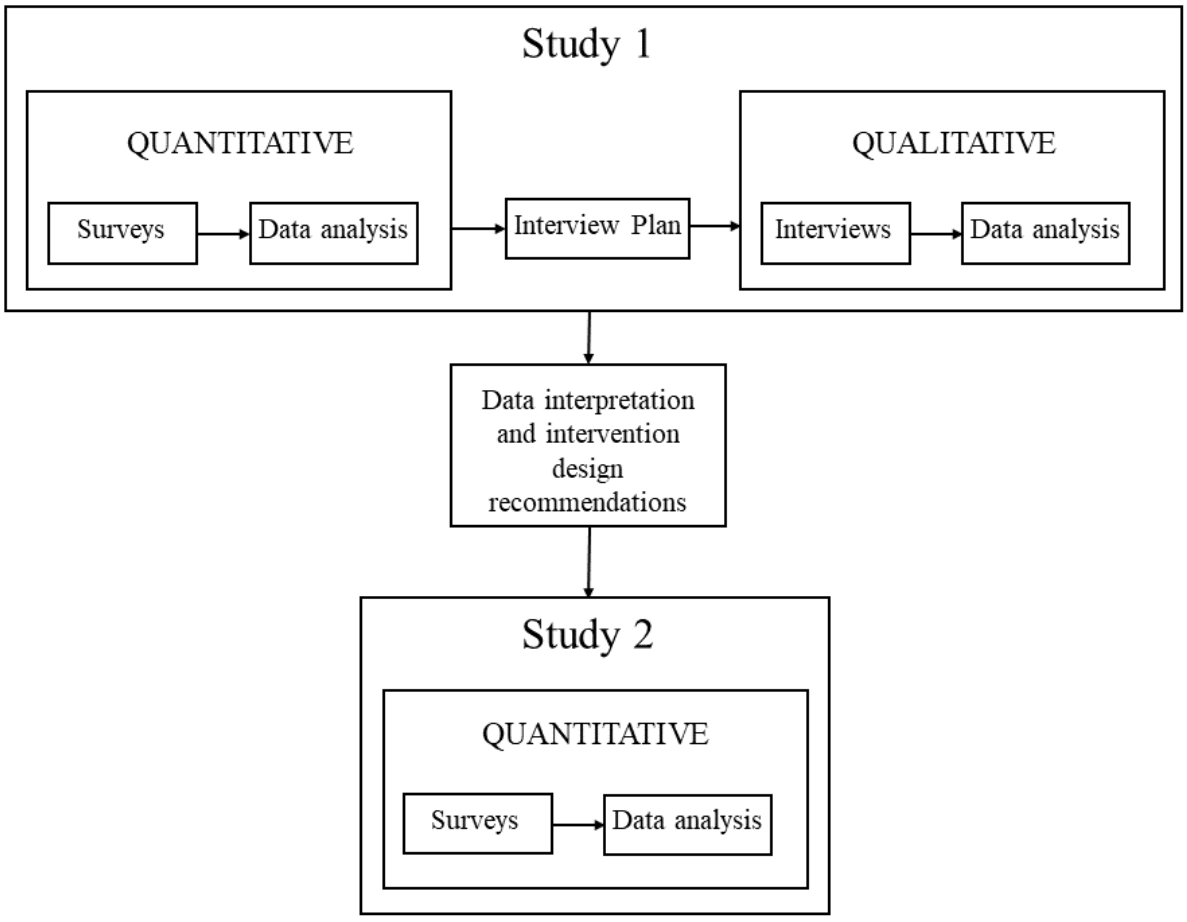


Figure 2. *Study 1 research question 1 path diagram*

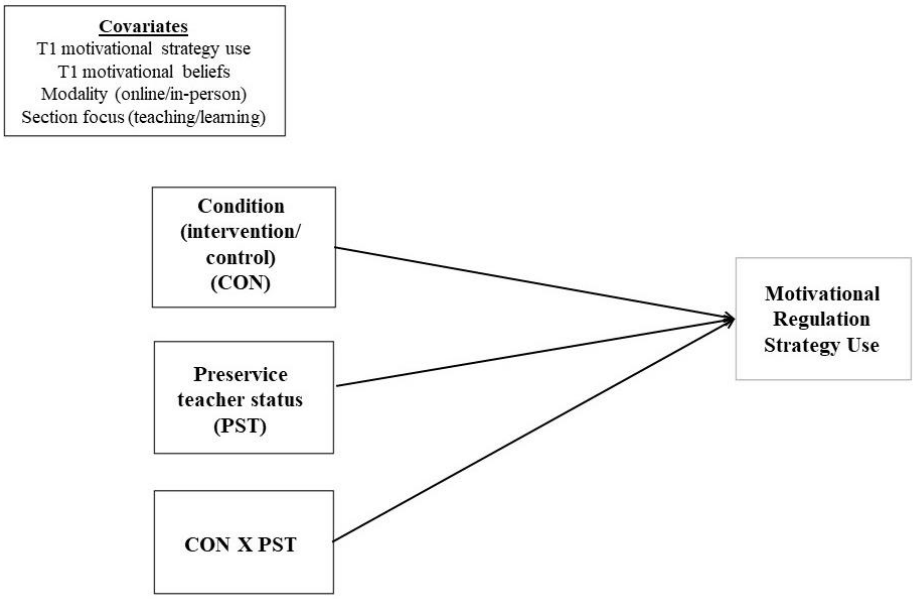


Figure 3. *Study 1 research question 2 path diagram*

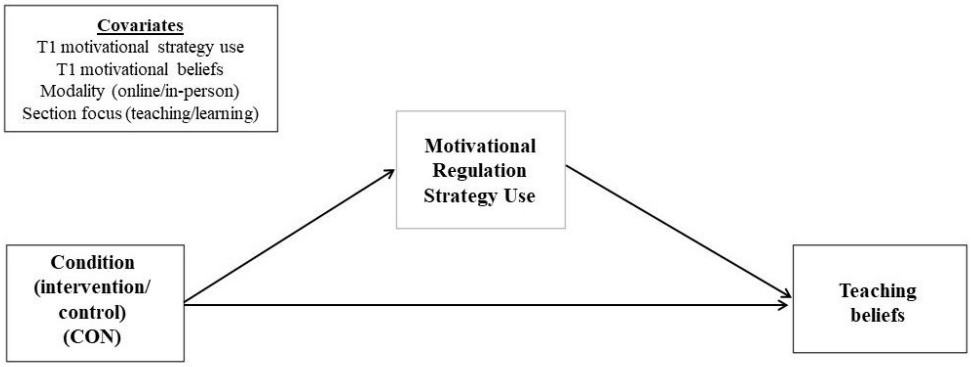


Figure 4. *Study 1 research question 3 path diagram*

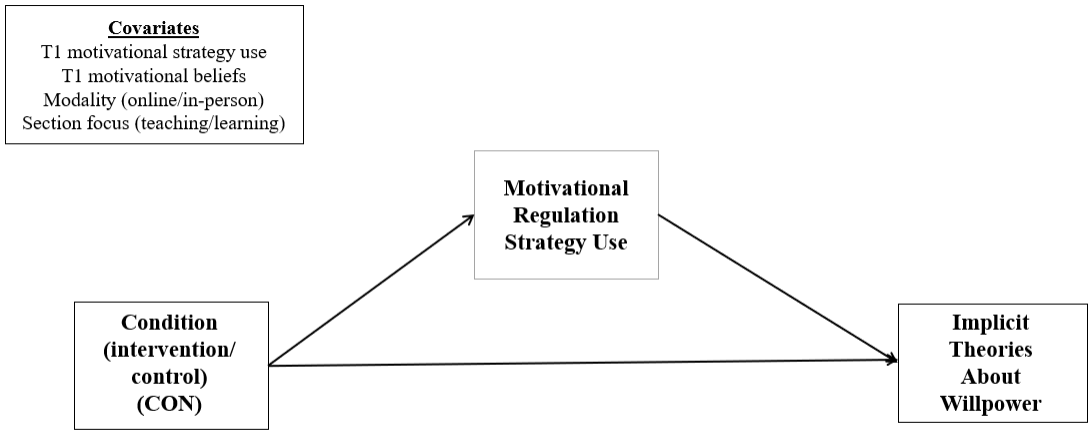
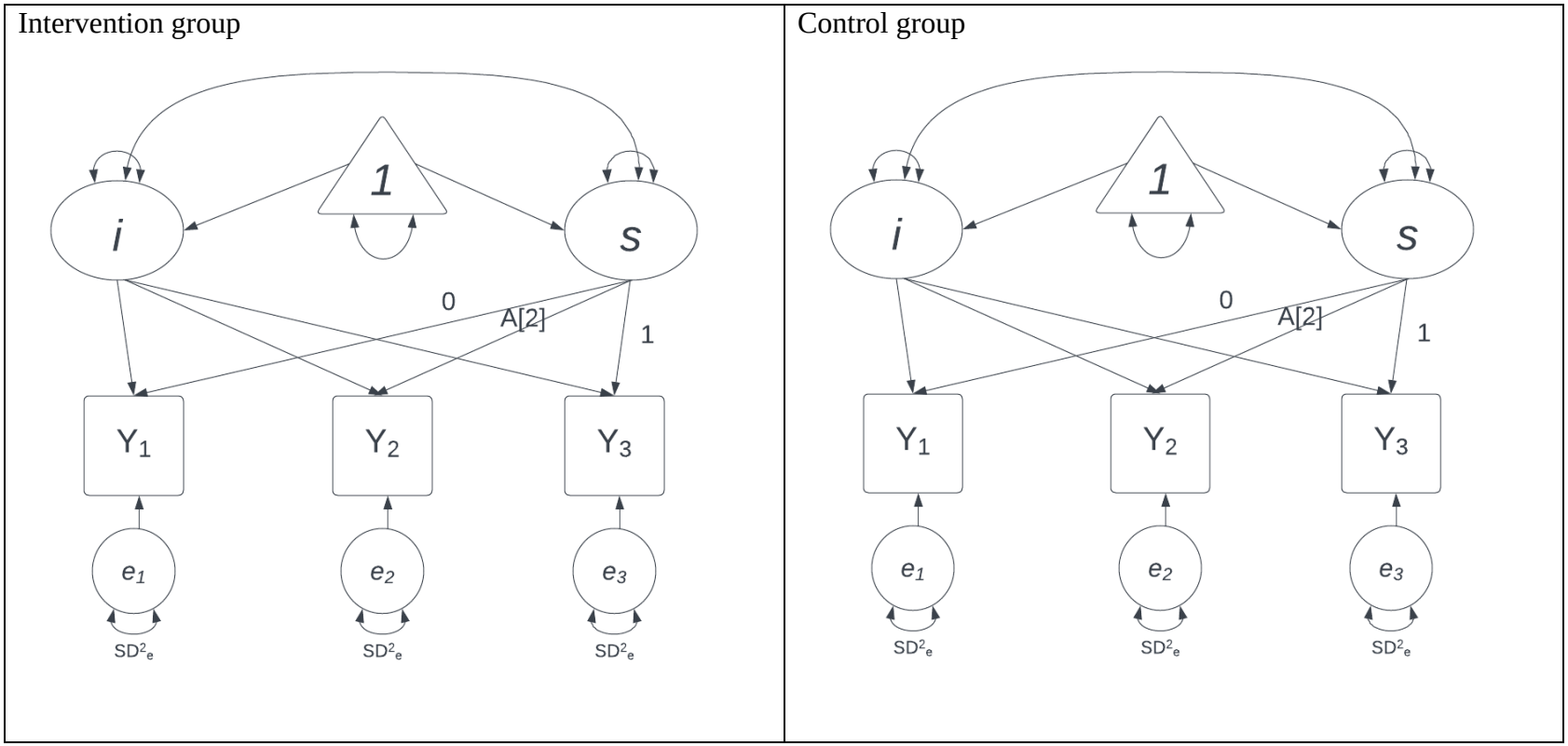
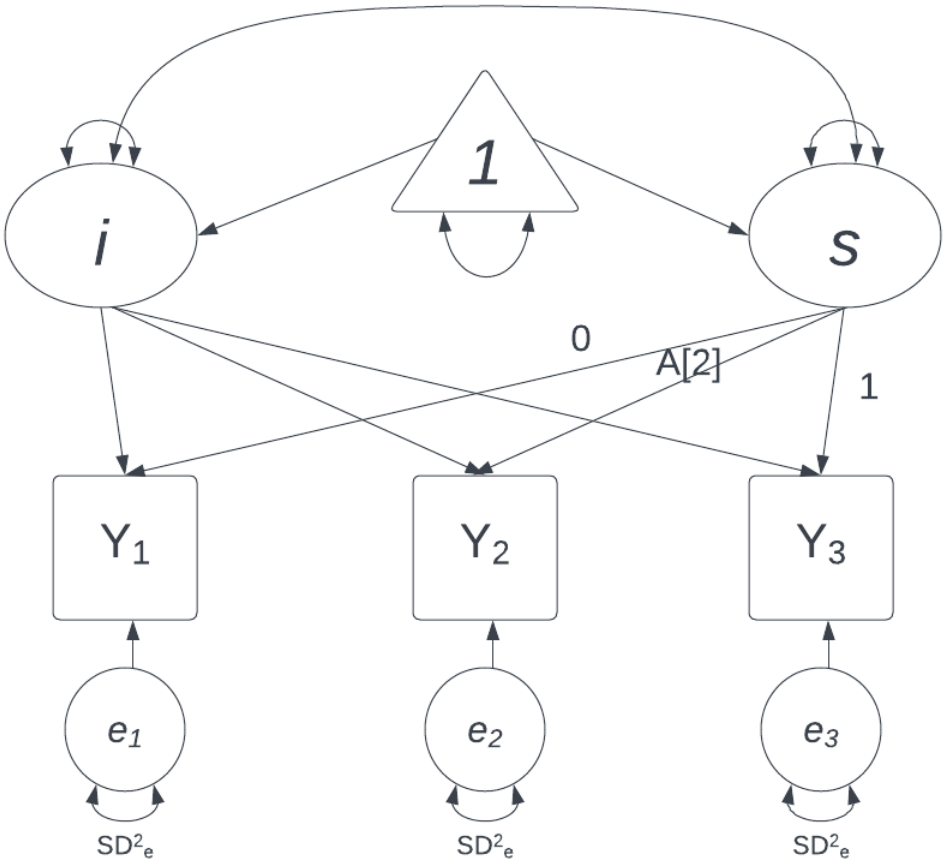


Figure 5. *Study 2 multigroup latent growth curve model*



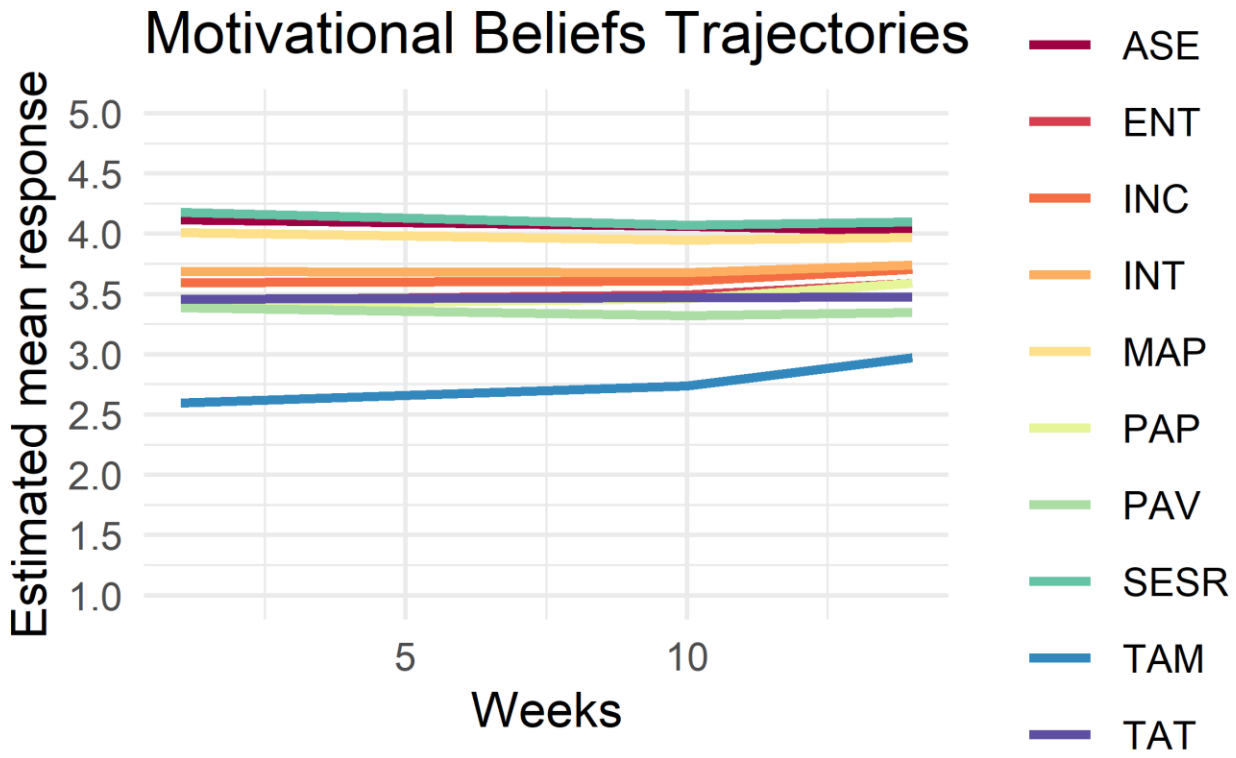
Note. i = intercept; s = slope; Y = motivational beliefs or regulation strategies

Figure 6. *Study 2 latent growth curve model for full sample*



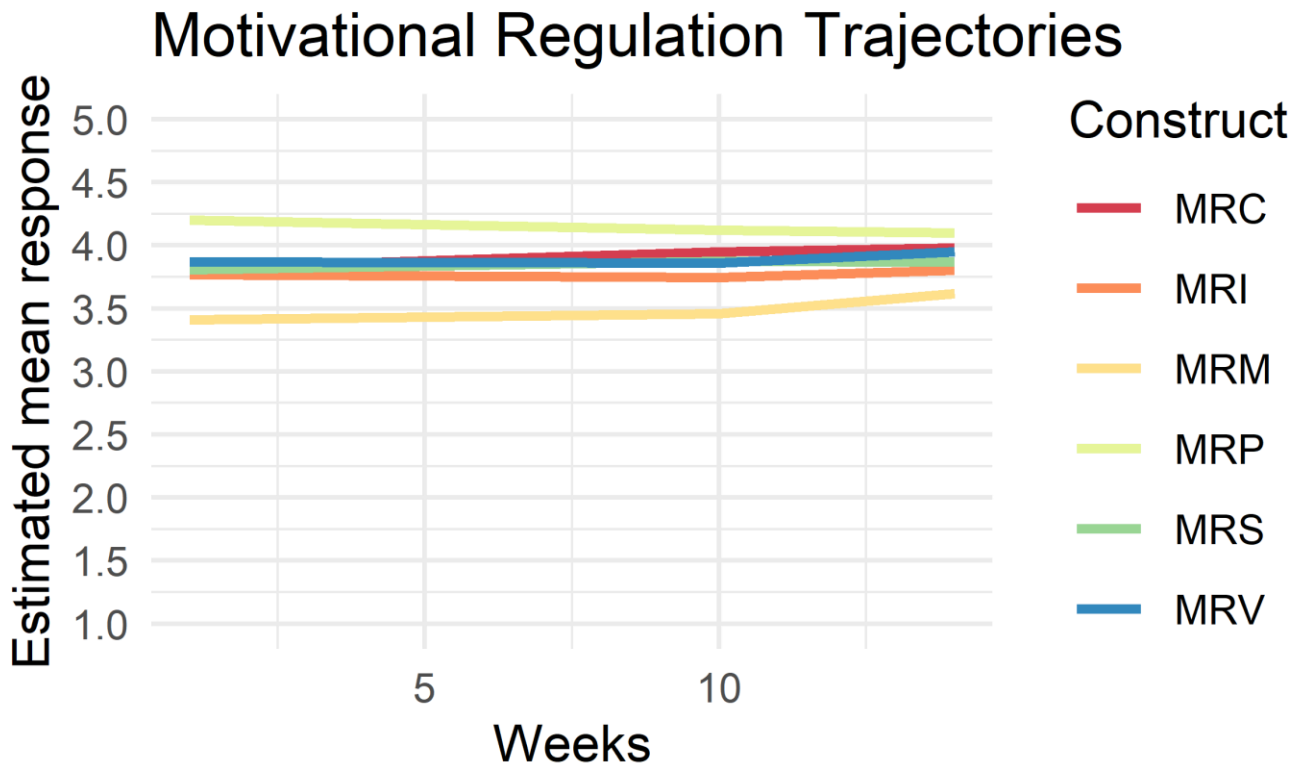
Note. i = intercept; s = slope; Y = motivational beliefs or regulation strategies

Figure 7. *Motivational beliefs trajectories*



Note. ASE = academic self-efficacy, ENT = fixed mindset, INC = growth mindset, INT = task value/personal interest, MAP = mastery-approach goals, PAP = performance-approach goals, PAV = performance-avoidance goals, SESR = self-efficacy for self-regulation, TAM = implicit theories of willpower: strenuous mental activity, TAT = implicit theories of willpower = resisting temptations

Figure 8. *Motivational regulation strategies trajectories*



Note. MRC = self-consequating, MRI = motivational regulation of situational interest, MRM = motivational regulation of mastery goals, MRP = motivational regulation of performance goals, MRS = environmental structuring, MRV = motivational regulation of value

Figure 9. *Study 2 research question 2 path diagram*

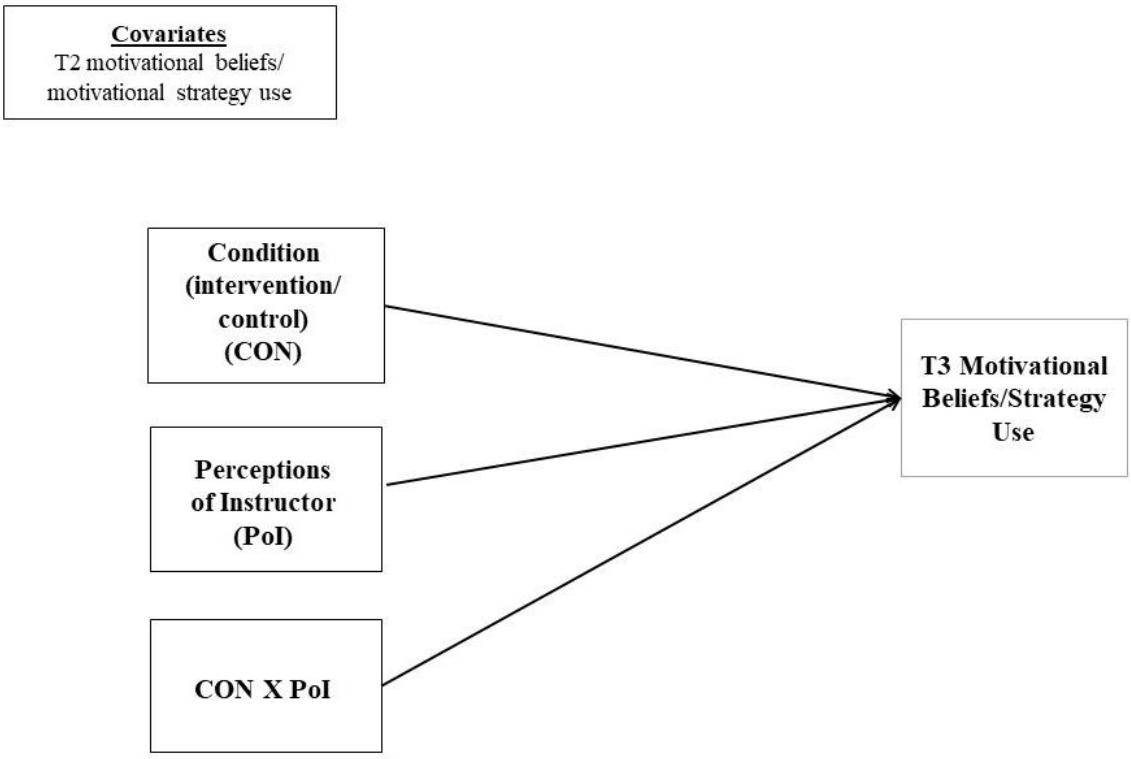
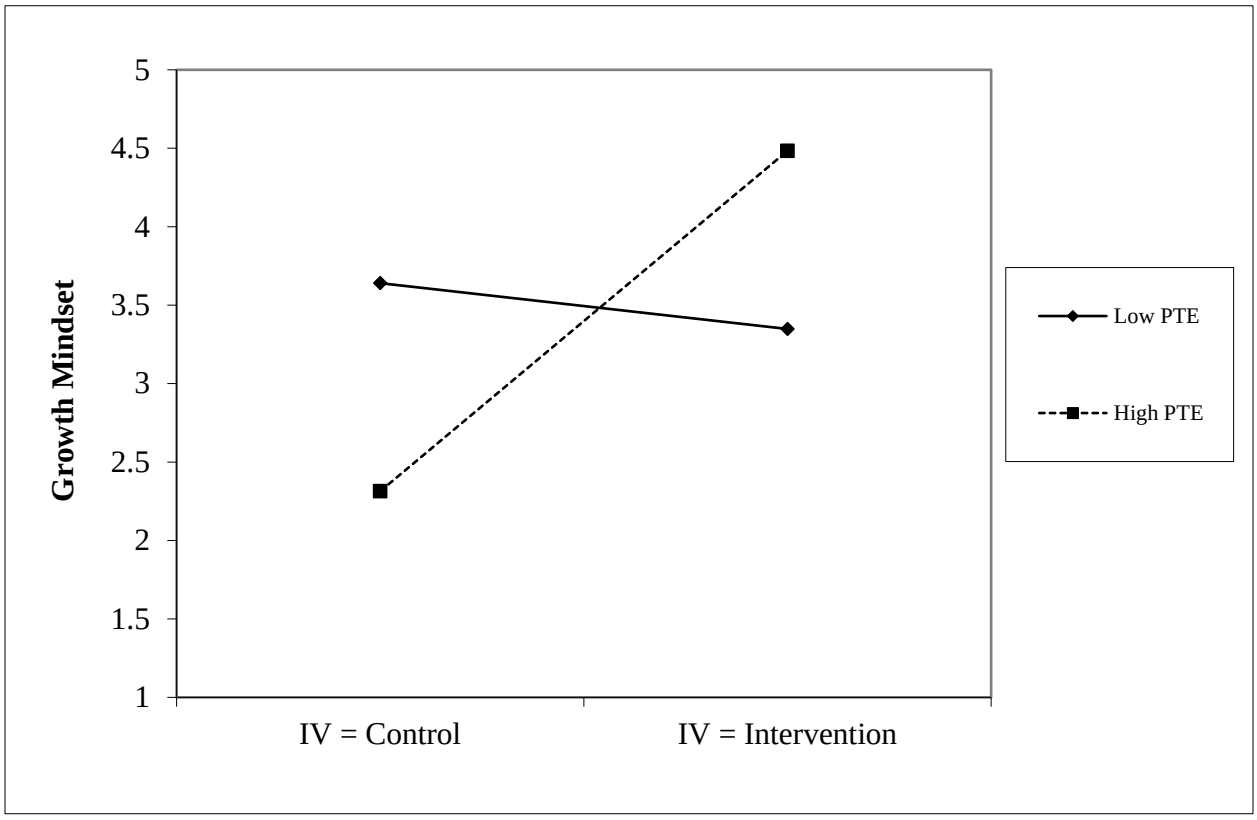


Figure 10. *Simple slope estimation for condition by perceived teacher enthusiasm interaction on growth mindset beliefs (Study 2)*



Note. PTE = perceived teacher enthusiasm

Figure 11. *Study 2 research question 3 path diagram*

APPENDIX C. SUPPORTING INFORMATION

Sample motivational regulation reflection "exit ticket" worksheet from Study 1

Motivation Booster Tool-Kit: Interest Beliefs

Interest beliefs are the extent to which a task is enjoyable to an individual. When someone is interested in doing something, they are likely to re-engage with the task or activity.

Interest beliefs are related to other beliefs including:

- Identity/Attainment Value (personal values, sense of self)
- Utility Value (goals, aspirations)
- Positive Affective/Emotional States (enjoyment, fun, curiosity)

Associated Beliefs	*Some tips for increasing situational interest*

• Identity/Attainment Value: the task is tied to my identity or sense of self
• Utility Value: the task may be useful to my current or future goals
• Positive Affective/Emotional State: the task may be fun or enjoyable
	• Remember that this task may be related to something that is personally important to you
	• Remember that this task may bring you one step closer to a bigger goal or aspiration you have for yourself
	• Make the task more interesting by:
	  ○ Making it into a game
	  ○ Bundling it with something else you enjoy doing, like good music or watching TV
	  ○ Focusing on what is most fun about the task

Practice: Shift Your Situational Interest Beliefs to Increase Your Motivation

What is something that you need to do, but you don't want to because it is boring?

What are some ways you could *increase* your interest in the task (to make it less boring)?

Study 1 Measures

Academic Self-Efficacy adapted from PALS (Midgley et al., 2000)	
1	I'm certain I can master the content in the courses I am taking this semester.
2	I can master the content in even the most challenging course if I try.
3	I can do a good job on almost all my coursework if I do not give up.
4	I'm confident that I can learn the content taught in my courses.
5	I'm certain I can earn a good grade in my courses.

Self-Efficacy for Self-Regulated Learning adapted from Zimmerman et al., 1992	
1	I can finish homework assignments by deadlines.
2	I can study when there are other interesting things to do.
3	I can concentrate when I am in class.
4	I can plan my schoolwork.
5	I can organize my schoolwork.
6	I can remember information presented in class and from readings.
7	I can arrange a place to study without distractions.
8	I can motivate myself to do schoolwork.

Achievement Goals adapted from PALS (Midgley et al., 2000)	
Mastery-Approach Goals	
1	It's important to me that I learn a lot of new concepts in my courses.
2	One of my goals in my courses is to learn as much as I can.
3	One of my goals in my courses is to master a lot of new skills.
4	It's important to me that I thoroughly understand my coursework.
5	It's important to me that I improve my skills this semester.
Performance-Approach Goals	
1	It's important to me that other students think I am good at academics.
2	One of my goals is to show others that I'm good at academics.
3	One of my goals is to show others that the coursework is easy for me.
4	One of my goals is to look smart in comparison to the other students.
5	It's important to me that I look smart compared to others.
Performance-Avoidance Goals	
1	It's important to me that I don't look stupid in my courses.
2	One of my goals is to keep others from thinking I'm not smart.
3	It's important to me that my professors don't think that I know less than others.
4	One of my goals in class is to avoid looking like I have trouble doing the work.

Theories of Intelligence (Dweck, 2000)	
Fixed Mindset	
1	You have a certain amount of intelligence, and you can't really do much to change it.

2	Your intelligence is something about you that you can't change very much.
3	You can learn new things, but you can't really change your basic intelligence.
4	To be honest, you can't really change how intelligent you are.
Growth Mindset	
1	You can always substantially change how intelligent you are.
2	No matter who you are, you can significantly change your intelligence level.
3	No matter how much intelligence you have, you can always change it quite a bit.
4	You can change even your basic intelligence level considerably.

Task Value/Personal Interest Adapted from MSLQ (Pintrich et al., 1991)	
1	I think I will be able to use what I learn in my courses now in my future courses.
2	It is important for me to learn the material in my courses.
3	I am very interested in the content areas of my courses.
4	I think the course material is useful for me to learn.
5	I like the subject matter of my courses.
6	Understanding the material in my courses is very important to me.

Motivational Regulation Strategy Use adapted from Wolters & Rosenthal, 2000	
Regulation of Value	
1	I think up situations where it would be helpful for me to know the material or skills.
2	I try to make the material seem more useful by relating it to what I want to do in my life.
3	I make an effort to relate what we're learning to my personal interests.
4	I try to connect the material with something I like doing or find interesting.
5	I tell myself that it is important to learn the material because I will need it later in life.
6	I try to make myself see how knowing the material is personally relevant.
Regulation of Performance Goals	
1	I remind myself about how important it is to get good grades.
2	I think about how my grade will be affected if I don't do my reading or studying.
3	I remind myself how important it is to do well on the tests and assignments in school.
4	I convince myself to keep working by thinking about getting good grades.
5	I tell myself that I need to keep studying to do well in school.
Self-Consequating	
1	I promise myself some kind of a reward if I get my readings or studying done.
2	I make a deal with myself that if I get a certain amount of the work done I can do something fun afterwards.
3	I tell myself I can do something I like later if right now I do the work I have do get done.

4	I set a goal for how much I need to study and promise myself a reward if I reach that goal.
5	I promise myself I can do something I want later if I finish the assigned work now.
Environmental Structuring	
1	I try to get rid of any distractions that are around me.
2	I make sure I have as few distractions as possible.
3	I change my surroundings so that it is easy to concentrate on the work.
4	I try to study at a time when I can be more focused.
Regulation of Situational Interest	
1	I make studying more enjoyable by turning it into a game.
2	I try to make a game out of learning the material or completing the assignment.
3	I make doing the work enjoyable by focusing on something about it that is fun.
4	I try to get myself to see how doing the work can be fun.
5	I think of a way to make the work seem enjoyable to complete.
Regulation of Mastery Goals	
1	I persuade myself to keep at it just to see how much I can learn.
2	I tell myself that I should keep working just to learn as much as I can.
3	I challenge myself to complete the work and learn as much as possible.
4	I convince myself to work hard just for the sake of learning.
5	I tell myself that I should study just to learn as much as I can.

Implicit Theories of Willpower (Job et al., 2010)	
Strenuous Mental Activity	
1	When you have been working on a strenuous mental task, you feel energized and you are able to immediately start with another demanding activity.
2	Your mental stamina fuels itself. Even after strenuous mental exertion, you can continue doing more of it.
3	After a strenuous mental activity, you feel energized for further challenging activities.
Resisting Temptations	
1	If you have just resisted a strong temptation, you feel strengthened and you can withstand any new temptations.
2	Resisting temptations activates your willpower and you become even better able to face new upcoming temptations.
3	Your capacity to resist temptations is not limited. Even after you have resisted a strong temptation you can control yourself right afterwards.

Teacher Efficacy (Lauermann & Karabenick, 2013) *I am confident that I will be able to…*	
Efficacy for Student Motivation	
1	Get any of my students interested in the subject I teach.
2	Get any of my students to value learning the subject I teach.
3	Get any of my students to like the subject I teach.

Efficacy for Teaching	
1	Teach any of my lessons so that it reflects my highest ability as a teacher.
2	Teach any of my lessons so that it is effective for student learning.
3	Teach any of my lessons so that it is engaging for students.

Teacher Responsibility for Student Motivation (Lauermann & Karabenick, 2013) *I would be personally responsible if…*	
1	A student of mine was not interested in the subject I teach.
2	A student of mine did not value learning the subject I teach.
3	A student of mine disliked the subject I teach.

Teaching Career Intentions Adapted from Woodcock et al., 2012
To what extent do you intend to pursue a career in teaching? 1 = definitely will not, *2, 3, 4, 5, 6, 7, 8, 9, 10=definitely will*

Sample Email and Text Messages for Interview Participant Recruitment

Email message

Subject line: Help improve TE 150 at MSU by participating in a paid interview

Hi <<First Name>>,
I hope you had a great summer! My name is Alexandra and I am a Ph.D. student researcher working on a project to improve the TE 150 course at MSU. Last semester, you completed two surveys about your experiences in TE 150 taught by <<course instructor>>. Thank you for providing this feedback! In order to understand students' experiences in TE 150, so we can make improvements for future students, we are following up with students to provide additional feedback via an interview.

I am writing to invite you to take part in a brief paid interview with me, which will last between 30 to 60 minutes. You will receive a $50 Amazon gift card for participating in the interview.

The interview will be conducted online using Zoom and will be recorded. All of your responses will be confidential. Only the researchers will see the recordings, identifying information like your name will be removed, and the recordings will be stored on a secure server.

If you are interested in participating, you may click on this link [online scheduling form link] to select a time for your interview.

Once you submit your response, you will receive a confirmation email and calendar invite with your selected time and date.

I would be happy to provide more information about the interview if you have any questions. Please email me at leeale13@msu.edu if you would like additional information or can't find a time that works for you.

Hope to talk with you soon!

Thanks!
Alexandra

Text message

Hi XXXX! I wanted to follow up on my emails to see if you would be available to participate in a 30-60 minute paid interview ($50 Amazon gift card) to provide feedback on how the TE 150 course can be improved. You can schedule an interview time here (online scheduling form link). Thank you! [prayer hands] - Alexandra

Study 1b Interview Protocol

Interview Protocol

Addresses:

RQ 4a: How do students that were taught about motivation theories (control and intervention condition) describe their motivational beliefs and regulation strategy use and what factors do they identify as important to shaping their beliefs and strategies?

RQ 4b: What aspects of the motivation unit do pre-service teachers' perceive as being most effective in shifting their understanding of motivation and use of motivational regulation strategies?

Facilitation notes:

- For online students, have screenshots of the different module activities available to reference
- For face-to-face students, have pdf version of the exit tickets available to reference if they were in the experimental condition
- For each student, have their final journal reflection available to reference

Intro:

- Introduce yourself and thank student for taking the time to participate in the interview
- Request permission to record
    - StudyID_IntVideo_YYYYMMDD
    - StudyID_IntAudio_YYYYMMDD
- Explain purpose of the interview: The goal of this interview is to get a better understanding of what students learned about motivation during the TE 150 course and how the course can be improved. We know you have completed several surveys about the course, but interviews provide more detailed information about students' experiences.
- In order to improve TE 150, we need to know about what is helpful and what is not helpful, so please be honest with me so we know where to put our energy as we refine the motivation unit for the course.

MAKE SURE YOU'RE RECORDING!

1. Before we launch into the main part of the interview, I'd like to hear a bit more about you.

   What is your major at MSU? What year are you in school? What do you plan on doing after you graduate?
    a. If the student is not a TE major, why did you take the TE 150 course?

2. As part of this interview we will be discussing motivation, since this was a topic covered in the TE 150 course. So, I was curious to hear how what you think it means for people to "motivate themselves".
    a. What might be different (or the same) when thinking about motivating yourself versus motivating others?

3. The next set of questions are more specifically about the final unit covered in the TE 150 course – motivation theories. As part of this unit, the course covered the major motivation theories including self-efficacy, expectancy-value theory, mindsets, achievement goals, and self-determination theory.

   To get us started, I am curious to hear about what you remember learning about motivation as part of the TE 150 course? What stuck with you or did you think about outside of the class?
   a. What beliefs (e.g., types of goals, perceptions of why a task is important, etc.) result in someone being highly motivated?
   b. Alternatively, can you think of beliefs that would result in someone not being motivated?
   c. Based on what you learned last semester in TE 150 about motivation, did you try to do anything new or different to motivate yourself?
      i. If so, how did it go?
      ii. If not, why not?

4. Can you tell me about a time recently where you needed to motivate yourself to do something you didn't want to do?
   a. What was the task? How did you get yourself to do it?

5. What do you find to be the biggest challenges in motivating yourself? How do you overcome these challenges?
   a. Probe the student to provide concrete examples.

6. Was there anything you learned in TE 150 about motivation that changed how you motivate yourself (especially for things that you don't want to do)?
   a. If so, what is a specific example of how you've applied a new strategy to motivate yourself?
   b. If not, why do you think the course, and the motivation unit in particular, did not shift what you do to motivate yourself?

7. Was there anything you learned about motivation that changed how you think about motivating others, such as your future students or friends?
   a. If so, what is a specific example of how you've applied a new strategy to motivate someone else?
   b. If not, why do you think the course, and the motivation unit in particular, did not shift what you do to motivate others?

8. As part of the motivation unit, we designed different activities with the goal of helping students apply what they were learning about motivation theories to different real-world situations. We would like to get your feedback on a couple of these activities to see how they can be improved.

a. For online students in the intervention condition, review the XXX activity.
b. For online students in the control condition, review the XXX activity.
c. For FTF students in the intervention condition, review the exit tickets.
d. For FTF students in the control condition, review the D2L readings and have them also think about what they saw in the lecture slides.
   - In what ways did this activity help you learn about motivation?

   - Did this activity prompt you to apply what you were learning about motivation to your life? Why or why not?

   - What ideas do you have for how this activity could be improved to support undergraduate students', like yourself, learning about motivation?

e. For all students, review the final journal reflection prompts. [share screen]
   - In what ways did this activity help you learn about motivation?

   - Did this activity prompt you to apply what you were learning about motivation to your life? Why or why not?

   - What ideas do you have for how this activity could be improved to support undergraduate students' learning about motivation?

f. Brainstorming alternative activities:
   - What ideas do you have for activities that would help students apply what they are learning about motivation to their own lives?

   - Are there any examples that come to mind from another course you've taken that could be helpful for TE 150 instructors to consider?

8. (dosage) We know that this unit came at the end of the semester and that you have a lot of competing demands, given that, we were curious how deeply you were able to engage in the motivation unit? Did you regularly attend class/complete the online modules? How engaged were you during class activities/discussions or online activities?
9. Journal reflection questions
- Review students journal reflection ahead of the interview and see if there are any specific excerpts that would be helpful to have the student react to as part of the interview.
    - E.g., If a student wrote about a specific motivational regulation strategy, refer to the excerpt and ask them is they did use this strategy and what their experience was.

10. Overall…
- What did you like about TE 150?
- What could be improved in the course for future students?

Thank the participant for their time and feedback.

Wrap-up:

- Provide a link to the payment form for the interview via the chat for the participant and let them know they will receive payment via an Amazon gift card within one week.
    - Share link to payment form

Sample motivation plan from Study 2

NAME:

MOTIVATION PLAN

MY BIG HAIRY AUDACIOUS GOAL (BHAG):

Achieving my goal will...

➔

➔

➔

MASTERY GOALS

Mastery goals benefits:

MASTERY GOALS ARE...

Note. These definitions will be used next semester to help TE 150 instructors explain the theory more clearly to students.

REFLECTION: What is something you have strong mastery goals for? Why?

MASTERY GOALS BOOSTERS

MASTERY GOALS BOOSTERS
Challenge yourself to focus on what you are learning as you complete your school work or do a new task.
Remind yourself that learning requires hard work, but that by putting in the effort, you can learn and improve.
Focus on how much you have learned and improved over time... *What do know now that you didn't a year ago? What is something you can do today that you never thought would be possible?*
Remind yourself that you can do hard things and that effort leads to learning and improvement.
Don't worry about what others are doing -- focus on yourself and your own improvement over time. Remind yourself that everyone is on their own unique learning journey.

TO ACHIEVE MY BHAG, I NEED MASTERY GOALS FOR:

ACTION PLAN: TO BOOST MY MASTERY GOALS I WILL...

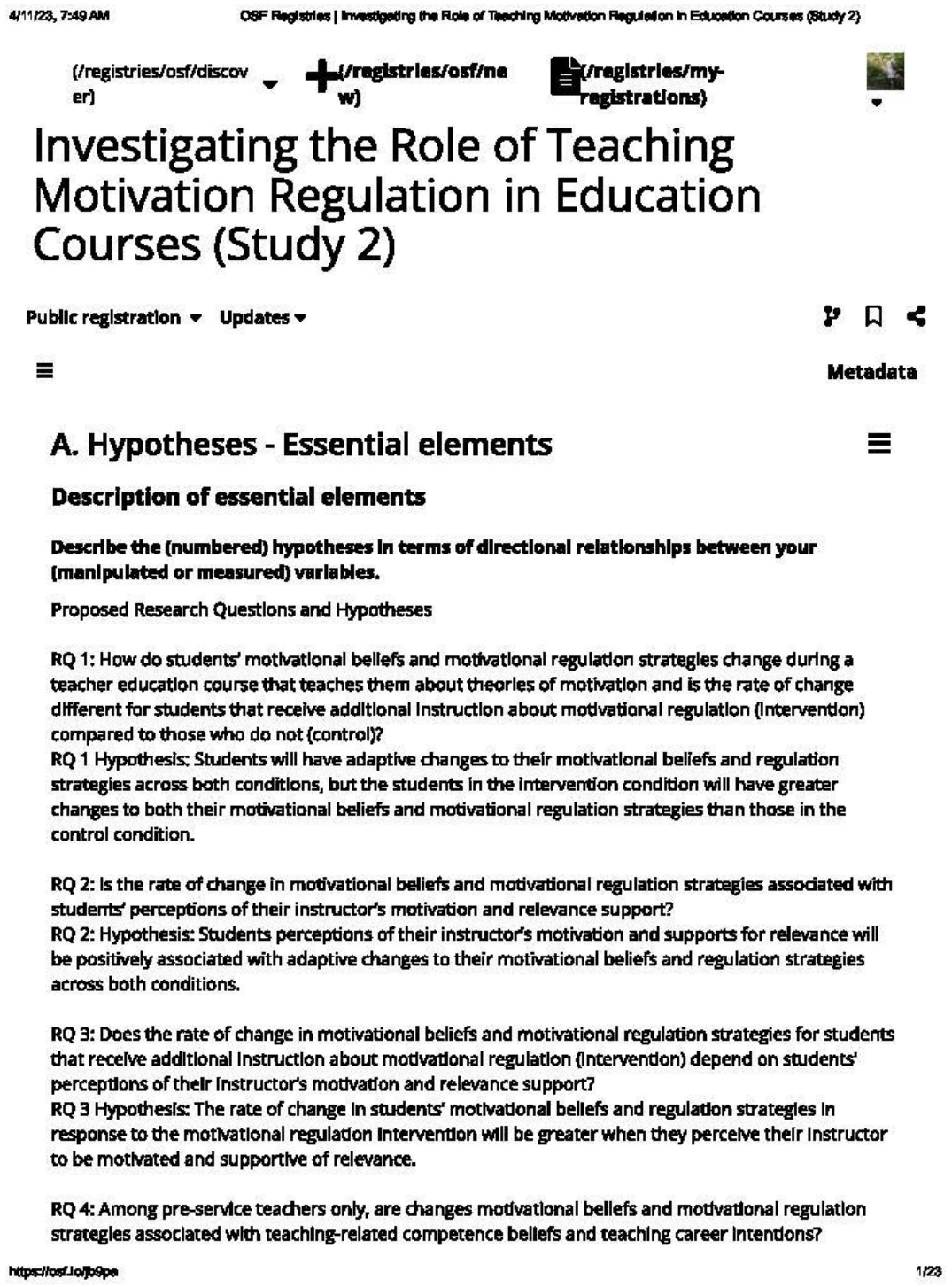
➔

➔

➔

ACCOUNTABILITY (summary of base group members' plans):

Sample of pre-registration



4/11/23, 7:49 AM OSF Registries | Investigating the Role of Teaching Motivation Regulation in Education Courses (Study 2)

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Investigating the Role of Teaching Motivation Regulation in Education Courses (Study 2)

Public registration Updates

Metadata

A. Hypotheses - Essential elements

Description of essential elements

Describe the (numbered) hypotheses in terms of directional relationships between your (manipulated or measured) variables.

Proposed Research Questions and Hypotheses

RQ 1: How do students' motivational beliefs and motivational regulation strategies change during a teacher education course that teaches them about theories of motivation and is the rate of change different for students that receive additional instruction about motivational regulation (intervention) compared to those who do not (control)?
RQ 1 Hypothesis: Students will have adaptive changes to their motivational beliefs and regulation strategies across both conditions, but the students in the intervention condition will have greater changes to both their motivational beliefs and motivational regulation strategies than those in the control condition.

RQ 2: Is the rate of change in motivational beliefs and motivational regulation strategies associated with students' perceptions of their instructor's motivation and relevance support?
RQ 2: Hypothesis: Students perceptions of their instructor's motivation and supports for relevance will be positively associated with adaptive changes to their motivational beliefs and regulation strategies across both conditions.

RQ 3: Does the rate of change in motivational beliefs and motivational regulation strategies for students that receive additional instruction about motivational regulation (intervention) depend on students' perceptions of their instructor's motivation and relevance support?
RQ 3 Hypothesis: The rate of change in students' motivational beliefs and regulation strategies in response to the motivational regulation intervention will be greater when they perceive their instructor to be motivated and supportive of relevance.

RQ 4: Among pre-service teachers only, are changes motivational beliefs and motivational regulation strategies associated with teaching-related competence beliefs and teaching career intentions?

https://osf.io/jb9pe 1/23

Note. The analytical plan shifted from what was outlined in the pre-registration to include multigroup analysis.

Additional Measures for Study 2

Student-Perceived Instructional Practices (Parrisius et al., 2020) *Our [course] instructor…*	
Perceived Teacher Enthusiasm	
… teaches with enthusiasm.	1
… really seems to take pleasure in teaching.	2
… gets us really excited sometimes.	3
Perceived use of everyday life examples	
… uses examples from daily life to show us why [course] can be useful.	1
… often uses examples from everyday life to explain concepts in [course] to us.	2
… usually has us start with our own experiences and examples from everyday life when we work on something new.	3