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I Believe I Can Connect:
Exploring Teachers' Relational Self-Efficacy and Teacher-Student Relationships

A Dissertation

presented by

Carly Dolan Robinson

to

The Committee on Higher Degrees in Education

in partial fulfillment of the

requirements for the degree of

Doctor of Philosophy in

the subject of

Education

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University

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Massachusetts

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I Believe I Can Connect:
Exploring Teachers' Relational Self-Efficacy and Teacher-Student Relationships

Abstract

Unequivocally, students with more positive teacher-student relationships attain countless more desirable outcomes than students with less positive relationships. But cultivating positive relationships is not easy. We all have worried we will not be able to connect with new people or get a relationship back on track after a conflict. Teacher-student relationships, in particular, pose unique challenges: teachers and students are assigned to each other more or less at random each year, their power differential is exacerbated by an age gap, and teachers have to evaluate students. Despite these challenges, teachers rarely receive training or support on how to cultivate positive teacher-student relationships. Thus, it is completely reasonable that teachers may lack confidence in their ability to develop and maintain these consequential relationships with students.

Research on self-efficacy shows that people's beliefs about their ability in a domain impact their performance in that domain, yet we know little about teachers' confidence in their relationship-building skills with students. In this dissertation I introduce the concept of teachers' relational self-efficacy, which I define as teachers' beliefs about their capability to successfully form, maintain, and repair relationships with students. My theory-driven research addresses the policy- and practitioner-relevant question of how we can improve teacher-student relationships in the classroom. In Paper 1, through a longitudinal study, I provide evidence that we can measure teachers' relational self-efficacy and that it predicts subsequent teacher and student

perceptions of the teacher-student relationship. In Paper 2, I conduct a randomized field experiment showing that an intervention can increase teachers' relational self-efficacy and their downstream teacher-student relationships. As a follow-up to the field experiment, Paper 3 is an online survey experiment that examines the logic of certain study design choices. These studies demonstrate how changing beliefs may be a lever for improving relationships.

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Introduction

Ask almost anyone about their most impactful educational experience and you will not be regaled with tales of effective curricula or gains on state tests. A few will note the subject matter they fell in love with. But mostly you will hear stories about teachers who cared, teachers who inspired, and teachers who expected more. These anecdotal stories are overwhelmingly borne out by research: students with more positive teacher-student relationships (TSRs) attain a myriad of more desirable student outcomes than their counterparts with less positive relationships (Pianta, 1999; Roorda, Koomen, Spilt, & Oort, 2011).

But, like all worthwhile pursuits, cultivating positive relationships is not easy. Whether it be at the office or with a romantic partner, we all have worried we will not be able to connect with new people or get a relationship back on track after a conflict. For teachers, these uncertainties may be even more well-founded given the unique challenges they face when trying to build positive relationships with students. Each year, we ask teachers to cultivate relationships with dozens, if not hundreds, of new students from varied backgrounds assigned to their classroom. The intergenerational nature of these relationships makes finding common ground difficult, while also exacerbating the inherent power differential between teachers—who are often feeling the pressure to raise student test scores—and the students they are evaluating.

Yet, educational reforms and policy initiatives rarely invest resources into one of the hardest and most important aspects of teaching – building relationships with students (Hargreaves, 1998). Pre-service teachers receive little training on how to cultivate positive relationships in the classroom (Brophy, 1988) and school administrators tend to focus their support on instructional- and accountability-related efforts (Valli & Buese, 2007). Without formal training or on-going support, it is completely reasonable that teachers may lack

confidence in their ability to build positive relationships with students (Brekelmans, Wubbels, & Van Tartwijk, 2005).

Decades of research on self-efficacy shows that people's beliefs about their ability to succeed in a particular domain impact their performance in that domain (Bandura, 1997), but we do not know much about teachers' confidence in their relationship-building skills with students and how it affects educational outcomes. In this dissertation, I introduce the concept of teachers' *relational self-efficacy*, which I define as teachers' beliefs about their capability to successfully form, maintain, and when necessary, repair relationships with students. Because TSRs decline sharply after elementary school (O'Connor & McCartney, 2007; Wentzel, 1998), I focus on relationships between middle and high school students and their teachers.

My research addresses the policy- and practitioner-relevant question of how we can improve TSRs in the classroom. The first paper, "How Teachers' Relational Self-Efficacy Predicts the Quality of Their Teacher-Student Relationships," surveyed 70 middle and high school teachers and 848 of their students at two time points during the school year. This longitudinal study introduces the concept of teachers' relational self-efficacy and explores the consequences of teachers' beliefs about their relationship-building ability. Specifically, I assessed middle and high school teachers' self-reported relational self-efficacy at the beginning of the semester and explored how it predicts teachers' prioritizing of the role of building TSRs and their perceptions of their TSRs at the end of the semester. This paper provides evidence that we can measure teachers' relational self-efficacy and that it predicts downstream teacher and student perceptions of the TSR.

Armed with Paper 1's longitudinal findings showing that teachers' relational self-efficacy may be a critical antecedent to improving TSRs, I developed and tested an intervention that was

designed to increase teachers' relational self-efficacy. The second paper, "A Field Experiment Exploring the Impact of Bolstering Teachers' Relational Self-Efficacy," presents the first randomized field experiment to explore whether teachers' relational self-efficacy beliefs and perceptions of their TSRs can be increased through an intervention ($n_{teachers} = 52$; $n_{students} = 589$). In this paper, I describe the intervention components—which were specifically designed to target the four sources of self-efficacy (Bandura, 1997)—and measure the downstream impact on teachers' relational self-efficacy, as well as teacher and student perceptions of their TSRs. Contrary to my expectations, teachers who completed the relational self-efficacy treatment did not have higher relational self-efficacy than teachers who completed the control activity immediately after the intervention took place. However, at the end of the semester these treatment teachers did have higher relational self-efficacy than control teachers: teachers assigned to the treatment activity reported relational self-efficacy beliefs that were two-thirds of a standard deviation higher at the end of the semester. They also reported more positive relationships with their students at the end of the semester, although their students did not report a similar improvement in their perceptions of their TSRs.

Finally, the third paper serves as a follow-up to this randomized field experiment. "Moving from the Field to the (Online) Lab: A Follow-up Survey Experiment Investigating Teachers' Relational Self-Efficacy" describes an online survey to discern whether the control activity used in the field experiment unintentionally resulted in a temporary boost of teachers' confidence in their relationship-building abilities with students, thus suppressing the treatment effect immediately after the intervention. In addition to examining the consequences of certain study design choices, this paper also serves as an example of how educational researchers can use more accessible platforms to conduct follow-up studies that complement studies in the field.

Specifically, future scholars might consider using online surveys or non-traditional participants to test out competing theories and explore mechanisms that studies conducted on the ground cannot disentangle post-hoc.

Taken together, these three papers make theoretical and practical contributions to the fields of education and psychology. From a theoretical standpoint, self-efficacy is a well-established predictor of ability and outcomes in most domains (Bandura, 1997), including teaching (Caprara, Barbaranelli, Steca, & Malone, 2006). But, when it comes to social settings, people's perceptions of their social skills do not always predict their social abilities (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999; Kruger, Epley, Parker, & Ng, 2005). This research provides evidence that relational self-efficacy functions similarly to self-efficacy in other domains—teachers with higher relational self-efficacy have more positive TSRs in their eyes as well as through the eyes of their students. People's beliefs about their abilities to engage in particular relationships do appear to predict how positive those relationships are perceived in the future.

Practically, in addition to introducing the concept of teachers' relational self-efficacy, I find that we can change teachers' beliefs via a short writing intervention. In doing so, I contribute to the small body of empirical research showing how to improve perceptions of the TSR. Much of the research on belief-focused interventions are student-directed, but I show that shifting teacher beliefs may be a promising lever for changing classroom dynamics. Broadly, this work informs how we might think about improving relationships in the classroom and beyond.

Paper 1: How Teachers' Relational Self-Efficacy Predicts the Quality of Their Teacher-Student Relationships

Teacher-student relationships (TSRs) prove time and again to be a key factor affecting educational outcomes. Students with more positive TSRs attain a myriad of more desirable student outcomes than their counterparts with less positive relationships (Baker, Grant, & Morlock, 2008; Birch & Ladd, 1998; Brinkworth, McIntyre, Juraschek, & Gehlbach, 2018; Brophy & Good, 1974; Pianta, Hamre, & Stuhlman, 2003; Robinson, Scott, & Gottfried, 2019; Roorda et al., 2011; Sabol & Pianta, 2012; Wentzel, 1998, 2009). Although building positive TSRs can be time consuming and difficult (Hamre & Pianta, 2006; Sabol & Pianta, 2012), traditional approaches to training teachers leave these valuable learning relationships to chance and provide little training on how to cultivate positive relationships in the classroom (Bridgeland, Bruce, & Hariharan, 2013; Brophy, 1988). Moreover, school administrators tend to focus their on-the-job support on instructional- and accountability-related efforts (Valli & Buese, 2007). Without formal training or on-going support for building positive relationships with students, teachers may lack confidence in their ability to build positive relationships with students (Brekelmans et al., 2005).

Decades of research on self-efficacy shows that people's beliefs about their ability to succeed in a particular domain positively impact their perceptions and performance in that domain (Bandura, 1997). Indeed, many studies demonstrate that teachers' self-efficacy beliefs associate with their attitudes and behaviors (Brouwers & Tomic, 1999; Evans & Tribble, 1986; Skaalvik & Skaalvik, 2010; Tschannen-Moran & Hoy, 2001). Prior research on teachers' self-efficacy does not consider how teachers' confidence in their relationship-building skills with students might impact their subsequent classroom relationships. Given that teacher self-efficacy is conceptualized as a domain-specific and malleable belief about what teachers perceive they

can accomplish in a given context, general measures of teacher self-efficacy will not wholly capture teachers' confidence in their relationship-building abilities (Zee & Koomen, 2016).

The present study introduces the concept of teachers' *relational self-efficacy*, defined as teachers' beliefs about their capability to successfully form, maintain, and (when necessary) repair relationships with students. If relational self-efficacy functions as self-efficacy tends to in other domains, we would expect that the stronger teachers' relational self-efficacy, the more likely they will seek out, engage with, and exert effort in relationship-building activities with students. Logically, engaging in more relationship-building behaviors may improve how teachers and their students perceive the quality of their TSRs. In this paper, I explore the extent to which middle and high school teachers' relational self-efficacy at the beginning of the semester predicts end-of-semester outcomes, including teacher and student perceptions of the TSR.

The Opportunities & Challenges of Building TSRs

Research clearly shows that TSRs represent one of the most critical pathways to student success (e.g., Martin & Collie, 2019; Pianta et al., 2003; Roorda et al., 2011), and may be especially important for adolescents (Murray, 2002; Pianta & Allen, 2008; Roorda et al., 2011). But middle and high school teachers face unique challenges when trying to build positive relationships with students. Each year, we ask teachers to cultivate relationships with dozens, if not hundreds, of new and diverse students assigned to their classrooms. What's more, TSRs differ from many other relationships we encounter in our lives. These relationships are intergenerational, which can make finding common ground difficult for both teachers and students. Mirroring the generational divide, as well as how we conceptualize teaching and learning in schools, teachers also hold more power than students. Exacerbating the power differential, we expect teachers to evaluate students—something that rarely sets a relationship off

on the right foot. At the same time, teachers are often feeling pressure to raise student test scores from their administration, and even receive signals that investing in building TSRs might not be a worthwhile pursuit (Valli & Buese, 2007).

Considering these are just a few of the obstacles secondary teachers might confront when trying to connect with their students, it is of little surprise that TSRs decline sharply after elementary school—as teachers tend to have more students, teachers and students spend less time together, and there is (often) more testing pressure (O'Connor & McCartney, 2007; Wentzel, 1998). Yet, educational reforms, policy initiatives, and teacher trainings rarely invest resources into this complex and fundamental aspect of teaching (Brekelmans et al., 2005; Bridgeland et al., 2013; Hargreaves, 1998). Whether intended or (more likely) unintended, these norms signal that developing strong TSRs is a form of "extra credit" that teachers can pursue if they so choose. To realize the full potential of these social bonds, we must consider how teachers cultivate positive relationships with *all* of their students. .

But what constitutes a "positive" TSR? The academic literature conceptualizes TSRs in a wide variety of ways. Depending on the study, TSRs might be operationalized as care (Wentzel, 1997), support (Goodenow, 1993), high expectations (Wentzel, 2002), and so on. Like Brinkworth and colleagues (2018), I take a holistic approach to operationalizing TSRs. Assessing the relationship *overall*, as opposed to only considering a discrete relational subcomponent, acknowledges that positive relationships will not look the same across different teachers and students. This approach relates to Dutton and Heaphy's (2003) conceptualization of high quality relationships, as they both aim to measure multiple subcomponents to capture a more complete set of dimensions around which relationships can vary. For example, one teacher may not be perceived as especially caring by her students, but she runs an engaging class where students

enjoy learning and builds positive relationships with her students in that way. On the other hand, another teacher may take an interest in his students' lives outside the classroom, which makes up for his authoritarian teaching style when it comes to building positive relationships. Using a holistic conceptualization of TSRs allows researchers to assess all-around improvements in relationship quality.

While teachers and students construct their relationships together, most research on TSRs focuses on either the teacher or the student perspective. At the secondary-level, research tends to emphasize the student experience (e.g., Wentzel, 1997; Wentzel, 1998). That is, researchers most often explore how students perceive the TSR and how those perceptions correlate with various student outcomes. This tendency to only measure either the student or teacher perception of the relationship overlooks key information. At the dyad level, the correlations between teacher and student perceptions of the TSR are consistently moderate to low (Brinkworth et al., 2018; Gehlbach, Brinkworth, & Harris, 2011; Hughes, 2011; Robinson et al., 2019; Th Wubbels, Brekelmans, & Hermans, 1987), implying that individual perceptions about the quality of the same relationship actually differ quite a bit. Thus, incorporating both teachers' and students' perceptions into the measurement of the TSR will sharpen our understanding of how each party's views are associated with student outcomes. Like mentoring relationships, *both* students and teachers can reap benefits from experiencing high quality relationships in the classroom (Ragins & Verbos, 2007).[1] Hence, the TSR encompasses both the teacher and the student perceptions about their shared social relationship (Clark & Lemay Jr, 2010).

[1] Although, like classroom-based relationships, mentoring research typically only looks at relationships from the mentee's viewpoint.

That said, the inherent asymmetry in student and teacher relationships puts the onus of building a positive relationship on the teacher. The rationale for putting the relational burden on the teacher is especially obvious in the early grades, but the power differential holds in almost all teacher-student interactions (Hurt, Scott, & McCroskey, 1978). Teachers decide whether to invest in, not invest in, or disengage from a relationship with a student and, very often, teachers will invest in students whom they expect to succeed (Muller, 2001). Reinforcing this idea, recent research found that teachers' perceptions of the TSR more strongly associated with student achievement than the students' perceptions (Brinkworth et al., 2018; Robinson et al., 2019). Therefore, teachers' beliefs about their relationships with students might influence how and with whom they cultivate positive TSRs.

Relational Self-Efficacy and TSRs

Self-efficacy beliefs have long been linked to motivation and, subsequently, behavior (Bandura, 1977; Zimmerman, 2000). According to social cognitive theory, people's self-efficacy – that is, their beliefs about their capability to perform a given behavior – affects the way they actually perform that behavior (Bandura, 1977, 1997). The theory posits that the strength of people's convictions in their own abilities or effectiveness affect their choices to engage in certain activities, the amount of effort they will devote to them, and how long they will persist in the face of obstacles, thus directly impacting individual performance (Bandura, 1977; Lent, 2016; Zimmerman, 2013). Notably, self-efficacy beliefs are specific to particular activity domains and situations, and are vital forces in the subsequent successes or failures in endeavors within those domains or situations (Ajzen, 2002; Bandura, 1997; Klassen & Usher, 2010; Pajares, 2006).

Self-Efficacy in the Social Domain

When it comes to the domain of interpersonal relationships, I define "relational self-efficacy" as an individual's confidence in his or her ability to successfully engage positively in a particular interpersonal relationship. Engaging in a particular interpersonal relationship involves forming, maintaining/managing, and (when necessary) repairing that relationship. Like self-efficacy in general, relational self-efficacy occurs at different levels of specificity. Relational self-efficacy can be applied to a specific relationship (i.e., one's perceived ability to engage in positive relationship behaviors with a specific person, like one's current spouse); it can also apply to more general conceptions of particular kinds of interpersonal relationships (e.g., one's perceived ability to engage in positive relationship behaviors with a specific group of people, like co-workers). Individuals have beliefs about their capabilities to develop and maintain positive relationships with people, and those beliefs vary depending on situations and contextual features (Bandura, 1997). Thus, people may feel quite efficacious in some interpersonal contexts (e.g., with their spouse) but less so in others (e.g., with their co-workers) (Lent & Lopez, 2002).

Prior research outside of education has addressed self-efficacy within a social context, or "social self-efficacy" (Anderson & Betz, 2001). Social self-efficacy overlaps with the conception of relational self-efficacy in its focus on the social *domain* of self-efficacy. But, social self-efficacy is defined more broadly as "an individual's confidence in his or her ability to engage in the social interactional tasks necessary to initiate and maintain interpersonal relationships" (Smith & Betz, 2000), whereas relational self-efficacy focuses on specific kinds of relationships within one's life—in this case, teachers' relationships with their students.

To elucidate the distinction between social self-efficacy and relational self-efficacy, I use the example of the teacher-student dyad and sample items used to assess each construct. A

teacher's social self-efficacy does not focus on the TSR, but instead refers to an individual's general beliefs about their social abilities (e.g., "How confident are you putting yourself in a new and different social situation?"). Relational self-efficacy, on the other hand, more precisely focuses on individual beliefs about the TSR. That is, a teacher's relational self-efficacy with their students directly concerns the teacher's beliefs about their ability to engage in positive relationship-building behaviors with their students (e.g., "How confident are you that you can build positive relationships with all your students?").

Social self-efficacy tends to be most valuable when considering how one's social skills relate to overall functioning (e.g., Anderson & Betz, 2001). Relational self-efficacy matters when we want to know about an individual's beliefs about their capacity to form and maintain relationships and may be particularly relevant when considering how beliefs associate with relationship quality. Thus, when considering how self-efficacy beliefs would correlate with the quality of the TSR, it is logical to focus on relational self-efficacy.

Teachers' Relational Self-Efficacy

Despite how well-studied self-efficacy and TSRs are in education, no one has studied teachers' relational self-efficacy with students, or their confidence in their capacities to build positive TSRs. Scholars have studied teacher self-efficacy more broadly, referring to teachers' beliefs in their ability to influence student learning outcomes (Miller, Ramirez, & Murdock, 2017; Tschannen-Moran & Hoy, 2001; Wheatley, 2005). Past correlational studies found that teachers' self-efficacy beliefs about their teaching ability associate with many meaningful educational outcomes, including student achievement (J. A. Ross, 1992) and teacher attitudes and behaviors (Brouwers & Tomic, 1999; Caprara et al., 2006; Evans & Tribble, 1986; Skaalvik & Skaalvik, 2010).

The highly contextualized nature of self-efficacy suggests that teacher self-efficacy should be measured in terms of specific beliefs that fluctuate across tasks, domains, and contexts (Zee & Koomen, 2016). Consequently, measures used to assess teacher self-efficacy are multi-dimensional and comprise a number of key features of teaching (Skaalvik & Skaalvik, 2007; Tschannen-Moran & Hoy, 2001). And while these existing measures do assess teachers' beliefs about their abilities to motivate and discipline students—two aspects of teaching that certainly relate to TSRs—none directly address teachers' beliefs about their capacities to build TSRs. Self-efficacy scales that are not distinctly linked to what they seek to predict usually have poor predictive validity (Bandura, 1997). Thus, if we want to assess teachers' beliefs about their ability to build TSRs, it must be measured directly. Supporting this idea, several studies have found no, or very slight, associations between existing teachers' self-efficacy measures and the quality of their relationships with individual students (Chung, Marvin, & Churchill, 2005; De Jong et al., 2014; Yoon, 2002).

Research implies we should care about teachers' self-efficacy beliefs, but most scholarship on teacher self-efficacy all but ignores a key aspect of teaching: developing relationships with students. From a theoretical standpoint, this question of *how* teachers' relational self-efficacy associates with their ability to cultivate relationships with students and the subsequent quality of their TSRs is very much unknown. As Koomen and Zee (2016) note in their review of the past 40 years of research on teacher self-efficacy, current instruments do not wholly capture the role of teachers in maintaining relationships with students. To address this, they call for broadening the construct of teacher self-efficacy to include dyadic relationships to elucidate the link between teacher self-efficacy beliefs and classroom relationships.

If relational self-efficacy functions as it tends to in other domains, the stronger teachers' relational self-efficacy, the more likely they will seek out, engage with, and exert effort in relationship-building, maintaining, or repairing activities with students—behaviors that associate with how teachers and their students perceive their shared relationship. By directly measuring teachers' relational self-efficacy, we can investigate whether stronger relational self-efficacy beliefs translate into teachers prioritizing the role of building TSRs and more positive perceptions of the TSR.

The Present Study

This longitudinal study introduces the concept of teachers' relational self-efficacy and explores the consequences of teachers' beliefs about their relationship-building ability. Specifically, I assessed middle and high school teachers' self-reported relational self-efficacy at the beginning of the semester and explored how it predicts teachers' prioritizing of the role of building TSRs and their perceptions of their TSRs at the end of the semester.

In line with recommended practices (Gehlbach & Robinson, 2018), I preregistered my study, including the following hypotheses and corresponding analysis plan, on *Open Science Framework* (https://osf.io/sj27w/; see Appendix A):

> *Hypothesis 1*: Teachers with stronger relational self-efficacy will be more likely to prioritize the role of building TSRs.
>
> *Hypothesis 2*: Teachers with stronger relational self-efficacy at the beginning of the semester will report more positive TSRs at the end of the semester.

As an exploratory hypothesis, I predicted that *students* of teachers with stronger relational self-efficacy at the beginning of the semester would report more positive TSRs at the end of the semester.

Additionally, I evaluated whether teachers' relational self-efficacy predicted the two main outcomes (prioritizing the role of building TSRs and teachers' perceptions of their TSRs) when accounting for existing measures of teacher self-efficacy and social self-efficacy. If either existing measure does as well or better at predicting TSR-related outcomes, then collecting teachers' relational self-efficacy reports would not be necessary. I also considered whether key teacher and student characteristics might moderate the impact teachers' relational self-efficacy has on teachers' perceptions of the TSR. Specifically, I look at whether teachers' TSR perceptions are differentially associated with their relational self-efficacy based on teacher demographics (gender, number of years teaching, and the level they currently teach), student demographic variables (gender and race), and students' academic grades.

Method

Participants

The study occurred at three, diverse schools (one private middle school and high school, one charter middle school, and one public high school) and the final sample consisted of 70 teachers and 848 of their students.

Teachers. Prior to the start of the semester, administrators in each school selected a "target" class period in which teachers and their students would participate in the study. All 80 teachers who taught during the target class period were encouraged to participate by school leaders and emails from the research team, but they received no compensation. Teachers indicated their willingness to participate by completing an initial, beginning-of-semester survey. Of those who were eligible to participate, ten teachers did not complete the initial survey and therefore were excluded from the study. This left 70 teachers in the final sample. The ten

excluded teachers did not differ demographically (in terms of gender and race) from the final sample, *p*s > .05.

Based on institutional records and self-report when institutional records were unavailable, the final teacher sample was 67% female and 33% male, as well as 73% White, 9% Hispanic/Latinx, 7% Asian American/Pacific Islander, 6% Black/African American, and 5% selected multiple categories or other. The present sample of teachers is slightly less White than the U.S. national average (82%) (U.S. Department of Education, 2016). The average age of teachers was 38.3 years (*SD* = 11). The mean number of years teachers reported teaching was 10 (*SD* = 7.8) and 5.4 at their current school (*SD* = 4.9).

Students. There were 848 students in the participating teachers' target classes. All 848 students were considered eligible to participate, and their teachers responded to questions about these students. 88% of the students completed at least one survey (746; 679 students completed the initial survey and 589 students completed the final survey).[2] There were no incentives for students to participate.

The student sample was 45% female and 46% male, with 9% of students choosing not to respond or selecting "Other." Thirty percent of students identified as White, 36% as Hispanic/Latinx, 4% Asian American/Pacific Islander, 16% as Black/African American, and the remainder selected multiple categories or other. The average age of students was 14.5 years (*SD* = 2.0). Twelve percent of students were in sixth grade, 12% in seventh grade, 9% in eighth grade, 21% in ninth grade, 16% in tenth grade, 13% in eleventh grade, and 18% in twelfth grade.

[2] Students who did not complete at least one survey did not confirm demographic data provided by schools (where schools did not provide detailed information), so we cannot ascertain whether they differed demographically from participating students.

Pre-specified Measures

The following measures were used to assess the pre-specified hypotheses. Additionally, I coordinated with each school to collect institutional data (e.g., student and faculty demographics).

Teachers' relational self-efficacy. Teachers completed the eight-item teacher relational self-efficacy scale on the initial teacher survey (α = .83). The scale was developed based on Bandura's (2006) recommendations for creating self-efficacy scales and the teacher general self-efficacy scale (Skaalvik & Skaalvik, 2007). In addition to reviewing the literature, I solicited input from numerous teachers, piloted the scales extensively, and adhered to current best practices in item wording and designing survey scales (Dillman, Smyth, & Christian, 2014; Gehlbach, 2015; Gehlbach & Artino, 2018; Gehlbach & Brinkworth, 2011). The scale includes items such as "How confident are you that you can build positive relationships with all your students?" and "If a relationship with a student starts out poorly, how confident are you that you improve that relationship later in the year?" See Table 1.1 for all items. The responses for each item were on a 5-point Likert scale (e.g., ranging from "Not at all confident" to "Extremely confident").

A confirmatory factor analysis (CFA) showed that the relational self-efficacy scale fit a one-factor model, $\chi^2(20) = 26.73$, $p = .14$; RMSEA = .07, 90% CI [.00, .13]; CFI = .956. I extracted a factor score for the scale and found the correlation with the unit-weighted composite was .99. For ease of interpretation and per the study preregistration, I present the results of the unit-weighted score.

Teachers' prioritizing the role of building TSRs. On the final survey, teachers completed a five-item scale assessing how much they prioritize the role of building TSRs in their

practice (α = .70). The scale includes items such as "How much effort do you put into getting to know each of your students?" See Table 1.1 for all items. After correlating the errors for related items on the prioritizing role of building TSRs scale (items 1 & 3 and items 2 & 4)[3], a CFA showed that the data fit a one-factor model, $\chi^2(3) = 3.16$, $p = .37$; RMSEA = .027, 90% CI [.00, .21]; CFI = .997. The correlation between the factor-weighted composite and the unit-weighted composite was .94.

Table 1.1. Items in the Teachers' Relational Self-Efficacy Scale and Teachers' Prioritizing the Role of Building TSRs Scale

	Teachers' Relational Self-Efficacy Scale
1	How confident are you that you can build positive relationships with all your students?
2	How confident are you that you can support your students emotionally?
3	How much can you do to make your students enjoy coming to school?
4	How much can you do to get your students to trust you?
5	To what extent do you feel capable of designing relationship building activities for your classroom?
6	If a relationship with a student starts out poorly, how confident are you that you can improve that relationship later in the year?
7	How much can you do to cultivate a positive relationship with students who are not performing well in your class?
8	How confident are you that you can build positive relationships with students who come from different backgrounds than you?
	Teachers' Prioritizing the Role of Building TSRs Scale
1	How often do you devote prep time toward developing strategies for connecting with students?
2	How much effort do you put into getting to know each of your students?
3	How often do you consider students' interests when planning a lesson?
4	How important is it for you to learn about your students' lives outside of the classroom?
5	If you had the opportunity to train future teachers, to what extent would you emphasize the importance of building positive teacher-student relationships?

Teachers' and students' perceptions of the TSR. I borrowed, with minor adaptions, measures from Brinkworth and colleagues (2018) to measure teachers' and students' holistic

[3] Items 1 and 3 both deal with prioritizing TSRs in class preparation. Items 2 and 4 both deal with learning more about students.

perceptions of the TSR. Teachers evaluated their overall relationship with each student in their target class using an eight-item scale on the final teacher survey (e.g., "How friendly is [student] towards you?" and "How respectful is [student] towards you?"; α = .90). Students in the teachers' target classes completed a parallel, eight-item scale on the final student survey (α = .92).

Exploratory Measures

I collected exploratory measures to add nuance to the primary findings from the pre-specified hypotheses. Teachers were provided with limited time to complete each survey. Thus, there was a limit to the number of items teachers could reasonably respond to in the allotted time on the first survey. I prioritized including all the measures pertaining to my preregistered hypotheses. In the remaining space, I focused on including exploratory measures, including those assessing teachers' general self-efficacy and their social self-efficacy. I also collected student semester grades from the school's institutional records. Appendix A provide additional details on the measures collected.

Teachers' general self-efficacy. To ascertain whether teachers' relational self-efficacy differs from current measures of teachers' general self-efficacy and to minimize the burden on teachers, I adapted six items from an existing teachers' self-efficacy scale (Skaalvik & Skaalvik, 2010). Specifically, on the initial survey teachers responded to one-item from each of the six subscales assessing confidence in their ability to: deliver instruction, adapt instruction to individual needs, motivate students, maintain discipline, cooperate with colleagues and parents, and cope with change (α = .71). The items were selected based on pilot interviews with teachers (to determine which item best represented the measured subconstruct).

I also explored whether the teacher relational self-efficacy and the general measure of teacher self-efficacy function better as two latent constructs or one, overall teacher self-efficacy measure. A likelihood ratio test comparing the two models suggested that relational self-efficacy functions better is its own latent construct than embedded in a general measure of teacher self-efficacy, $LR\ \chi^2(1) = 10.31$, $p = .001$.

Social self-efficacy. To measure teachers' social self-efficacy, I included an adapted item from the perceived social self-efficacy scale: "Outside of school and being a teacher, how confident are you putting yourself in a new and different social situation?" (Smith & Betz, 2000).

Student grades. I obtained students' semester grades from each school. Grades were either reported as a four-point scale grade point average (GPA) scale (A = 4.0, A- = 3.67, B+ = 3.33, etc.) or a percentage out of 100. To put on a common scale, I standardized students' average semester grades within each school. Because teachers often assign student grades based on varying, idiosyncratic criteria (Graham, 2015), I consider student grades to be a proxy for teachers' general perceptions of students' academic performance as opposed to an actual measure of academic performance. In this study, I explore whether students' grades moderate the association between teachers' relational self-efficacy and their perceptions of their TSRs.

Procedures

The study took place over the course of one semester at each school. At the beginning of the semester, teachers completed the initial teacher survey in which they consented to participate. Within the first two weeks of the semester, teachers administered the initial student survey to students in their target class. The final teacher and student surveys took place at the end of the semester. To increase student response rates on both surveys, teachers received reminders with lists of students who had yet to complete the survey the week after the initial surveys were

administered. Students who did not complete one or both surveys were either absent and/or teachers did not provide additional time during class. Depending on the length of the semester and the timing of the survey administration, the teachers and students completed the final surveys between 8 weeks and 14 weeks after they took the initial surveys. All surveys were administered online via the Qualtrics platform. Before accessing the outcome data, I preregistered the study on *Open Science Framework*.

Analytic Plan

Preregistered analysis plan. I used 97.5% confidence intervals to account for the testing of two prespecified hypotheses. To evaluate my first hypothesis (that teachers with stronger relational self-efficacy would be more likely to prioritize the role of building TSRs), I used the following model[4]:

$$(1) \qquad TSRRole_t = \beta_0 + \beta_1 RSE_t + \boldsymbol{X}_t + \alpha_s + \varepsilon_t,$$

where $TSRRole_t$ is the teacher-level outcome, RSE_t is a measure of teachers' relational self-efficacy at time 1, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, and the grade level teachers report teaching), α_s is a school fixed effect, and ε_t is a classroom-level residual.

To evaluate the second hypothesis (that teachers with stronger relational self-efficacy at the beginning of the year will report more positive TSRs with individual students at the end of the semester), I used the following model:

$$(2) \qquad TSR_{it} = \beta_0 + \beta_1 RSE_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + u_t + \epsilon_{it},$$

[4] The model specified in the preregistration incorrectly included a classroom random effect. Because this model is assessing a classroom-level outcome, it is not possible to add a classroom-level random effect.

where all notations are the same as above, but TSR_{it} is the teacher-student dyad level outcome, $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender), u_t is a classroom random effect, and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

Exploratory analyses. In addition to evaluating the two prespecified hypotheses, I conducted several exploratory analyses to provide further insights about the concept of relational self-efficacy and TSRs. To begin with, I had an exploratory hypothesis that *students* of teachers with stronger relational self-efficacy at the beginning of the semester would report more positive TSRs at the end of the semester (which I evaluated using equation 2, above). I also re-ran the two prespecified hypotheses when accounting for a) teachers' general self-efficacy and b) their social self-efficacy. Finally, I conducted heterogeneity analyses to investigate whether teachers' perceptions of the TSR are differentially associated with their relational self-efficacy based on teacher and student demographics and student academic grades.

Results

Descriptive Statistics

Table 1.2 presents descriptive statistics and a correlation matrix for the main variables of interest. As expected, teachers' relational self-efficacy correlated most with their confidence in their ability to motivate students (r = .57) and to discipline students (r = .53) – two factors that likely affect classroom relationships. Likewise, we would expect that teachers' social self-efficacy would be more correlated with teachers' relational self-efficacy (r = .41) than other aspects of their teaching self-efficacy (rs < .21, except their self-efficacy in their ability to motivate students which had a similar correlation with social self-efficacy) because they are both

assessing confidence in a social domain. Finally, in line with prior studies, students' perceptions and teachers' perceptions of their shared relationship were only moderately correlated (r = .41).

Prespecified Hypotheses

The first two columns of Table 1.3 present the results of the association between teachers' relational self-efficacy and the prespecified outcomes. First, I examined whether teachers' relational self-efficacy at the beginning of the semester predicted the extent to which they prioritize the role of relationship-building at the end of the semester (Hypothesis 1). Teachers with higher relational self-efficacy at the beginning of the semester tended to prioritize building TSRs more, B = 0.38, SE = 0.11, 97.5% CI [0.13, 0.63], p = .001; β = 0.41. Specifically, a one-standard deviation increase in teachers' relational self-efficacy is associated with a 0.41-standard deviation increase in teachers' prioritizing the role of building TSRs.

Next, I looked at how teachers' beginning-of-semester relational self-efficacy predicted how they perceive the quality of the relationships with their students at the end of the semester (Hypothesis 2). As displayed in Figure 1.1 (Panel A), teachers with higher relational self-efficacy perceived more positive TSRs a few months later, B = 0.36, SE = 0.07, 97.5% CI [0.20, 0.53], p < .001; β = 0.26. A one-standard deviation increase in teachers' relational self-efficacy at the beginning of the semester is associated with a 0.26-standard deviation increase in the quality of their self-reported end-of-semester relationships with individual students.

Exploratory Analyses

In addition to evaluating the prespecified hypotheses, I conducted several exploratory analyses that can further our understanding of how teachers' relational self-efficacy associates with TSRs.

Table 1.2. Descriptive Statistics and Correlation Matrix for Main Variables

			Teacher									
			Beginning of Semester								End of Semester	
Scale	*M*	*SD*	Relational Self-Efficacy	Delivering instruction SE	Adapting to change SE	Motivating students SE	Disciplining students SE	Cooperating with others SE	Coping with change SE	Social Self-Efficacy	Prioritizing Role of Building TSRs	TSR
Teacher: Beginning-of-Semester												
Relational Self-Efficacy	4.04	*0.49*										
Teacher General Self-Efficacy												
Delivering instruction SE	4.36	*0.61*	.32**									
Adapting to change SE	3.91	*0.7*	.29*	.28*								
Motivating students SE	3.5	*0.65*	.57***	.31**	.32**							
Disciplining students SE	3.27	*1.05*	.53***	.39***	.31**	.35**						
Cooperating with others SE	4.19	*0.62*	.21+	.20+	.31*	.20	.17					
Coping with change SE	3.8	*0.79*	.40***	.51***	.18	.34**	.42***	.22+				
Social Self-Efficacy	3.81	*1.11*	.41***	.12	.13	.41***	.21+	.01	.21+			
Teacher: End-of-Semester												
Prioritizing Role of Building TSRs	4.12	*0.46*	.44***	.22	.26*	.32**	.31**	.06	.08	.29+		
TSR	3.93	*0.68*	.28***	.02	.17***	.18***	.22***	.11**	.19***	.18***	.22***	
Student: End-of-Semester												
TSR	4.09	*0.76*	.16***	.09*	.06	.12**	.18***	-.02	.00	.03	.16***	.41***

*** p < .001, ** p < .01, * p < .05, + p < .1

Table 1.3. The Association Between Teachers' Relational Self-Efficacy and Primary Outcomes

	Teacher Prioritizing Role of Building TSRs	Teacher Perception of TSR	Student Perception of TSR
	(1)	(2)	(3)
Teachers' Relational Self-Efficacy	0.38**	0.36***	0.23*
	(0.13, 0.63)	(0.20, 0.53)	(0.01, 0.44)
Observations	70	774	598
Classroom RE	N	Y	Y
Number of Clusters		69	65

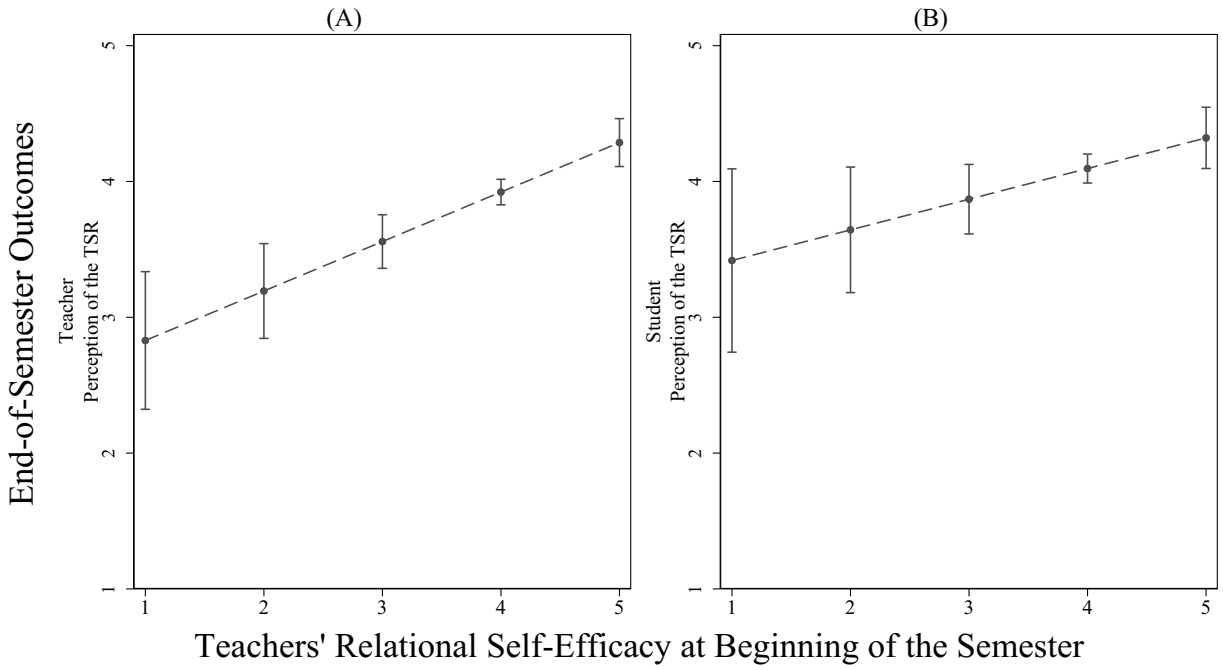
*** p < .001, ** p < .01, * p < .05, + p < .1

Notes: Confidence intervals in parentheses (Columns 1 & 2 show 97.5% CIs; Column 3 shows 95% CIs). All models include a school fixed effect and control for teachers' gender, years teaching, and grade level. Columns 2 & 3 control for student gender and use robust standard errors clustered at the classroom level. Only 65 teachers had students who completed the final survey.

Student perceptions of the TSR. My stated exploratory hypothesis focused on whether teachers' relational self-efficacy at the beginning of the semester predicted their students' perceptions of the TSR at the end of the semester. Table 1.3 (Column 3) and Figure 1.1 (Panel B) show that students of teachers with higher relational self-efficacy do indeed report more positive TSRs a few months later, $B = 0.23$, $SE = 0.11$, 95% CI [0.01, 0.44], $p = .041$; $\beta = 0.14$. A one-standard deviation increase in teachers' relational self-efficacy at the beginning of the semester is associated students' perceptions of their relationship with that teacher being 0.14-standard deviations higher at the end of the semester.

Accounting for teachers' general self-efficacy and social self-efficacy. Given the existing measures of teachers' general self-efficacy or social self-efficacy, the following analyses aimed to determine whether assessing teachers' relational self-efficacy is necessary. Teachers' relational self-efficacy predicted teachers' prioritizing of the role of building TSRs (*B*s ranging from 0.28 to 0.35) and their actual perceptions of their TSRs (*B*s ranging from 0.27 to 0.34), even when accounting for their general self-efficacy or their social self-efficacy. The results,

Figure 1.1. Association between teachers' beginning-of-semester relational self-efficacy and end-of-semester teacher-student relationships



Notes: Error Bars represent associated Confidence Intervals from Table 1.3. Each x-axis represents teachers' relational self-efficacy at the beginning of the semester. Panel A: Teacher Perception of the TSR; Panel B: Student Perception of the TSR

presented in Table 1.4, indicate that teachers' relational self-efficacy predicted these two TSR-related outcomes over and above these existing measures of self-efficacy.

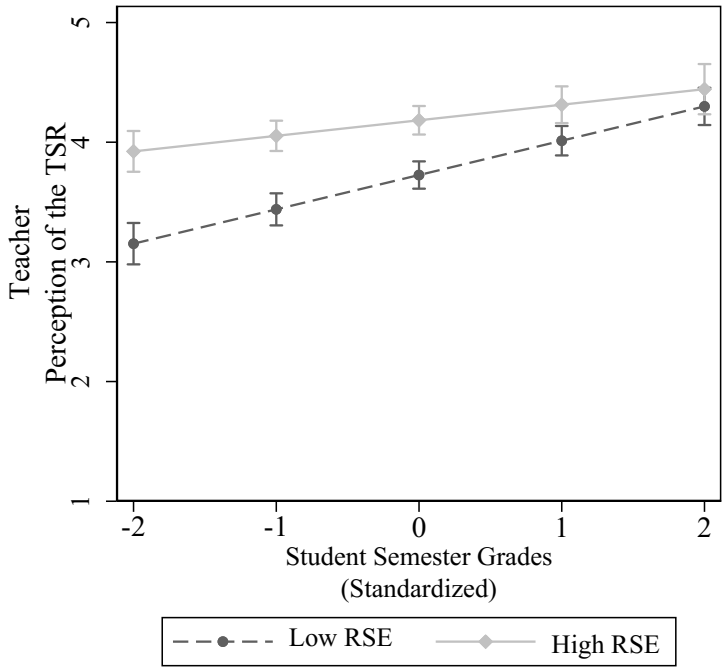
Heterogeneity analyses. Teachers' relational self-efficacy may predict the quality of their TSRs differently, depending on key teacher and student characteristics. To explore this, I conducted heterogeneity analyses to see if the association between teachers' relational self-efficacy and perceptions of their TSRs differed by teacher demographics (gender, number of years teaching, and the level they currently teach), student demographic variables (gender and race), or students' academic grades. As Panel A in Table 1.5 shows, no teacher or student

demographic variables moderated the association between teachers' relational self-efficacy and teachers' own perceptions of the TSR. However, Figure 1.2 illustrates the statistically significant interaction between teachers' relational self-efficacy and a student's grades on teachers' perceptions of their TSRs, B = -0.13, SE = 0.04, 95% CI [-0.21, -0.05], p = .001. While teachers with high and low relational self-efficacy had generally equivalent perceptions of their TSRs with students who earned good grades, teachers with low relational self-efficacy were more likely to perceive worse TSRs with students with lower grades. Teachers with high relational self-efficacy did not have lower perceptions of their TSRs with students who earned lower grades.

Panel B in Table 1.5 displays how teacher and student characteristics moderate the association between teachers' relational self-efficacy and students' perceptions of the TSR. The number of years teachers taught, student gender, and students' own grades do not appear to moderate the association. Yet, teachers' levels of relational self-efficacy may matter for student perceptions of their TSRs when it comes to teacher gender, grade level, and for students of color. First, students perceive less positive TSRs with female teachers who report having low relational self-efficacy than male teachers with low relational self-efficacy, B = 0.38, SE = 0.17, 95% CI [0.05, 0.70], p = .025; Figure 1.3. Second, students in younger grades who have a teacher with low relational self-efficacy report a worse relationship with that teacher than students who have a teacher with high relational self-efficacy, B = -0.11, SE = 0.05, 95% CI [-0.21, -0.01], p = .027; Figure 1.4. Conversely, teachers' levels of relational self-efficacy do not seem to affect older students' perceptions of their TSRs. Finally, while white students perceive equally positive TSRs with teachers who have high and low relational self-efficacy, students of color perceive more

positive TSRs with teachers who have higher levels of relational self- efficacy, $B = 0.31$, $SE = 0.15$, 95% CI [0.01, 0.61], $p = .041$; Figure 1.5.

Figure 1.2. Teachers' perception of the TSR by student academic grades & teachers' relational self-efficacy



Notes: Error bars represent 95% confidence intervals. The 'Low' and 'High' RSE (Relational Self-Efficacy) lines represent teachers in the 10th and 90th percentile, respectively.

Table 1.4. The Association Between Teachers' Relational Self-Efficacy and Primary Outcomes, Controlling for Other Self-Efficacy Measures

	Teacher Prioritizing Role of Building TSRs				Teacher Perception of TSR			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Relational self-efficacy	0.38***	0.28+	0.34*	0.35**	0.36***	0.27*	0.28**	0.34***
	(0.17, 0.60)	(-0.03, 0.60)	(0.07, 0.61)	(0.12, 0.58)	(0.22, 0.51)	(0.03, 0.51)	(0.11, 0.46)	(0.19, 0.48)
Adapting to change SE		0.06				0.08		
		(-0.12, 0.23)				(-0.07, 0.23)		
Motivating students SE		0.11				0.01		
		(-0.13, 0.35)				(-0.21, 0.23)		
Disciplining students SE		0.05				0.03		
		(-0.08, 0.17)				(-0.07, 0.13)		
Cooperating with others SE		-0.02				0.11		
		(-0.21, 0.16)				(-0.02, 0.23)		
Coping with change SE		-0.11				0.08		
		(-0.27, 0.05)				(-0.04, 0.20)		
Delivering instruction SE		0.06				-0.15+		
		(-0.16, 0.27)				(-0.32, 0.02)		
General teachers' self-efficacy (combined)			0.08				0.15	
			(-0.22, 0.38)				(-0.07, 0.37)	
Social self-efficacy				0.06				0.03
				(-0.04, 0.16)				(-0.04, 0.11)
Observations	70	70	70	70	774	774	774	774
Classroom RE	N	N	N	N	Y	Y	Y	Y
Number of Clusters					69	69	69	69

*** p < .001, ** p < .01, * p < .05, + p < .1

Notes: 95% confidence intervals in parentheses. All models include a school fixed effect and control for teachers' gender, years teaching, and grade level; Columns 5-8 control for student gender and use robust standard errors clustered at the classroom level. The clusters of teachers differ in columns 5-8 because there was no student gender indicator for all students in one teacher's class.

Figure 1.3. Students' perception of the TSR by teacher gender and teachers' relational self-efficacy



Figure 1.4. Students' perception of the TSR by grade level and teachers' relational self-efficacy

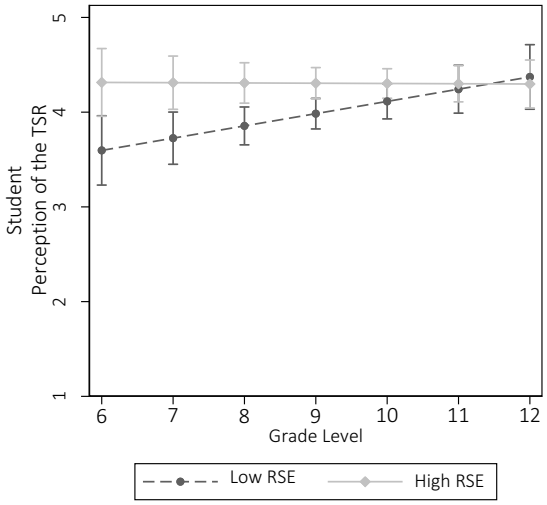
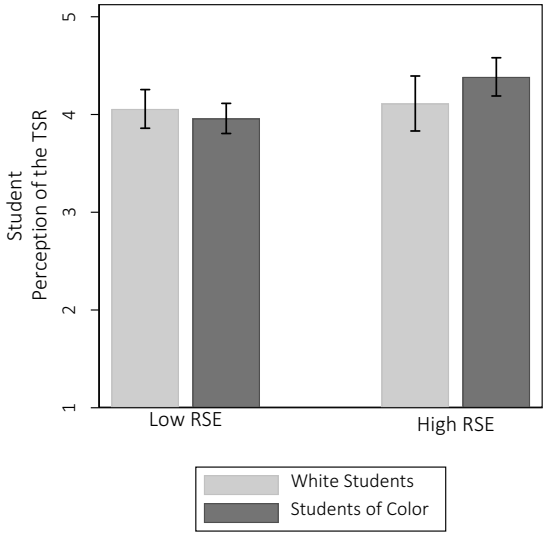


Figure 1.5. Students' perception of the TSR by student race and teachers' relational self-efficacy



Notes: Error bars represent 95% confidence intervals. The 'Low' and 'High' RSE (Relational Self-Efficacy) lines represent teachers in the 10th and 90th percentile, respectively.

Table 1.5. Heterogeneity Analyses

	Teacher			Student		
	Female (vs. Male)	Years Teaching	Grade Level	Female (vs. Male)	Student of Color (vs. white student)	Student Grades (Standardized)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Teacher Perception of the TSR						
Teachers' Relational Self-Efficacy x Moderator	0.09	-0.01	-0.05	-0.00	0.04	-0.13***
	(-0.19, 0.38)	(-0.03, 0.01)	(-0.14, 0.04)	(-0.21, 0.21)	(-0.23, 0.31)	(-0.21, -0.05)
Observations	774	774	774	774	692	768
Number of Clusters	69	69	69	69	69	68
Panel B: Student Perception of the TSR						
Teachers' Relational Self-Efficacy x Moderator	0.38*	0.00	-0.11*	0.09	0.31*	-0.08
	(0.05, 0.70)	(-0.03, 0.03)	(-0.21, -0.01)	(-0.13, 0.31)	(0.01, 0.61)	(-0.20, 0.04)
Observations	598	598	598	598	527	598
Number of Clusters	65	65	65	65	65	65

*** p < .001, ** p < .01, * p < .05, + p < .1

Notes: Robust 95% confidence intervals in parentheses. The coefficient represents the interaction between teachers' relational self-efficacy and the variable listed at the top of the column (e.g., the top coefficient in Column 1 represents the interaction between teachers' relational self-efficacy and teacher gender). All models include robust standard errors clustered at the classroom level, a school fixed effect, a classroom random effect, and control for teachers' gender, years teaching, and grade level and student gender (if not used in the interaction term). Only 65 teachers had students who completed the final survey.

Discussion

Despite the preponderance of research on teachers' self-efficacy, few have considered how teachers' beliefs about their ability to connect with students may impact teaching and relationship quality (Zee & Koomen, 2016). This research introduces the concept of teachers' relational self-efficacy and explores how teachers' confidence in their relationship-building abilities associates with their subsequent perceptions of their TSRs. Specifically, the main goal of this research was to test my hypotheses that teachers who have stronger relational self-efficacy will be more likely to (1) prioritize the role of building TSRs, (2) report more positive relationships with students, and (3) have students who report more positive relationships with them.

I found support for all three hypotheses. First, teachers with greater confidence in their ability to cultivate relationships with their students were more likely to report prioritizing the role of building TSRs in their practice. This provides the first evidence that relational self-efficacy correlates with teachers' beliefs that may influence their classroom beliefs and behaviors. As social cognitive theory suggests, individuals who feel more efficacious in a domain are more likely to seek out more opportunities to engage more in that domain (Bandura, 1977, 1997). In this case, teachers who believe they can cultivate positive TSRs were more likely to report prioritizing activities associated with building relationships with students in their practice.

Second, teachers' relational self-efficacy beliefs predicted their own perceptions of their TSRs. The more confidence teachers had in their ability to develop and maintain TSRs at the beginning of the year, the more positive they perceived their individual relationships with students at the end of the semester. Similar to how self-efficacy functions in other domains, teachers' beliefs about their TSR-building abilities do influence their subsequent views and

attitudes towards their own TSRs. Given that prior research shows that teachers' (not students') perceptions of the TSR correlates most strongly with student academic grades (Brinkworth et al., 2018; Robinson et al., 2019), teachers' perceptions of their TSRs may have implications for student outcomes.

Third, an exploratory analysis found that students of teachers with higher relational self-efficacy early on also reported perceiving more positive relationships with those teachers a few months later. That is, students tend to evaluate their relationship with a teacher more positively if that teacher was confident in their ability to cultivate that relationship. This lends support to the logic that teachers' relational self-efficacy may impact the extent to which they seek out, engage with, and exert effort in relationship-building, maintaining, or repairing activities with students.

The additional exploratory analyses provide some insights into how teachers' relational self-efficacy may matter more or less for different teachers and students. From the teacher side, teachers who feel more confident in their ability to interact with students may also perceive more positive relationships with *all* their students. I find that teachers with low relational self-efficacy tend to report worse TSRs with low academically performing students than high performing students, whereas teachers with high relational self-efficacy perceive equally positive TSRs with students no matter their academic grades. Given increasing evidence of a relationship-gap (teachers perceive more positive relationships with their high performing students than with their low-performing students) (Gehlbach et al., 2016; Robinson et al., 2019), the mere act of bolstering relational self-efficacy may help teachers perceive stronger relationships with traditionally at-risk students.

From the student side, teachers' relational self-efficacy differentially associates with student perceptions of their TSRs depending on the teacher's gender, grade level, and the

student's own race. First, I found students of teachers with low relational self-efficacy reported worse TSRs when that teacher was female or taught a lower grade. In other words, relational self-efficacy may be more important when it comes to building positive TSRs for female teachers and middle school teachers, as compared to male and high school teachers, respectively. The present research does not shed any light on to why this may be the case, but one possibility might be that many *assume* female teachers and teachers in younger grades are better able to cultivate positive TSRs than male teachers and teachers in older grades (Hargreaves, 1998). Thus, having low relational self-efficacy could result in female and middle school teachers avoiding relationship-building practices even more. Conversely, students may exhibit gender bias in evaluations of their TSRs making them more likely to penalize female teachers who lack confidence in their relationship-building abilities. Prior research in postsecondary courses show that gender bias in student evaluations is widespread and prevalent (e.g., MacNell, Driscoll, & Hunt, 2015), and future studies might explore whether these biases exist in middle and high school.

Second, students of color report more positive TSRs with teachers who have higher relational self-efficacy, whereas white students' perceptions of their TSRs do not differ based on teachers' confidence in their capacity to build TSRs. Again, we need additional research to understand the mechanisms underpinning this association, but (predominantly white) teachers with higher relational self-efficacy may be better able to connect with students who come from different backgrounds than their own.

Implications for Studying Relational Self-Efficacy and Improving TSRs

While scholars have called for adapting teacher self-efficacy instruments to include the emotional domain and dyadic relationships (Zee & Koomen, 2016), practitioners may reasonably

ask whether assessing teachers' relational self-efficacy is necessary given existing teacher self-efficacy instruments. I found that teachers' relational self-efficacy robustly predicts teachers' prioritizing of TSRs and their perceptions of TSRs, even when accounting for existing measures of teacher self-efficacy. This suggests that, if you care about the relationship between teachers and their students, directly assessing teachers' relational self-efficacy will provide insights that otherwise would be missed with existing measures of teacher self-efficacy.

Given that teaching is fundamentally a social enterprise between teachers and students (Gehlbach, 2010; Goodenow, 1992) and TSRs robustly predict student outcomes (Roorda et al., 2011), understanding how teachers' relational self-efficacy associates with TSRs could have enormous implications for how we train and support teachers. Building relationships with students is one of the most underestimated and challenging aspects of teaching. But teachers need to believe they can successfully cultivate TSRs or they may avoid opportunities to connect with students. These longitudinal findings suggest that increasing teachers' relational self-efficacy may be a promising locus of intervention for improving TSRs for a couple of reasons.

On the one hand, interventions that increase teachers' relational self-efficacy may lead to teachers seeking out, engaging with, and persisting in more TSR-building activities. Intervention studies in various fields, including education and health, demonstrate the promise of improving outcomes by targeting self-efficacy beliefs (Contento, Randell, & Basch, 2002; Luszczynska, Tryburcy, & Schwarzer, 2006). Therefore, future research should explore how we can increase teachers' relational self-efficacy and explore the impact on teacher and student perceptions of their TSRs. Interventions that do strengthen teachers' relational self-efficacy may also have important equity implications, given that low confidence in one's relationship-building abilities

with students appears to result in worse TSRs with academically low performing students. Arguably, students who struggle in school are those who need these positive TSRs the most.

On the other hand, there are several studies that have introduced interventions designed to create more positive interactions between teachers and their students, which have had varying degrees of success (e.g., Gehlbach et al., 2016; Hamre et al., 2012; Pianta & Allen, 2008; Rimm-Kaufman & Chiu, 2007; Robinson et al., 2019). What we don't know is whether teachers' beliefs about relationships impact the success or failure of these interventions. Perhaps interventions aiming to improve TSRs fail, not because the underlying theory or execution was off base, but because they do not address teachers' underlying beliefs about their ability to improve their relationships with students. Teachers who feel improving TSRs is a hopeless pursuit may need more than training or encouragement to successfully carry out a relationship-building intervention. In this case, future interventions that aim to improve TSRs might consider whether they should include a feature that targets teachers' beliefs about their abilities to connect with students.

The heterogeneity analyses shed some light on which teachers we might target with interventions that attempt to increase relational self-efficacy. In particular, middle school teachers may benefit from support helping them increase their confidence in their relationship-building abilities. Teachers who teach diverse student bodies, both academically and demographically, might also reap more benefits from a relational self-efficacy intervention. It is often easy for teachers to cultivate positive TSRs with students who have positive school experiences and do well academically. It is harder to connect positively with students who struggle, but often those are the students who need it most. Teachers who believe they can

successfully connect with *all* their students are indeed more likely to have positive TSRs with *both* low and high achieving students, as well as white students and students of color.

Of course, there are several limitations of this research. First, and what warrants the most consideration, is that the present study cannot show that increasing teachers' relational self-efficacy has a causal impact on teacher and student perceptions of their TSRs. The longitudinal nature of the data is a strength, but there may be additional factors that explain the correlation between teachers' beginning-of-semester relational self-efficacy and end-of-semester perceptions of their TSRs. For instance, successfully connecting with students may (and likely does) result in teachers having higher relational self-efficacy. In fact, social cognitive theory (Bandura, 1986) posits a reciprocal association between self-efficacy beliefs and experiences, such that each influences one another bidirectionally. This helps to explain why mastery experiences are viewed as the most powerful source of self-efficacy beliefs (Bandura, 1997; Kadden & Litt, 2011; Tschannen-Moran & McMaster, 2009; Usher & Pajares, 2008). But, the relative influence of beliefs and experiences are not necessarily equal in strength, nor do they emerge as a holistic entity—one still can cause the other (Bandura, 1986). Assuming relational self-efficacy and experiencing positive TSRs both impact one another, the findings from the present study incites the question, does bolstering teachers' relational self-efficacy beliefs improve teacher and student perceptions of their TSRs? I hope these correlational findings can be used as a starting point for future experimental research targeting teachers' relational self-efficacy beliefs.

Second, and relatedly, this study does not allow us to determine if teachers' relational self-efficacy beliefs influence their behaviors. The fact that teachers' relational self-efficacy at the beginning of the semester predicts *students'* perceptions of the TSR a few months later suggests that teachers may behave differently based on whether they believe they can

successfully connect with students or not. However, I do not observe the actual behaviors teachers engage in. I also don't study student behaviors. Future research might employ additional methods, like qualitative interviews or classroom observations, to gain more nuanced insights into the behavioral differences between teachers with high and low relational self-efficacy.

Third, I only studied teachers and students within a single, target class. Logistically, asking middle and high school teachers and students to report on every TSR they have is challenging, but future studies might consider how these relationships vary by class and across a wider range of teacher-student dyads. Future research might also consider how teachers' relational self-efficacy differs with *individual* students, in addition to their confidence in building relationships with students in general, and explore the downstream effects (e.g., Zee, de Jong, & Koomen, 2016; Zee, Koomen, Jellesma, Geerlings, & de Jong, 2016).

Fourth, while the study was conducted in three, diverse middle and high schools, the question remains of whether these findings generalize to other contexts. For one thing, the teachers in these three schools were predominantly white so this research should be replicated with a more diverse sample of teachers. Finally, at this point, we have no idea why teachers may have low or high relational self-efficacy. A key avenue for future research will be to investigate the sources of teachers' relational self-efficacy and what factors might lead to teachers having more or less confidence in their ability to cultivate positive TSRs.

Conclusion

From a theoretical standpoint, this study introduces the concept of relational self-efficacy and how the beliefs we have about specific relationships might influence outcomes associated with those relationships. By applying this concept to teachers, it becomes clear that teachers' self-efficacy beliefs about their TSRs do matter and should be considered when studying

teachers' self-efficacy more generally, particularly when looking at the relational aspects of teaching. Practically, understanding how teachers' beliefs about their relationship building abilities correlate with the quality of their TSRs provides important insights about teachers' and students' classroom experiences. These longitudinal findings suggest teachers' relational self-efficacy beliefs may systematically influence teachers' beliefs and behaviors in the classroom. Moreover, teachers' confidence in their relationship-building could translate into students perceiving more positive TSRs, which may have implications for students' learning and motivation. This research is a promising first step toward understanding teachers' relational self-efficacy beliefs in the service of improving classroom relationships and other valued educational outcomes. If we can provide teachers with the tools and confidence to build positive relationships in their classrooms, then we are setting the stage for teachers to build productive relationships with students and, in turn, increasing the likelihood of student success.

Paper 2: A Field Experiment Exploring the Impact of Bolstering Teachers' Relational Self-Efficacy

Unless people believe their actions can produce desired results, they have little incentive to act (Bandura, 1997). This basic premise stems from decades of research on self-efficacy, which indicates that the beliefs people hold about their capabilities in a domain strongly associate with their motivation and behaviors in that domain (Bandura, 1977, 1997). When it comes to teachers and their relationships with students, it follows logically that unless teachers believe they can build positive teacher-student relationships (TSRs), they have little incentive to engage in relationship-building behaviors with students.

Reinforcing this idea, Paper 1 of this dissertation found that teachers' relational self-efficacy—defined as teachers' beliefs about their capability to successfully form, maintain, and (when necessary) repair relationships with students—is associated with the quality of their TSRs. At this point we know surprisingly little about how to improve TSRs at scale (Gehlbach & Robinson, 2016), but these findings suggest that increasing teachers' relational self-efficacy beliefs may be a promising lever for improving TSRs. This paper presents results from a randomized field experiment evaluating the impact of a teacher-focused intervention that aimed to increase teachers' relational self-efficacy and downstream TSRs. I find that a short, 20-minute activity designed to bolster middle and high school teachers' confidence in their relationship-building skills with students improves their relational self-efficacy three months later. The activity also results in teachers perceiving more positive relationships with their students three months later.

The State of TSRs and How to Improve Them

Scholars have made significant progress in understanding TSRs through a solid base of correlational and longitudinal studies. These studies document the robust association between TSRs and positive outcomes for students, including academic achievement, motivation, expectations, and interest (Baker et al., 2008; Birch & Ladd, 1998; Brophy & Good, 1974; Pianta et al., 2003; Roorda et al., 2011; Sabol & Pianta, 2012; Wentzel, 1998, 2009). In addition to predicting desirable educational outcomes, positive TSRs are an important product in their own right. People who report stronger relationships have better health and live longer (House, Landis, & Umberson, 1988), and youth who can name a caring adult are more likely to be successful across numerous domains (Grossman & Bulle, 2006).

But cultivating positive relationships between teachers and each of their several dozen students is no small feat. Furthermore, teachers and students are often expected to develop a working relationship that generates not just learning, but also caring, support, and liking. Despite the consensus that TSRs matter (Gehlbach & Robinson, 2016; Hamre & Pianta, 2006), teacher education programs do not always successfully prepare teachers for establishing positive relationships with their students (Brekelmans et al., 2005; Brophy, 1988). And once teachers arrive in the classroom, research shows that improving classroom relationships can be time-consuming and difficult (Hamre & Pianta, 2006; Sabol & Pianta, 2012). The obstacles to building TSRs grow as students enter middle and high school (O'Connor & McCartney, 2007), where students have less time with individual teachers, accountability pressures increase, and students want more independence. Therefore teachers, particularly secondary school teachers, must believe that they can cultivate positive TSRs if they can be reasonably expected to exert the effort required to improve these relationships.

To date, only a handful of empirical studies have tested interventions designed to create more positive interactions between teachers and their students (Allen, Pianta, Gregory, Mikami, & Lun, 2011; Gehlbach et al., 2016; Gregory, Allen, Mikami, Hafen, & Pianta, 2014; Rimm-Kaufman & Chiu, 2007; Robinson et al., 2019). These interventions, diverse in both their approaches and modes of delivery, had mixed success in improving TSRs. And none considered teachers' beliefs in their abilities to build relationships with students. The present study explores whether an intervention can increase teachers' relational self-efficacy beliefs and meaningfully improve how teachers perceive their TSRs.

Targeting Teachers' Relational Self-Efficacy Beliefs to Improve TSRs

Targeting teacher beliefs—particularly their relational self-efficacy beliefs—may be a promising approach to influencing TSRs for three reasons. First, correlational studies suggest teachers' beliefs are associated with their perceptions and behaviors. In the context of TSRs, Brophy (1985) found that some teachers view themselves primarily as instructors (i.e., subject matter specialists concerned with instructing their students in the formal academic curriculum) or socializers (i.e., parent surrogates or therapists), and those conceptions related to their classroom conduct (see also McPartland, 1990; Nespor, 1987; Pajares, 1992).

When it comes to teachers' self-efficacy more generally, their beliefs about their teaching abilities influence their thoughts and feelings, as well as their behaviors (Bandura, 1997). Prior research demonstrates that teachers who are confident in their teaching practice tend to engage in professional learning activities (Geijsel et al., 2009) and have more positive attitudes towards the profession (Brouwers & Tomic, 1999; Skaalvik & Skaalvik, 2010). In the first study to consider the association between teachers' relational self-efficacy and TSRs, Robinson (2019) found that teachers' confidence in their TSR-building abilities at the beginning of the semester correlates

with the extent to which they prioritize the role of building TSRs, their own perceptions of their TSRs, and their students' perceptions of the TSR at the end of the semester.

Second, beliefs – including a wide range of teacher beliefs – are malleable and subject to social influence (Dweck, 2006; Lewin, 1952; Tankard & Paluck, 2016). In the seminal Pygmalion experiment, researchers found that simply telling teachers certain students were expected to make large intellectual gains made teachers act in ways that were consistent with their (manipulated) beliefs about those students (Rosenthal & Jacobson, 1968). Similarly, experimental studies show that targeted interventions can induce changes in participants' self-efficacy beliefs in specific domains (Bandura, Reese, & Adams, 1982; Kadden & Litt, 2011). I discuss self-efficacy interventions further below, but these studies demonstrate that efficacy beliefs can be altered independently of performance. That is, people can increase their confidence in their abilities in a domain before actually experiencing performance gains in that domain.

Finally, targeting teacher beliefs may have a catalyzing effect such that teachers may begin to adopt complementary perceptions and behaviors that align with their beliefs (Lewin, 1952; Rogers, Goldstein, & Fox, 2018). Cohen and Garcia (2008) argue that interventions that successfully shift students' identities are recursive in nature because they interact with other factors in the social environment (see also Walton, 2014). According to social cognitive theory, self-efficacy beliefs contribute to the choices people make, the effort they put forth, and their persistence in the face of obstacles (Bandura, 1997). When it comes to teachers' relational self-efficacy, one can imagine that teachers who feel more efficacious in building TSRs will be more likely to initiate interactions with students. If that interaction goes well, teachers' may proactively seek out other opportunities to build relationships with students. Thus, interventions

that nudge teachers' relational self-efficacy beliefs may change how teachers and students think about their shared relationship and, potentially, alter the dynamic between teachers and their students.

Increasing Teachers' Relational Self-Efficacy

Sources of Self-Efficacy

Bandura (1997) theorized that self-efficacy beliefs stem from four primary sources: *mastery experiences*, *vicarious experiences*, *verbal persuasion*, and *affective and physiological* states. Therefore, interventions that feature one or more of these sources may increase self-efficacy. In the following paragraphs, I describe the four sources in more detail and consider how they might function in the context of teachers' relational self-efficacy.

First, a mastery experience (i.e., when someone succeeds in a task) provides evidence that they can be successful in future, related endeavors. Arguably the most powerful source of self-efficacy, these mastery experiences can be especially influential when individuals overcome obstacles to be successful (Bandura, 1997). So, when teachers positively connect with a student—particularly a student who they may perceive as difficult—it likely contributes to their perceived relational self-efficacy. Conversely, if teachers try and fail to build a positive relationship with a student, it may decrease their relational self-efficacy. Because people often first look to their own life events to inform their attitudes and beliefs, scholars hypothesize that interventions designed to provide a sense of mastery will have the best chance of improving self-efficacy (Kadden & Litt, 2011).

Vicarious experiences can also play a role in developing people's self-efficacy beliefs, especially when people may be uncertain about their own abilities or the domain lacks absolute measures of competence (Bandura, 1997; Usher & Pajares, 2008). When people see similar

others successfully engage in a task, they can persuade themselves that they can do it too (Bandura, 1997). In this way, teachers who hear about or visualize other teachers (especially those they identify as similar to themselves) successfully engaging in relationship-building strategies with students may be more likely to believe they too possess the capabilities to cultivate positive TSRs.

In addition to observing social models, others can directly influence self-efficacy through verbal persuasion. For teachers, verbal persuasion can be encouragements from colleagues or school leaders who express faith in their ability to carry out a particular teaching strategy. Or teachers may engage in professional development workshops that provide knowledge of a new strategy along with persuasive claims about its usefulness (Tschannen-Moran & McMaster, 2009). Verbal persuasion may provide teachers with the advice or urging they need to feel confident in their efforts aimed at improving their TSRs and help them persist in the face of barriers (Bandura, 1997; Tschannen-Moran & McMaster, 2009).

Finally, self-efficacy beliefs are informed by affective and physiological states. People interpret their levels of arousal, either positively or negatively, which can influence self-efficacy beliefs. People tend to expect success when they are feeling strong and positive, not when they are anxious and stressed, so reducing stress levels and increasing positive emotions associated with a task may enhance self-efficacy beliefs (Bandura, 1997). As such, linking the experience of building positive TSRs with feelings of accomplishment and pride may increase teachers' relational self-efficacy.

Interventions to Increase Self-Efficacy

While many scholars write about how these four sources might increase self-efficacy, there are fewer experimental studies evaluating interventions intentionally focused on increasing

self-efficacy beliefs. But the existing studies provide evidence that self-efficacy beliefs can be enhanced via targeted interventions, which can affect other, related outcomes. For instance, an email-based intervention aimed to increase fruit and vegetable consumption by building diet-related self-efficacy (Luszczynska et al., 2006). The treatment, which sought to enhance self-efficacy by means of verbal persuasion and positive emotions, resulted in increases in participants' self-efficacy and, subsequently, the number of fruits and vegetables they reported eating.

Another study evaluated the effects of both mastery and vicarious learning experiences on college students' math and science self-efficacy and actions (e.g., choice of major) (Luzzo, Hasper, Albert, Bibby, & Martinelli Jr, 1999). Compared to the control group, the intervention conditions focused on mastery experiences (either with or without a 15-minute vicarious learning component) increased students' math and science self-efficacy beliefs, as well as their intention to major in math or science-related fields.

A few experimental studies have explicitly focused on enhancing teachers' self-efficacy. One such study investigated the effects of professional development on sixth grade math teachers' self-efficacy beliefs (J. Ross & Bruce, 2007). The intervention, which also explicitly addressed the four sources of self-efficacy, only impacted teachers' confidence in their classroom management (and not their ability to engage student interest and use new instructional strategies). Another quasi-experimental study focused on bolstering teachers' self-efficacy via a professional development curriculum (Tschannen-Moran & McMaster, 2009). The researchers expected that incrementally introducing verbal persuasion, vicarious experiences, and mastery experiences would all have an additive effect on self-efficacy beliefs and take up of an introduced teaching practice. While they did not find evidence that additional sources of self-

efficacy increased self-efficacy, they do affirm Bandura's (1997) assertion that authentic, task-specific mastery experiences are most powerful when it comes to raising self-efficacy beliefs.

Taken together, these studies suggest that interventions may successfully shift people's self-efficacy beliefs in a certain domain by targeting the four sources of self-efficacy. At the same time, they also highlight the complex and nuanced processes by which different sources may increase or decrease self-efficacy beliefs depending on how they are targeted, highlighting the need for more research on the topic.

Targeting Relational Self-Efficacy to Improve Relationships

Unlike most domains, where self-efficacy is a well-established predictor of ability and outcomes, people's perceptions of their skills in the social domain often have little to no bearing on measures of their actual performance (Ames & Kammrath, 2004; Dunning et al., 2003; Falchikov & Boud, 1989). Specifically, people tend to overestimate their social skills and communications in situations (e.g., Kruger et al., 2005). Teachers also tend to overestimate how positive their TSRs are, compared to students (den Brok, Bergen, & Brekelmans, 2006; Theo Wubbels, Brekelmans, & Hooymayers, 1992). If increasing teachers' perceptions of their relational self-efficacy simply leads to overconfidence, this lack of awareness could result in teachers underinvesting in relationship-building because they overestimate their abilities. Conversely, if relational self-efficacy functions as it does in other domains, bolstering teachers' relational self-efficacy should translate into more positive TSRs because they will be more likely to exert effort in relationship-building activities with students.

The Present Study

This randomized field experiment is the first to explore whether teachers' relational self-efficacy beliefs and perceptions of their TSRs can be increased through an intervention.

Conducted in middle and high school settings during the last semester of the 2018-19 school year, I randomly assigned teachers to either a control or a treatment condition. The treatment group completed an intervention designed to enhance teachers' beliefs in their relationship-building abilities with students by targeting the four sources of self-efficacy. At the end of the year I measured teachers' relational self-efficacy, how much they prioritize the role of building TSRs, and their perceptions of their TSRs.

In line with recent best practices in educational research (Gehlbach & Robinson, 2018), I preregistered my methods, hypotheses, and analysis plan by submitting a statement of transparency to *Open Science Framework* (https://osf.io/z3hbe/). I prespecified three hypotheses:

Hypothesis 1: Teachers assigned to the treatment condition will report higher levels of relational self-efficacy as compared to those assigned to the control group. This finding will emerge (a) immediately post-intervention and (b) at the end of the semester.

Hypothesis 2: Teachers assigned to the treatment condition will report prioritizing the role of building TSRs at the end of the semester as compared to those assigned to the control group.

Hypothesis 3: Teachers assigned to the treatment condition will report having more positive TSRs at the end of the semester as compared to those assigned to the control group.

I also conducted several exploratory analyses with a goal of generating hypotheses that I can preregister and test in future studies. For instance, I investigated whether the intervention impacted teachers' relational self-efficacy toward *individual* students and if *students* of teachers assigned to the treatment group reported more positive TSRs at the end of the semester. Additionally, I conducted mediation analyses, and looked at whether the treatment influenced

any additional educational outcomes (e.g., student grades), and explored whether there was any heterogeneity in the treatment effect on my main dependent variables.

Method

Intervention and Study Design

The field experiment employed a 1x2 between-subject design. I performed a clustered stratified randomization (by school and grade level) to assign teachers to one of two conditions:

Treatment group: Teachers completed a three-part activity designed to increase their relational self-efficacy.

Control group: Teachers completed a three-part activity designed to increase their self-efficacy in delivering content in students' preferred learning styles.

The topic of delivering content via learning styles was selected for the control group because it remains to be one of the most pervasive myths in education and does not improve learning (Nancekivell, Shah, & Gelman, 2019; Pashler, McDaniel, Rohrer, & Bjork, 2008). Therefore, reflecting on how to teach to students preferred learning styles should not impact students' learning, nor teachers' beliefs about their ability to build TSRs.[5] Given that teaching to students' learning styles does not improve learning, teachers were eventually debriefed and told they were prompted to reflect on student learning styles because it tended to result in more creative ideas for delivering content (with the caveat that teaching to learning styles should not improve student learning).

[5] Paper 3 addresses the control condition activity more completely.

The intervention was delivered to participating teachers using the Qualtrics survey platform. The survey platform directed teachers to the intervention activity to which they were randomly assigned in the initial teacher survey. In both conditions, teachers were told: "The goal of this session is to learn about your past experiences, your views on other teachers' experiences, and to solicit advice from you on the topic." The directions also shared that the research team hoped to collect information that could be used to develop materials that will help future teachers. I designed the three activities to target the four sources of self-efficacy (i.e., mastery experiences, vicarious experiences, verbal persuasion, and affective states; Bandura, 1997), as well as psychological processes that can affect perceptions and behavior (i.e., plan-making; Nickerson & Rogers, 2010, and the saying-is-believing phenomenon; Walton & Cohen, 2011).

The first activity focused on increasing self-efficacy by reflecting on a mastery experience and linking that experience to an affective state. In the treatment group, I asked teachers to reflect on a time when they successfully connected with a student and to provide that student's first name. Teachers then answered questions about where the interaction took place, how they connected with the student (and to provide the steps they took as if they were telling a story), and why they thought the interaction was successful. These questions highlighted teachers' past enacted mastery experiences, which could serve to remind them of their capacity to successfully build TSRs. Teachers also considered the affective components of the interaction, responding to questions about how successfully connecting with a student made them feel and whether anything positive came out of the experience. The goal was to formally link building a TSR with a positive affective state, which could help teachers construe interacting with students as a positive experience they want to engage in again. The control group focused on delivering content to students in their preferred learning style. Teachers responded to equivalent prompts

that reflected on a mastery experience (i.e., recollecting the circumstances when they successfully delivered content in students' preferred learning style) and the affective components of the experience (i.e., how it made them feel).

The second activity aimed to increase teachers' self-efficacy through vicarious experiences and verbal persuasion. Teachers read several short testimonials from other teachers sharing their own strategies for either building positive TSRs (the treatment group) or delivering content to students' preferred learning styles (the control group). The goal was for teachers to learn about people similar to themselves (in this case, other U.S. middle and high school teachers) successfully cultivating TSRs.[6] This may raise efficacy beliefs that they, too, possess the capabilities to master the task of building relationships with students. After reading the testimonials, teachers ranked the strategies in order of how likely it was they would personally use them. They then received a more detailed description of their most highly ranked strategy, in which the teacher who shared the strategy provided more details about how the strategy is enacted along with persuasive claims about its usefulness. Here, the anonymous teacher was verbally persuading teachers that they possessed the capabilities to master the task.

The third and final activity asked teachers to create their own strategy for either strengthening their relationships with their most difficult students (the treatment group) or delivering content to students who prefer a specific learning style (the control group). In both conditions the teachers were asked to think about a specific strategy they hoped to use in the

[6] In this case, the anonymous teachers are "similar" only inasmuch they share a profession and teach at the same schooling level.

upcoming month. They then responded to a series of questions to help break down the strategy into a series of manageable steps that could be shared with future teachers. There were three main goals for this final activity. First, by coming up with a strategy for achieving positive TSRs, treatment group teachers were going through a cognitive simulation of enacting a mastery TSR-building experience. Second, teachers created a plan for carrying out the strategy while also anticipating obstacles and thinking about how to overcome them. Prompting teachers to make plans for building TSRs leveraged both the mechanical benefits of planning and people's preferences for consistency to increase follow-through (Rogers, Milkman, John, & Norton, 2015). Additionally, by identifying the action one will take when an obstacle arises, teachers are better prepared when they encounter barriers that could hinder building positive TSRs (Gollwitzer, 1999). Third, this activity leverages the saying-is-believing phenomenon, or the tendency to endorse messages that one has freely advocated (Aronson, Fried, & Good, 2002; Klaas, 1978). Teachers recommended their own strategies for building positive TSRs and were told that they may be shared with future teachers. As such, teachers may feel cognitive dissonance if they advocate for a strategy but then do not engage it in themselves (Festinger, 1962). It took teachers, on average, about 20-minutes to complete the entire activity.

Four- to five-weeks after the initial survey, all teachers received a "Teacher Reflection Packet" that included their intervention activity responses. The Teacher Reflection Packet served as a booster shot to reinforce the initial, beginning-of-the-semester intervention. The packet, which was delivered via email and in hard-copy form, recapped the strategies teachers shared (part 3), their past successes (part 1), and provided them with details on the teacher-shared strategy they said they'd be most likely to use in their own practice (part 2). They also were encouraged to take an optional, midpoint survey. In this survey, I asked them if they had carried

out their strategy since proposing it on the initial survey. If they said yes, they reported on how the experience went. If they had not carried out the strategy yet, they indicated if or when they intended to carry out the strategy. This follow-up question intended to encourage teachers who had yet to carry out their proposed strategy to create a plan for doing so.

Participants

The study took place at two urban, public school sites in the northeast United States. The first school was a charter middle school and the second school was a magnet high school. In addition to serving diverse student bodies and having predominantly white teaching staffs (mirroring typical U.S. urban schools), both schools also incorporated an "Advisory" period into their core class schedule. While the schools were not affiliated in any way, Advisory served similar purposes in both schools. The goal of Advisory is to provide students with activities that support their academic, career, and social-emotional growth, while also strengthening relationships between students and a specific faculty member. The study was conducted during Advisory period, which met about once-a-week for one hour, on average.

Teachers were offered a $50-gift card upon completion of all study-related activities. They also received a $5-Starbucks gift card along with the booster shot (i.e., the hard-copy Teacher Reflection Packet). There were no incentives for students to participate. The final experimental sample consisted of 52 teachers and their 589 students.

Teachers. There were 64 Advisory teachers across both schools, all of whom were encouraged to participate by school leaders and emails from the research team. Teachers consented to participate on the initial, beginning-of-semester survey. This initial survey is also where the bulk of the intervention took place. Of the initial 64 teachers, five teachers did not start the initial survey and therefore did not consent to participate. An additional five teachers began

completing the survey but did not complete the intervention, so were excluded from subsequent study activities. I also excluded one teacher who left on maternity leave during the semester the study was taking place and one teacher who assisted with the administration (and was privy to details of the research design). This left a final sample of 52 teachers. The twelve excluded teachers did not differ demographically (in terms of gender, race, and grade level) from the final sample, *p*s > .05.

I used institutional records to identify teachers' gender and race/ethnicity (when available). Otherwise, I collected teachers' demographic information at the end of the initial survey. Sixty-nine percent of teachers identified as female while the remaining 31% identified as male. The final teacher sample was 85% White, 6% Hispanic/Latinx, 2% Black/African American, and the remaining 7% selected "Other." This breakdown is very similar to the national average, in which 82% of the teaching workforce identify as White (U.S. Department of Education, 2016). The average number of years teachers reported teaching was 8.87 (*SD* = 7.34) and 4.72 at their current school (*SD* = 4.17).

Students. The 52 participating teachers taught 589 students in Advisory, all of whom were included in the final sample. Teachers responded to questions about each of the students' in their Advisory. Of the eligible students, 91% of students started at least one survey (534; 486 students entered the initial survey and 428 students entered the final survey). Students who completed no surveys did not differ demographically from students who completed at least one survey, *p*s > .05.

Based on institutional records and self-report when the records were unavailable, the student sample was 47% female and 46% male. Seven percent of the students chose not to respond or selected "Other," which led me to include a "missing" category in the student gender

variable. Fifty percent of students identified as Hispanic/Latinx, 20% as Black/African American, 15% as White, 3% as Asian American/Pacific Islander, and the remaining 13% identified as multiple races or "Other." The student sample is more Hispanic (U.S. = 24%) and less White (U.S. = 51%) than the national average (U.S. Department of Education, 2016). Twelve percent of students were in sixth grade, followed by 15% in seventh grade, 9% in eighth grade, 18% in ninth grade, 16% in tenth grade, 14% in eleventh grade, and 17% in twelfth grade.

Measures

In addition to the measures described here, I coordinated with the schools to collect data on student and faculty demographics, grades, and other measures of academic achievement. I also collected a range of additional measures for future, exploratory analyses. The preregistration (see Appendix B) provide details on individual measures. In general, I structured the survey items so that they were assessed on five-point Likert scales (e.g., 1 = "not at all confident" to 5 = "extremely confident"), unless otherwise noted.

Teachers' relational self-efficacy. I measured teachers' relational self-efficacy at multiple time points over the course of the semester. On the initial survey, prior to the intervention, teachers responded to one item asking, "How confident are you in your ability to form, maintain, and repair relationships with all your students?" This one item was designed to minimize the time burden on teachers[7] and intended to gauge teachers' pre-intervention

[7] The initial survey took an average of 20 minutes to complete, so asking all 8-items of the relational self-efficacy scale and all 8-items of the TSR scale would have extended the time to complete beyond that what the teachers were allotted.

relational self-efficacy and served as a covariate in the analyses that used post-intervention measures of relational self-efficacy as a dependent variable.

Teachers completed an eight-item teacher relational self-efficacy scale (see Paper 1) immediately after the intervention on the initial survey (α = .80). The scale included items such as "How confident are you that you can build positive relationships with all your students?" and "To what extent do you feel capable of designing relationship building activities for your classroom?"

Finally, teachers completed the same eight-item teacher relational self-efficacy scale again on the final survey (α = .87). They also responded to a single item assessing their relational self-efficacy with each individual student in their Advisory: "How confident are you that you developed a strong relationship with [student] this year?" I included the student-level item because recent research suggests that teacher self-efficacy beliefs may differ depending on whether they are measured at the domain- or student-specific level (Zee, de Jong, et al., 2016; Zee, Koomen, et al., 2016).

Teachers' prioritizing the role of building TSRs. On the initial survey, prior to the intervention, teachers responded to a one item asking, "How much effort do you put into getting to know each of your students?" This item served as teachers' pre-intervention prioritization of the role of building TSRs. On the final survey, teachers completed a five-item scale assessing how much they prioritize the role of building TSRs in their practice (α = .72; Robinson, 2019). The scale included the same pre-intervention item, "How much effort do you put into getting to know each of your students?" as well as other items such as "How often do you devote prep time toward developing strategies for connecting with students?"

Teachers' and students' perceptions of the TSR. I borrowed, with minor adaptions, measures from Brinkworth and colleagues (2018) to measure perceptions of the TSR. Teachers evaluated their overall relationship with each student in their Advisory using an eight-item scale on the final teacher survey (e.g., "How friendly is [student] towards you?" and "How excited would you be to have [student] again next year?"; α = .91). Students in the teachers' Advisory completed a parallel, eight-item scale on the final student survey (α = .93). Students also completed one item about how much of a priority they thought building TSRs was for their Advisory teacher, "How important do you think building strong relationships with students is for [teacher]?"

To have corresponding premeasures, students completed the eight-item scale on their initial student survey at the beginning of the semester (α = .92). Similarly, prior to the intervention on the initial teacher survey, teachers responded to one item on each of their Advisory students asking, "At this point in the year, how positive would you say your relationship is with [student]?"

Teachers' expectations for students. On the final survey, teachers answered one-item assessing how high their expectations were for each of their Advisory students: "How much potential do you think [student] has to succeed in college?" Teachers responded on a 7-point scale ranging from "well below average potential" (1) to "well above average potential" (7).

Interest in TSR-related professional development. The last question on the final survey asked teachers to select the professional development session topic they would most like to attend at the beginning of the next school year. Teachers could choose between three options: (1) a session that covers new technologies for teachers, (2) a session on new ways to deliver content to student, or (3) a session identifying new strategies for building positive relationships with

students. I coded the TSR-related professional development session as "1" and the other two sessions as "0."

Student grades and attendance. The school provided student semester grades and the number of absences students incurred during the semester the study took place. The semester grades were provided as a percentile score out of 100. I took an average of students' percentile scores to calculate their average semester grade percentile score. Student attendance was measured in full-day absences.

Procedures

The intervention occurred during the final semester of the 2018-19 school year. Shortly after the semester started (beginning March 2019), teachers introduced the study to their Advisory students and asked them to complete the first student survey. The initial student survey collected students' beginning-of-semester perceptions of their TSRs with their Advisory teacher, demographic information, as well as a host of other exploratory measures.

Teachers completed the initial teacher survey within the first two weeks of the semester. The first part of the teacher survey included the pre-intervention items used as covariates in my analyses (i.e., single items assessing teachers' beginning-of-semester relational self-efficacy, prioritizing the role of building TSRs, and perceptions of the TSR with individual Advisory students). The crux of the intervention occurred after completing the premeasures. At this point, teachers read directions telling them they were going to reflect on either TSRs (the treatment group) or delivering content in students' preferred learning styles (the control group). After the three-part intervention activity, teachers then completed the teacher relational self-efficacy scale and the demographic items. Four- to five-weeks after teachers took the initial survey, I sent teachers in both conditions a booster shot in the form of a Teacher Reflection Packet which

included their intervention activity responses. The booster shot encouraged teachers to reflect upon their answers and participate in a brief, voluntary mid-point survey (39 out of 52 participating teachers completed the survey).[8]

During the final weeks of the semester, students and teachers took a final survey. Students answered questions about their experiences in Advisory and with their Advisory teacher. Teachers answered questions about their teaching experiences, including questions about each student in their Advisory, as well as prioritizing the role of building TSR and relational self-efficacy measures.

Analytic Plan

Preregistered analysis plan. To assess my hypotheses, I employed Fisher Randomization Tests (FRT) to obtain exact *p*-values for the null hypotheses of no impact for each of my primary outcome variables (Athey & Imbens, 2017). I used 98.3% confidence intervals to evaluate my tests, which corresponds to a critical *p*-value of .017 and accounts for testing three hypotheses. In line with Cumming's (2014) recommendation, I assess my hypotheses by presenting and discussing confidence intervals and effect sizes, in addition to *p*-values.

To evaluate my first two hypotheses (that the treatment will increase teachers' relational self-efficacy (*H1),* and prioritizing the role of building TSRs (*H2)*), I used the following model:

$$(1) \qquad Y_t = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \alpha_s + \varepsilon_t,$$

[8] While all of the activities were voluntary (i.e., teacher participants could choose not to participate at any time), teachers had to complete the beginning- and end-of-semester surveys to quality for the compensation. The midpoint survey was not tied to receiving compensation.

where Y_t is the teacher-level outcome, $Treatment_t$ is an indicator that teacher *t* was exposed to the treatment condition, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, the grade level teachers report teaching, teachers' pre-intervention overall assessment of their TSRs *(H1 only)*, and teachers' pre-intervention assessment of their relational self-efficacy *(H1 only)*, teachers' pre-intervention prioritizing of the role of building TSRs *(H2 only)*), α_s is a school fixed effect, and ε_t is a classroom-level residual.

To evaluate my third hypothesis (that the treatment will improve teachers' perceptions of their TSRs), the model changes slightly:

$$(2) \qquad Y_{it} = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + \varepsilon_{it},$$

where all indicators remain the same except Y_{it} is the teacher-student dyad level outcome, $\boldsymbol{X}_t$ also includes teachers' pre-intervention assessment of their TSRs with each student, $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender), and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

Exploratory analyses. I also conducted several analyses to explore how the treatment may have impacted teacher and student outcomes. For these, I use 95% confidence intervals to assess the treatment impact on the teacher-level (equation 1) and teacher-student dyad level (equation 2) outcomes. For ordinal outcomes (e.g., teachers' relational self-efficacy with individual students), I present the point estimates from OLS regression models for ease of interpretation, but these mirror the estimates from the ordinal logistic models.

First, I evaluated whether the treatment impacted teachers' relational self-efficacy at the end of the semester toward *individual* students. Second, I tested my exploratory hypothesis that students of teachers assigned to the treatment group would report more positive TSRs at the end

of the semester. Third, I investigated whether the treatment had an impact on other outcome measures, including teachers' expectations of their students, teachers' appetite for a TSR-related professional development the following year, student semester grades, and student semester absences. Fourth, I conducted a mediation analysis exploring if teachers' relational self-efficacy mediated the treatment effect on teachers' perceptions of the TSR. Finally, I conducted analyses to determine if there was heterogeneity in the treatment effect. Specifically, I looked at whether the treatment differentially impacted outcomes by teacher characteristics (i.e., gender, the number of years teachers taught, and grade level) and student characteristics (i.e., gender and race). In these analyses, I added a *Treatment x Characteristic* interaction term to the relevant model.

Results

Baseline Equivalence and Descriptive Statistics

I checked to ensure the treatment and control groups were balanced across teacher-level (i.e., gender, years taught, grade level) and student-level (i.e., gender, grade level, race) covariates. Random assignment appeared to work as neither the teacher-level covariates nor the student-level covariates jointly predicted treatment assignment, $LR\ \chi^2(3, n = 52) = 0.49$, $p = .92$ and $LR\ \chi^2(8, n = 589) = 6.29$, $p = .62$, respectively. In the final sample, 26 teachers and their 294 students were assigned to the control group and 26 teachers and their 295 students to the treatment group, $LR\ \chi^2(1, n = 589) = 0.002$, $p = .97$.

It does not appear that there was differential student engagement in the study by condition. Eighty percent of students assigned to treatment teachers completed the initial student semester survey (vs. 85% of students assigned to control teachers), $\chi^2(1) = 1.94$, $p = .16$.

Similarly, 72% of treatment students and 73% of control students completed the final student survey, $\chi^2(1) = 0.09$, $p = .76$.

In Table 2.1, I present descriptive statistics for the main variables of interest: teachers' relational self-efficacy, teachers' prioritizing of the role of building TSRs, and teachers' and students' perceptions of the TSR. The average Advisory class size was 11.3 students (*SD* = 1.9), with the smallest enrolling four students and the largest, fifteen students.

Prespecified Hypotheses

Table 2.2 presents the average treatment effect across several outcomes. My first prespecified hypothesis was that the treatment would increase teachers' relational self-efficacy both immediately post-intervention and at the end of the semester (H1). I do not find evidence that the treatment instantly increased teachers' self-reported relational self-efficacy, FRT *p* = .197 (Table 2.2, Column 1). However, as Figure 2.1 illustrates, treatment does appear to increase teachers' relational self-efficacy over the course of the semester, *B* = 0.14, *SE* = 0.13, 98.3% CI [0.01, 0.64], FRT *p* = .017; *Cohen's d* = 0.64.

Second, I evaluated whether the treatment increased the extent to which teachers prioritized the role of relationship-building at the end of the semester (H2). The treatment did not appear to impact teachers' prioritization of the role of building TSRs, FRT *p* = .417 (Table 2.2, Column 4).

Finally, I predicted that the treatment would improve teachers' perceptions of their TSRs (H3). Compared to the control group, teachers reported more positive relationships with students at the end of the semester, *B* = 0.27, *SE* = 0.09, 98.3% CI [0.06, 0.49], FRT *p* = .005; *Cohen's d* = 0.39. Column 5 of Table 2.2 and Figure 2.2 illustrate the difference between conditions. In sum, I found evidence for my hypotheses that teachers' relational self-efficacy and teachers'

Table 2.1. Descriptive Statistics and Correlation Matrix for Main Variables

				Teacher								Student
				Relational Self-Efficacy				Prioritizing Role of Building TSRs		TSR		TSR
	n	*M*	*SD*	Pre-intervention (1)	Post-intervention (2)	End-of-semester (general) (3)	End-of-semester (individual) (4)	Pre-intervention (5)	End-of-semester (6)	Pre-intervention (7)	End-of-semester (8)	Pre-intervention (9)
Teacher: Relational Self-Efficacy												
Pre-Intervention	52	4.25	*0.68*									
Immediately Post-Intervention	52	4.04	*0.46*	.53***								
End-of-semester (general)	52	4.15	*0.53*	.48***	.59***							
End-of-semester (with individual students)	499	3.96	*1.02*	.14*	.19*	.26*						
Teacher: Prioritizing Role of Building TSRs												
Pre-Intervention	52	4.42	*0.5*	.37**	.42**	.35*	.14**					
End-of-semester	52	4.13	*0.45*	.41**	.37**	.54***	.19***	.53***				
Teacher: Perception of the TSR												
Pre-Intervention	589	3.89	*0.9*	.16***	.34*	.24*	.61***	.13**	.22***			
End-of-semester	589	3.87	*0.72*	.09*	.18*	.32*	.82***	.17***	.23***	.59***		
Student: Perception of the TSR												
Pre-intervention	480	4.21	*0.74*	.19***	0.19***	.15***	.39***	.07	.08+	.33***	.42***	
End-of-semester	424	4.07	*0.8*	.28***	.20***	.28***	.33***	.14**	.15**	.32***	.44***	.72***

Notes: The bolded variables are those tested in the prespecified hypotheses. The italicized variables are used as covariates in the prespecified analyses. The end-of-semester (with individual students) relational self-efficacy measure has only 499 students because the question was not presented to 8 teachers due to a programming glitch.

Table 2.2. Average Treatment Effects on Primary Outcomes

	Teacher					Student
	Relational Self-Efficacy					
	Immediately Post-intervention	End-of-semester (general)	End-of-semester (individual students)	End-of-Semester Prioritizing the Role of Building TSRs	End-of-Semester TSR	End-of-Semester TSR
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	0.14 (-0.13 - 0.42)	0.32* (0.01 - 0.64)	0.37** (0.15 - 0.60)	-0.09 (-0.36 - 0.18)	0.27** (0.06 - 0.49)	0.06 (-0.06 - 0.18)
Observations	52	52	499	52	589	374

Notes: Confidence intervals in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1
Columns 1, 2, 4, & 5 show 98.3% confidence intervals; Columns 3 & 6 show 95% confidence intervals
Columns 3, 5 &, 6 control for student gender and use robust standard errors clustered at the classroom level
Columns 1-3 control for teachers' pre-intervention general perception of their TSRs and pre-intervention relational self-efficacy
Column 4 controls for teachers' pre-intervention prioritizing of the role of building TSRs
Columns 5 & 6 control for teachers' and students' pre-intervention perceptions of the TSR, respectively

Figure 2.1. Average Treatment Effect on Teachers' End-of-Semester Relational Self-Efficacy

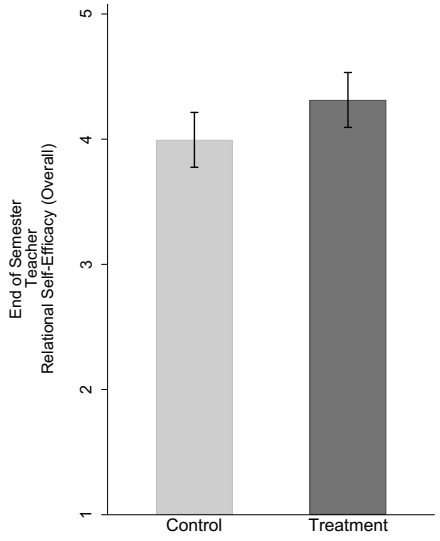
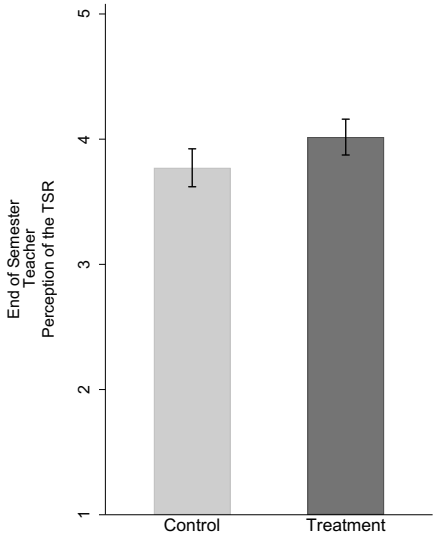


Figure 2.2. Average Treatment Effect on Teachers' End-of-Semester Perception of their TSRs



Notes: Error bars represent 98.3% confidence intervals.

perceptions of their TSRs would increase compared to teachers in the control condition at the end of the semester.

Exploratory Analyses

Additional Measure of Teachers' Relational Self-Efficacy. Teachers conveyed how confident they felt developing relationships with individual students in their Advisory. Echoing the results from teachers' overall end-of-semester relational self-efficacy (H1), treatment teachers did indeed report feeling more efficacious in their relationships with their individual Advisory students than control teachers, $B = 0.37$, $SE = 0.11$, 95% CI [0.15, 0.60], FRT $p = .008$; *Cohen's d* = 0.84 (Table 2.1, Column 3).

Student perceptions of the TSR. I was interested in whether students' perceptions of their TSRs changed depending on whether their Advisory teacher was assigned to the treatment group. While the treatment enhanced teachers' perceptions of their relationships with students, I found no evidence that it does the same for students. Students of treatment teachers did not report more positive relationships at the end of the semester than students of control teachers, FRT $p = .385$ (Table 2.1, Column 6). In spite of that, students did appear to notice a change in how teachers perceived TSRs in their practice. Students reported that building strong relationships with students was more important for teachers in the treatment group than teachers in the control group, $B = 0.19$, $SE = 0.08$, 95% CI [0.01, 0.36], FRT $p = .027$; *Cohen's d* = 0.39.

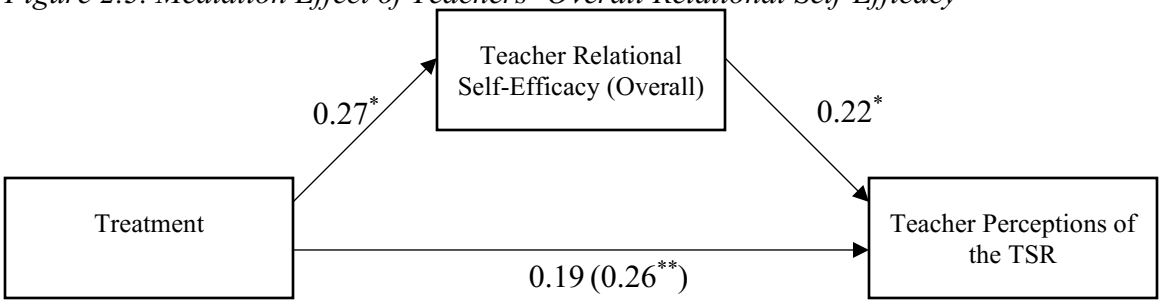
Additional Outcome Measures. I collected additional variables that allowed me to examine whether the treatment impacted any other teacher or student outcomes. In particular, I was interested in whether the relational self-efficacy treatment affected teachers' expectations for their Advisory students, their interest in attending a TSR-related professional development session the following year, student semester absences, and student semester grades.

Compared to teachers in the control group, treatment teachers had higher expectations that their Advisory students would succeed in college, $B = 0.37$, $SE = 0.17$, 95% CI [0.02, 0.72], FRT $p = .061$; *Cohen's d* = 0.24. Additionally, 65% of treatment teachers reported wanting to attend a TSR-related professional development session the following year compared to only 38% of control teachers, $B_{logit} = 1.30$, $SE = 0.63$, 95% CI [0.05, 2.54], FRT $p = .057$. Teacher in the learning styles control condition were equally likely to report wanting to attend a professional development session focused on TSRs (38%), learning styles (35%), or new technologies (27%). Finally, I found no differences in students' semester absences ($B = 0.83$, $SE = 0.85$, 95% CI [-0.87, 2.52], FRT $p = .349$) and grades ($B = 0.31$, $SE = 0.67$, 95% CI [-1.04, 1.66], FRT $p = .662$) based on the condition to which their Advisory teacher was assigned.

Mediation Analysis. With evidence that teachers in the treatment condition increased their perceptions of their TSRs, I sought determine if this effect was mediated by an increase in teachers' relational self-efficacy. I conducted a mediation model to assess whether teachers' overall perceptions of their relational self-efficacy at the end of the semester could explain why teachers experienced more positive TSRs. Figure 2.3 shows that teachers' overall perceptions of relational self-efficacy partially mediates the treatment effect on teachers' perceptions of the TSR. The increase in teachers' relational self-efficacy explains 24% of the total treatment effect on teachers' perceptions of their TSRs.

Heterogeneity Analysis. To learn more about the association between teachers' relational self-efficacy and teacher and student relational outcomes, I conducted several heterogeneity analyses. Specifically, I explored whether the treatment was more or less effective based on several teacher characteristics (gender, number of years teaching, and the grade level they currently teach) and student characteristics (gender and race).

Figure 2.3. Mediation Effect of Teachers' Overall Relational Self-Efficacy



* $p < .05$, ** $p < .01$, *** $p < .001$

Notes: This model presents regression coefficients for the association between the treatment and teacher perceptions of their TSRs as mediated by teachers' overall relational self-efficacy. The regression coefficient between the treatment and teacher perceptions of the TSR is in parentheses. Both regression models controlled for teacher and student gender, years taught, grade level, and relevant pre-intervention measures (i.e., relational self-efficacy and teacher perceptions of TSRs).

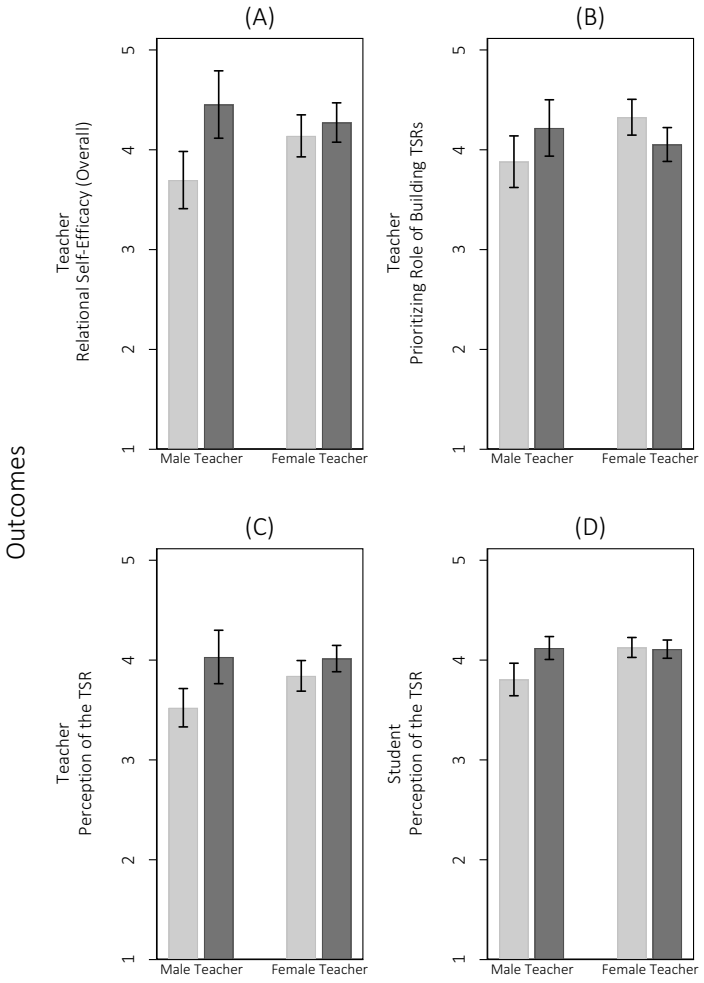
Panels A-E in Table 2.4 show the seven interaction term estimates on my primary outcomes: teachers' relational self-efficacy (immediately post-intervention and at the end of the semester), teachers' prioritizing of the role of building TSRs, teachers' perceptions of the TSR, and students' perceptions of the TSR.

I found no evidence of treatment effect variation on any of these outcomes by grade level, student gender, or student race. Teacher gender does appear to moderate the treatment effect on teachers' end-of-semester relational self-efficacy, teachers' prioritizing of the role of building TSRs, and teachers' and students' perceptions of the TSR (Table 2.3, Column 1; Figure 2.4, Panels A-D). Male teachers in the treatment condition had end-of-semester relational self-efficacy scores that were 0.75-points higher, on average, than male teachers in the control group. Comparatively, female teachers in the treatment condition had relational self-efficacy scores only 0.13-points higher than those in the control conditions, $B = -0.62$, $SE = .26$, $p = .019$. This corresponded to male teachers in the treatment condition prioritizing the role of building TSRs more ($B = -0.61$, $SE = 0.22$, $p = .009$), perceiving more positive TSRs ($B = -0.34$, $SE = .19$, $p =$

.088), and having students who perceived more positive TSRs (B = -0.33, SE = .12, p = .007) than female teachers in the treatment condition.

The treatment also appeared to have a larger effect on teachers' prioritizing the role of building TSRs for early career teachers than experienced teachers, B = -0.04, SE = 0.01, p = .007. The early career teachers in the treatment group reported prioritizing the role of building TSRs more than those in the control group while the reverse is true for experienced teachers.

Figure 2.4. Average Treatment Effect by Teacher Gender



Notes: Error Bars represent 95% confidence intervals.
Control = Light Gray Bars
Treatment = Dark Gray Bars

Table 2.3. Heterogeneity Analyses.

	Teacher			Student	
	Female (vs. Male) (1)	Years Teaching (2)	Grade Level (3)	Female (vs. Male) (4)	Student of Color (vs. White Student) (5)
Panel A: Teacher Relational Self-Efficacy (Immediate Post-Intervention)					
Teachers' Relational Self-Efficacy x Moderator	-0.24	-0.03+	0.03		
	(-0.71 - 0.23)	(-0.06 - 0.00)	(-0.08 - 0.14)		
Observations	52	52	52		
Panel B: Teacher Relational Self-Efficacy (End-of-Semester)					
Treatment x Moderator	-0.62*	-0.01	-0.05		
	(-1.14 - -0.11)	(-0.05 - 0.02)	(-0.17 - 0.08)		
Observations	52	52	52		
Panel C: Teacher Prioritizing Role of Building TSR					
Treatment x Moderator	-0.61**	-0.04**	0.01		
	(-1.06 - -0.16)	(-0.07 - -0.01)	(-0.11 - 0.12)		
Observations	52	52	52		
Panel D: Teacher Perception of the TSR					
Treatment x Moderator	-0.34+	-0.00	-0.05	-0.04	0.07
	(-0.72 - 0.05)	(-0.03 - 0.02)	(-0.14 - 0.05)	(-0.26 - 0.19)	(-0.19 - 0.33)
Observations	589	589	589	547	502
Number of Clusters	52	52	52	52	52
Panel E: Student Perception of the TSR					
Treatment x Moderator	-0.33**	-0.01	-0.04	0.03	0.22
	(-0.57 - -0.10)	(-0.02 - 0.01)	(-0.11 - 0.02)	(-0.21 - 0.27)	(-0.13 - 0.57)
Observations	374	374	374	360	324
Number of Clusters	47	47	47	47	47

95% confidence intervals in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Discussion

Teachers play a key role in students' educational experiences (Chetty, Friedman, & Rockoff, 2014; Liu & Loeb, 2019; Wentzel, Battle, Russell, & Looney, 2010). And scholars consider teacher self-efficacy beliefs to be among the most powerful influences on teachers' receptivity to change (Tschannen-Moran & McMaster, 2009). Yet education improvement

efforts often fail to consider how teachers' beliefs might influence the outcomes they intend to improve (Fives & Buehl, 2012). Given the robust research on the importance of TSRs, I explored whether teachers' relational self-efficacy beliefs can be increased and if doing so changes teachers' perceptions of their relationships with students. Specifically, I designed an intervention to enhance teachers' confidence in their relationship-building with students and assessed whether it resulted in improvements in their relational self-efficacy, how much they prioritize the role of building TSRs in their practice, and their perceptions of their TSRs.

The Impact of the Teachers' Relational Self-Efficacy Intervention

While the intervention did not immediately increase teachers' relational self-efficacy, it did appear to improve over the course of the semester: teachers who completed the treatment activity reported relational self-efficacy beliefs that were two-thirds of a standard deviation higher at the end of the semester.

The current design does not allow me to explore what mechanisms might be at play, but there are a few plausible reasons why the intervention may have a delayed effect on teachers' relational self-efficacy. First, an abstract activity aimed at increasing confidence in relationship-building behaviors may not be enough to change self-efficacy beliefs. Perhaps teachers needed to engage with students before their efficacy beliefs actually changed. This interpretation aligns with social cognitive theory, which posits that there is a reciprocal association between self-efficacy in a domain and specific experiences in that domain (Bandura, 1997). For instance, prior research shows that the consequences of teachers' self-efficacy beliefs tend to become more evident as they gain experience (Zee & Koomen, 2016). In this case, as teachers' bolstered relational self-efficacy supports their successful implementation of a new TSR-building strategy,

the implementation experience becomes a mastery experience that contributes to future relational self-efficacy assessments (Tschannen-Moran & McMaster, 2009).

Second, and relatedly, the relational self-efficacy intervention might have sparked a recursive process that resulted in downstream changes in beliefs (Cohen & Garcia, 2008; Walton, 2014). For example, while teachers may not have experienced an immediate bump in their relational self-efficacy beliefs, completing the treatment activity might have prompted them to reflect on their interactions with their students and highlight their successes. Then these changes teachers' interpretations of their TSRs may lead to more confidence in teachers' TSR-building down the road. Third, the mid-semester booster shot—which encouraged teachers to review the responses they wrote during the intervention—may be partially responsible for the delayed appearance of the treatment effect. The initial activity only took about 20 minutes, so the additional exposure to the intervention materials very likely strengthened the effect of the treatment.

In addition to the rise in teachers' relational self-efficacy, the intervention improved teachers' perceptions of their TSRs at the end of the semester. Teachers who completed the relational self-efficacy treatment reported a 0.4-standard deviation increase in perceptions of their relationships with their Advisory students than control teachers. The mediation analysis suggested that the increase in teachers' perceptions of their TSRs was at least partially due to the treatment increasing teachers' relational self-efficacy beliefs. However, these data were collected at the same time so additional research is warranted.

While the intervention changed teachers' own perceptions of their TSRs, I did not find support for my exploratory hypothesis that the intervention would change *students'* perceptions of their TSRs. Students appeared to perceive equally positive TSRs with treatment and control

teachers at the end of the semester. However, students may have inferred changes in teachers' perceptions or behaviors as a result of the intervention. Students of teachers in the treatment group reported that their Advisory teachers valued building relationships with students more than students of control teachers (even if it did not change their own perceptions of the TSR).

Given research to date suggests that it is principally the teachers' views that correlate with students' academic outcomes (Brinkworth et al., 2018; Robinson et al., 2019), understanding how to increase teachers' perceptions of their TSRs matter. Whether intentionally or not, teachers make decisions that promote or hinder a relationship with a given student (Muller, 2001). Research on self-efficacy suggests that teachers will engage in relationships with students with whom they expect their efforts will be successful. Teachers tend to believe they will be most successful at building positive relationships with high-performing students (Muller, 2001), so they may underinvest in cultivating relationships with low-performing students who likely need their support the most. Thus, increasing teachers' confidence in their ability to build TSRs could have important implications for teachers' perceptions of their TSRs with low-performing students or those whom they perceive to be difficult (Paper 1). A logical next step will be to consider whether interventions can increase teachers' relational self-efficacy with individual students, in addition to their confidence in building relationships with students in general, and explore the subsequent impact on TSRs (e.g., Zee, de Jong, et al., 2016; Zee, Koomen, et al., 2016). This may allow for more targeted interventions that result in improvements in at-risk students' academic performance (Gehlbach et al., 2016).

Additionally, I failed to find evidence for my prespecified hypothesis that treatment teachers would prioritize the role of building TSRs more than their control counterparts at the end of the semester. More research is needed, but it is possible that providing teachers with

dedicated time to reflect upon TSRs allowed them to more seamlessly embed TSR-promoting into their everyday practice, and therefore they did not perceive themselves giving additional weight to TSRs. Or, perhaps, the light-touch intervention increased teachers' beliefs about their TSR-building abilities and their perceptions of their TSRs over the course of the semester, but the treatment was not strong enough to alter how they structured their practice or to overcome external pressures (e.g., to raise test scores). This latter explanation may justify why students reported that treatment teachers valued TSRs more than control teachers, but that did not translate into actually experiencing more positive TSRs. Future research should consider how self-efficacy beliefs contribute to how people prioritize the many roles they are expected to embody in a specific domain.

Teacher Expectations, Information-Seeking, and Student Academic Outcomes

My exploratory analyses shed light on other outcomes that the relational self-efficacy intervention did and did not impact. First, the activity increased teachers' expectations for their Advisory students. Specifically, treatment teachers had one-quarter of a standard deviation higher expectations for their Advisory students' college success. Teachers' expectations can have profound impacts on student academic trajectories (Gershenson, Holt, & Papageorge, 2016; Papageorge, Gershenson, & Kang, 2016; Rosenthal & Jacobson, 1968; Szumski & Karwowski, 2019), so drawing a causal link between the present intervention and teachers' expectations for their students will be of interest to scholars and practitioners alike.

Second, teachers who engaged in the relational self-efficacy activity were more likely to express interest in a TSR-related professional development session. Sixty-eight percent of teachers assigned to the treatment group selected learning new strategies for cultivating positive TSRs as their first-choice professional development session, compared to only 38% of control

teachers. Theoretically, this is what we would expect from an increase in teachers' relational self-efficacy: teachers with more confidence in their TSR-building abilities will be more likely to seek out opportunities that promote positive TSRs (as I suggested in Paper 1). This finding provides some preliminary evidence that targeting teachers' beliefs may be a first step to successfully implementing interventions to improve TSRs, in general.

Finally, the intervention did not have any impact on students' semester grades or absences. Students do not receive a grade from their Advisory teachers, so it was not particularly surprising that the Advisory teacher-focused intervention did not impact student academic performance in the semester it took place. It is slightly more plausible that Advisory teachers could exert influence over student absences (because Advisory teachers are often the first point of contact when students are absent), but there is no evidence that the intervention contributed to the number of days students missed. I hope a future iteration of this intervention enlists core subject teachers and look at changes in course-related outcomes, including grades and motivation.

The Moderating Role of Teacher- and Student-Level Characteristics

The heterogeneity analyses provide additional insights into how the intervention functioned based on different teacher- and student-level characteristics. To start, the relational self-efficacy activity appeared to be generally more effective for male teachers than female teachers. At the end of the semester, male teachers in the treatment group were more likely to report higher levels of relational self-efficacy, prioritizing the role of building TSRs more, and more positive perceptions of their TSRs. The students of male teachers in the treatment group were also more likely to report more positive TSRs compared to male teachers in the control group, whereas students of female teachers reported equally positive relationships with teachers

in both conditions. At this point we do not know why male teachers may be more responsive to the intervention, but future studies should explore the mechanisms underlying gender differences in relational self-efficacy. It is worth exploring further, given that prior research suggests relational self-efficacy may be more consequential for female teachers' TSRs (detailed in Paper 1). From a gender perspective, this sets up an interesting tension for future research on relational self-efficacy to pursue as women are typically stereotyped as being more focused on relationships (Hargreaves, 1998; Noddings, 1992) and men tend to be more confident (Lundeberg, Fox, & Punćcohaŕ, 1994). Perhaps male teachers, who may assume relationships are less their domain than female teachers, are especially responsive to interventions that increase their confidence in relationship-building.

It seemed plausible that teachers' experience in the classroom might also moderate the treatment effect. In general, it appeared that the number of years experience teachers reported did not differentially impact the quality of the TSRs for treatment versus control teachers. However, there is suggestive evidence that early career teachers in the treatment group reported higher relational self-efficacy and prioritized the role of building TSRs more as a result of the intervention. Conversely, more experienced teachers in the treatment group had lower relational self-efficacy and prioritized the role of building TSRs less than teachers in the control group. One way to interpret these findings would be that teachers who have more teaching experience are less responsive to interventions attempting to increase relational self-efficacy because they have more established (and less malleable) relationship-building practices. In general, teachers' self-efficacy increases over their career (Fives & Buehl, 2009) and they have more real-world experience to inform their beliefs, so it may become more difficult to intervene upon.

Limitations

The present study has several limitations which I hope can be addressed in future research. First, as alluded to at the beginning of the Discussion section, I do not know why the treatment activity bolstered teachers' relational self-efficacy at the end of the semester but did not do so immediately post-intervention.[9] There are several plausible theories, which only can be disentangled by re-designing and replicating the intervention. For instance, classroom observations or qualitative interviews might provide additional insights into how the intervention impacts teachers' perceptions and behaviors over the course of the semester.

Second, the treatment activity was designed to maximize the likelihood of increasing teachers' relational self-efficacy and targeted all four sources of self-efficacy. Therefore, I cannot discern if certain aspects of the activity or sources of self-efficacy were more effective than others. A next iteration of this study might vary which portions of the activity teachers complete to determine whether one section (or particular source) drives the increases relational self-efficacy and perceptions of TSRs, or if all three sections work in tandem to increase teachers' confidence in building TSRs.

Third, we need more research to understand whether these findings with generalize to the broader population of students. While many public schools implement Advisory periods, the fact that the study took place at a charter school and a regional magnet school naturally brings the external validity of these results into question. While the two school sites are relatively typical of

[9] Paper 3 explores at least one possibility

urban schools when it comes to demographics and academic performance, a critical next step will be to replicate these findings with a larger sample of teachers and students across a diverse group of schools (i.e., public, private, charter, magnet, and so on).

Fourth, the mediation analysis suggested that the increase in teachers' perceptions of their TSRs was at least partially due to the treatment increasing teachers' relational self-efficacy beliefs. However, teachers' relational self-efficacy and their perceptions of their TSRs were measured at the same time. Identifying mediating mechanisms is a life-long pursuit that cannot be uncovered through single studies (Bullock, Green, & Ha, 2010). But subsequent studies can explore how teachers' relational self-efficacy changes over time, which will help to expose the underlying mechanisms.

Fifth, teachers' beliefs in their abilities to repair relationships with students may be particularly important for improving TSRs with students who have behavior issues or who are frequently in trouble. This study does not explicitly measure or target teachers' beliefs in their ability to repair relationships, despite is being a key aspect of teachers' relational self-efficacy. A next step in this research should explore the extent to which teachers can get a relationship back on the right track.

Finally, the intervention was implemented during the final semester of the school year. At this point, teachers and students have interacted for several months and likely have entrenched perceptions of their TSRs. This might result in muted treatment effects as compared to if the intervention were launched at the beginning of the school year, when teachers and students are just embarking on building their relationships for the year. Future research will hopefully determine if there are optimal times during the school year to intervene upon relational self-efficacy beliefs.

Conclusion

To date, there is little experimental research evaluating strategies for improving TSRs. I provide causal evidence that an activity aimed at increasing teachers' relational self-efficacy can result in teachers gaining confidence in their TSR-building abilities and perceiving more positive relationships with their students. Given that teaching is fundamentally a social enterprise between teachers and students and TSRs robustly predict student outcomes, teachers' relational self-efficacy may have enormous implications for how we train and support teachers. The mere act of bolstering relational self-efficacy may help teachers perceive stronger relationships with their students. This research is a promising first step toward developing stronger interventions targeting teachers' relational self-efficacy beliefs in the service of improving teacher-student relationships and other valued educational outcomes.

Paper 3: Moving from the Field to the (Online) Lab: A Follow-up Survey Experiment Investigating Teachers' Relational Self-Efficacy

Understanding *why* an intervention works—or does not work—is often just as important as whether it works. You will hear calls to "open the black box or "look under the hood" in order to identify an intervention's components that brought about the results (Bloom, 2005; Cook, 2003; Imai, Keele, Tingley, & Yamamoto, 2011). In disciplines like psychology, where research is often conducted in a lab or online, altering a study condition or identifying a mechanism might just involve recruiting more participants to conduct another, slightly modified study. But, in an applied field like education, field studies are resource-intensive and re-running a study with a "tweaked" design to test a theory or potential mechanism is often unrealistic from a logistical and cost standpoint.

In this paper, I take a preliminary step towards opening the black box of the relational self-efficacy intervention. Paper 2 of this dissertation reports on an intervention designed to increase teachers' confidence in their ability to build TSRs and measure the impact on teachers' relational self-efficacy and the quality of their TSRs. Compared to teachers in the control condition, teachers in the treatment condition reported higher relational self-efficacy beliefs and more positive TSRs months after the intervention took place. However, there was no difference in teachers' relational self-efficacy beliefs immediately after the intervention.

Initially, I planned to conduct a mechanism study in which I varied which portions of the activity teachers completed. Doing so would allow me to determine whether one section (or particular source of self-efficacy) caused immediate increases in teachers' relational self-efficacy, or if all three sections work in tandem to increase teachers' confidence in building

TSRs. But, in order to do so, I would first need to understand why the treatment did not appear to immediately boost teachers' relational self-efficacy beliefs compared to the control group.

The purpose of this paper is twofold. First, as delineated above, I wanted to explore why the treatment activity—which was explicitly designed to increase teachers' relational self-efficacy—did not immediately do so. In this study, I focus in particular on the choice of the control group and do so in an online laboratory. Second, and more generally, I use this example to more broadly propose that educational researchers take advantage of relatively inexpensive and easy-to-recruit participants to add context to large, resource intensive field studies.

Moving from the Field to the (Online) Laboratory

There are many reasons to be skeptical that laboratory-based studies will replicate in educational settings. While an intervention conducted in a lab can rule out confounding influences on the outcome, schools are unpredictable and variable making it reasonable to question how effective the intervention will be in an actual school (Hulleman & Cordray, 2009). Fortunately, researchers are increasingly moving from the laboratory to the field to conduct experiments evaluating educational interventions with actual teachers and students.

Yet, this shift to field studies does not come without drawbacks. Partnering with schools and districts to conduct studies that are jointly beneficial takes time, resources, and effort. And even then, many well-designed studies will fail to produce meaningful results because of a snow day in the middle of data collection or teachers cannot dedicate the time required to implement an intervention with fidelity (Hulleman & Cordray, 2009; Murrah, Kosovich, & Hulleman, 2017). With this in mind, it makes sense to design an intervention to be as strong as possible in order to increase the likelihood an intervention will impact student and teacher outcomes. This rationale results in many educational interventions taking a "kitchen sink" approach—tossing in

as much as possible to bolster the treatment. When that happens, we may know that some combination of activities resulted in improved outcomes, but we often cannot identify the active ingredient. For example, I designed the relational self-efficacy field experiment to target four sources theory suggests will increase self-efficacy beliefs. But, in making that choice, I limited my ability to determine if teachers increased their relational self-efficacy by reflecting on mastery experiences, learning vicariously from other teachers, or developing their own strategy for building TSRs.

In the same way, when field studies are implemented successfully unanticipated results can leave researchers only hypothesizing what happened. Consider the relational self-efficacy field experiment: I was operating under the assumption that if the relational self-efficacy treatment failed to immediately increase teachers' relational self-efficacy beliefs, there would be no impact on teachers' long-term relational self-efficacy beliefs. Of course, my assumption was wrong, and the study was not designed to understand what may have resulted in the delayed treatment effect. There are many potential explanations for this finding. Did I select the wrong control activity? Does increasing relational self-efficacy require teachers to actually interact with students? Was the mid-semester "booster shot" (where I provided teachers with their responses to the intervention prompts) a necessary feature? The list goes on.

As researchers, we should not be surprised that the data may surprise us. And, despite our best laid plans, we often cannot predict the ways in which we might be surprised. We also often have to make study design decisions that, necessarily, will not allow us to answer all our research questions. For instance, do you maximize the likelihood the intervention works or narrowly explore a single mechanism? Given the challenges and unpredictability of conducting educational field studies, I propose that educational researchers can complement field studies

with lab and online studies to address questions or issues that arise after a study has been conducted.

Thinking back to the discipline of psychology, many peer-reviewed articles present multiple studies to make their point or rule out competing theories. Running multiple studies is much easier done when participants can easily be recruited online or via undergraduate introductory psychology requirements. But, when hindsight reveals a field experiment had a design flaw or cannot discount a confounding variable, running it again is unlikely. Instead of explaining away the limitations, educational researchers may be able to design creative, follow-up studies that shed additional light on their findings. Amazon Mechanical Turk and Qualtrics Panels are popular outlets to recruit participants for studies, and education-specific organizations have recently emerged to provide researchers with these opportunities. For instance, the Character Lab Research Network connects researchers with actual schools and facilitates student-focused, online-based research studies. When it comes to teachers, Research Together provides an online network of teachers who signed up to participate in educational research. Studies using these samples will not be a panacea and the majority of lingering questions do indeed require additional field studies. However, small scale studies conducted online or in a lab offer a lower stakes way to test out hypotheses and tweak study designs, all in the service of improving future iterations of educational interventions to be tested in the field.

The Present Study

In the initial relational self-efficacy field experiment, I hypothesized that teachers who completed the relational self-efficacy treatment would have higher relational self-efficacy than teachers who completed the control activity immediately after the intervention took place. Contrary to my expectations, this was not borne out in the data. However, at the end of the

semester these treatment teachers did have higher relational self-efficacy than control teachers. Prior research suggests that it is plausible that delayed treatment effects, or "sleeper effects," may emerge long after the initial intervention (e.g., Belsky et al., 2007). The present online survey experiment aimed to unearth one potential explanation for the delayed emergence of the treatment effect. Specifically, I wanted to discern whether the control activity used in the field experiment unintentionally boosted teachers' confidence temporarily in their relationship-building abilities with students, thus suppressing the treatment effect immediately after the intervention.

The control activity in the field experiment focused on increasing teachers' self-efficacy in delivering content in students' preferred learning styles. This topic was chosen because students do not actually learn more when they are taught in their preferred learning styles (Nancekivell et al., 2019; Pashler et al., 2008). The rationale being that, even if teachers gained confidence in their abilities to teach to students' learning styles, any subsequent changes in beliefs or behaviors regarding learning styles would be unlikely to impact student outcomes.

But, upon reviewing the teachers' responses, the activity caused many teachers to think deeply about their students and reflect upon how they had been able to relate to them prior to the intervention. For instance, teachers often determined that a student might benefit if content was delivered in a particular way based on an interaction with a student. If that interaction was positive, this activity may have unintentionally resulted in teachers thinking about a time they successfully connected with a student and learned about them. To give an example, one teacher in the learning styles control condition described a prior experience inviting a small group of students to complete an activity afterschool. This teacher described how the more intimate setting allowed them to connect more effectively with individual students.

A key feature of the relational self-efficacy treatment involved teachers reflecting upon a mastery experience when they cultivated a relationship with a student, which social cognitive theory suggests would increase relational self-efficacy (Bandura, 1997). If teachers who partook in the learning styles control activity were recalling times when they adapted their teaching to specific students, it is very possible these experiences simultaneously elicited memories of a positive interaction with students.

To determine whether the learning style control activity unintentionally increased teachers' relational self-efficacy, I conducted a follow-up survey with U.S. teachers. I randomly assigned elementary, middle, and high school teachers to one of three conditions: the relational self-efficacy treatment condition, the original learning styles control condition, and a second control condition that focused on increasing teachers' confidence in their organizational skills. Immediately after completing the intervention, teachers completed a relational self-efficacy scale.

I had two, primary research questions:

(1) Do teachers assigned to the relational self-efficacy treatment condition report higher levels of relational self-efficacy as compared to those assigned to the learning styles control condition, immediately post-intervention?

(2) Do teachers assigned to the relational self-efficacy treatment condition report higher levels of relational self-efficacy as compared to those assigned to the organizational strategies control condition, immediately post-intervention?

Additionally, I looked at whether the treatment influenced the likelihood teachers requested more information on TSR-related resources.

Method

Intervention and Study Design

The survey experiment employed a 1x3 between-subject design. I randomly assigned teachers to one of three conditions:

Relational self-efficacy treatment condition: Teachers completed a three-part activity designed to increase their relational self-efficacy.

Learning styles control condition: Teachers completed a three-part activity designed to increase their self-efficacy in delivering content in students' preferred learning styles.

Organizational strategies control condition: Teachers completed a three-part activity designed to increase their self-efficacy in staying organized in their teaching practice.

The treatment and learning styles control conditions were both adapted from the field experiment (see Paper 2). The organizational strategies control condition was selected because pilot studies indicated asking teachers to reflect on their organization in their occupation tended not to evoke recollections about positive experiences with students.

Mirroring the field experiment, the three activities again targeted mastery experiences, vicarious experiences, verbal persuasion, and affective states to enhance self-efficacy beliefs in the specific domain (Bandura, 1997). In the first activity, teachers reflected on a time when they successfully connected with a student and answered questions about the interaction and how it made them feel. The learning styles control group focused on delivering content to students in their preferred learning style. In the new, organizational strategies control condition, teachers responded to equivalent prompts that reflected on a mastery experience (i.e., recollecting a time

they successfully carried out an organizational strategy in their teaching practice) and the affective components of the experience (i.e., how it made them feel).

In the second activity, teachers read four short testimonials from other teachers. In the treatment condition, teachers communicated their strategies for building positive TSRs. In the learning styles control condition, teachers imparted how they delivered content to students' preferred learning styles. Teachers in the organizational strategies control condition read testimonials from teachers who shared their strategies for staying organized in their teaching practice. Teachers ranked the strategies in order of how likely it was they would personally use them and received a more detailed description of one of the strategies, including learning why these approaches worked for them. The goal was to increase teachers' self-efficacy in that particular domain through vicarious experiences (i.e., learning about other teachers' approaches) and verbal persuasion (i.e., learning why these approaches worked for other teachers).

Finally, I asked teachers to outline their own strategy by responding to a series of questions to help break down the strategy into a series of management steps to explain how and why it works. Like the prior two activities, the conditions varied in their focus. The treatment teachers described a strategy for strengthening their relationships with difficult students. Teachers in the learning styles control condition gave an example of how they might teach to students in their preferred learning style. In the organizational skills control condition, teachers broke down a specific strategy to be more organized in their teaching practice. The directions made it clear that the research team hoped to share the participants' strategies with future teachers and that teachers who offered the best and most useful strategies would be awarded a bonus. In addition to leveraging the saying-is-believing phenomenon (Aronson et al., 2002; Klaas, 1978), this activity identified obstacles their strategy might face and proposed solutions

(Gollwitzer, 1999) and were going through a cognitive simulation of enacting a mastery experience in that particular domain.

Participants

With a goal of at least 40 teachers per condition, I recruited over 200 teacher participants on Amazon Mechanical Turk. Specifically, I posted a request for current U.S. schoolteachers (teaching grades 1-12) to complete a survey about their teaching and teaching experiences.

Three hundred ten participants entered the survey. I embedded a few questions intended to confirm that the participants were, indeed, current teachers who taught grades 1-12. On the first page of the survey, 48 participants were terminated because they indicated they were not a current teacher (n = 7) or they did not teach one of the eligible grades (n = 41). On the final page of the survey, I asked teachers to briefly describe the training they received to be a teacher. I coded the responses as either plausible (e.g., "Bachelor's degree in Education"; "Teach for America") or nonsensical[10] (e.g., "YES"; "25000"), and excluded participants who provided nonsensical responses (n = 106). The invalidity of these participants was further confirmed by coding their intervention responses (n = 105): they either wrote less than 300 characters across twelve open-ended items or copied and pasted responses they found on the internet. Finally, 11 participants took the survey twice (and were therefore excluded because they could be assigned to multiple conditions) and 22 participants did not complete the survey. This left a final sample of 123 valid participants.

[10] Many of the nonsensical responses were clearly bots completing the survey. For instance, this was a typical bot response when asked to describe their training to become a teacher: "All states require K-12 public school teachers to have at least a bachelor's degree. Kindergarten and elementary school teachers must hold a bachelor's degree in elementary education. ... High school teachers are also often required to have majored in a particular subject area."

I collected teachers' demographic information at the end of the survey. Fifty-seven percent of teachers identified as male while the remaining 43% identified as female. The final teacher sample was 76% White, 5% Hispanic/Latinx, 15% Black/African American, and 4% Asian American/Pacific Islander. The large number of White teachers mirrors the 82% of teachers nationally who identify as White (U.S. Department of Education, 2016). Over three-quarters of the teachers taught at a public school (76%), while 20% taught at a private school and the remaining 3% taught at a charter school or selected "Other." Sixty-three percent of the teachers taught high school or middle school and the remaining 37% taught elementary school. The average number of years teachers reported teaching was 5.64 (SD = 4.17) and 4.08 at their current school (SD = 2.77).

Measures

Teachers' relational self-efficacy. I measured teachers' relational self-efficacy twice on the survey. Prior to the intervention, teachers responded to one item asking, "How confident are you in your ability to form, maintain, and repair relationships with all your students?" As in the field experiment, this item served as a covariate in the analyses that used post-intervention measures of relational self-efficacy as a dependent variable. Immediately after the intervention, teachers completed the eight-item teacher relational self-efficacy scale (α = .89; Paper 1). I structured the survey items so that they were assessed on five-point Likert scales (e.g., 1 = "not at all confident" to 5 = "extremely confident").

Interest in additional TSR-related resources. The last question on the final survey asked teachers to select a topic they would most like to receive more information on. Teachers could choose between three options: (1) a strategy for collecting and managing student and administrative information through online forms, (2) a checklist for effective lecturing, or (3) an

online program with ideas to help improve teacher-student relationships. I coded the TSR-related topic as "1" and the other two topics as "0."

Procedures

The intervention was delivered to participating teachers using the Qualtrics survey platform. After consenting to participate in the study, the survey platform randomly assigned teachers to one of the three conditions. In all three conditions, teachers were told: "The goal of this session is to learn about your past experiences, your views on other teachers' experiences, and to solicit advice from you on the topic." Teacher participants were compensated $3.00 for completing the survey. Teachers who provided exemplary responses on the survey were also given a bonus of an addition $1.00.

The first part of the teacher survey included the pre-intervention items used as covariates in my analyses (i.e., single items assessing teachers' beginning-of-semester relational self-efficacy and perceptions of their current TSRs). Upon completing the premeasures, teachers read directions telling them they were going to reflect on either TSRs (the treatment condition), delivering content in students' preferred learning styles (the learning styles control condition), or staying organized (the organizational strategies control condition). After the three-part intervention activity, teachers then completed the teacher relational self-efficacy scale, other post-intervention measures, and the demographic items.

Analytic Plan

To answer my research questions, I conducted OLS regressions. I used 98.3% confidence intervals to evaluate the tests, which corresponds to a critical *p*-value of .017 and accounts for comparing three conditions. I used the following model:

$$(1) \qquad Y_t = \beta_0 + \beta_1 Condition_t + \boldsymbol{X}_t + \varepsilon_t,$$

where Y_t is the teacher-level outcome, $Condition_t$ is a categorical indicator that teacher *t* was exposed to the treatment condition (*Condition* = 1), the learning styles control condition (*Condition* = 2), or the organizational strategies control condition (*Condition* = 3), $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, the grade level teachers report teaching, teachers' pre-intervention overall assessment of their current TSRs, and teachers' pre-intervention assessment of their relational self-efficacy), and ε_t is a teacher-level residual.

I also explored if teachers were more likely to request supplementary resources on TSRs versus other, non-relationship focused teaching resources. For this outcome, I used a logistic regression model with the same covariates as the model detailed above.

Results

Baseline Equivalence and Descriptive Statistics

I checked to ensure the conditions were balanced across covariates. Random assignment appeared to work as the covariates (gender, years teaching, and grade level) did not jointly predict condition assignment, *LR* $\chi^2(3, n = 123) = 1.38$, $p = .71$. In the final sample, 45 teachers were assigned to the relational self-efficacy treatment condition, 39 teachers were assigned to the learning styles control condition, and 39 teachers were assigned to the organizational skills control condition, *LR* $\chi^2(2, n = 123) = 0.577$, $p = .75$. There was no differential attrition by condition, $\chi^2(2) = 1.26$, $p = .53$.

Across the entire sample, the pre- and post-intervention relational self-efficacy averages were $M = 4.02$ ($SD = 0.65$) and $M = 4.03$ ($SD = 0.58$), respectively. There was a moderate positive correlation between teachers' pre- and post-intervention relational self-efficacy, $r = .52$, $p < .001$. Finally, teachers' pre-intervention relational self-efficacy did not differ by condition,

M_T = 3.93 (SD_T = 0.68), M_{OSC} = 4.05 (SD_{OSC} = 0.60), and M_{LSC} = 4.05 (SD_{LSC} = 0.60), *LR* χ^2*(*2, n = 123*)* = 1.47, *p* = .48, *Pseudo* R^2 = .01.

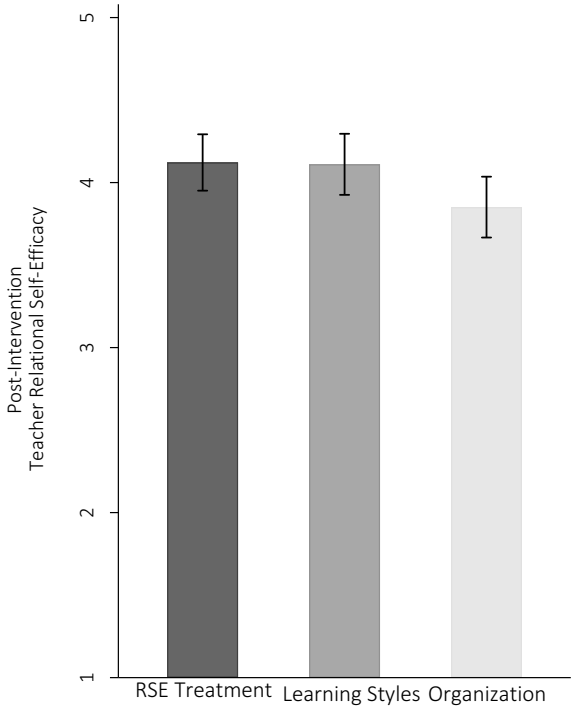
Teachers' relational self-efficacy

The two research questions aim to determine whether the treatment condition increases teachers' relational self-efficacy immediately post-intervention, relative to two control conditions. Figure 3.1 illustrates the impact of each condition on teachers' relational self-efficacy. As in Study 2, there is no statistically significant difference in teachers' immediate post-intervention relational self-efficacy between teachers in the treatment condition and teachers in the learning styles control condition, *B* = -0.01, *SE* = 0.10, 98.3% CI [-0.26, 0.24], *p* = .92. However, teachers assigned to the treatment condition had higher relational self-efficacy than teachers in the organizational skills control condition, *B* = -0.27, *SE* = 0.10, 98.3% CI [-0.52, -0.02], *p* = .01; *Cohen's d* = 0.49. I also find that there is a difference between the two control conditions, where teachers in the learning styles control condition have higher relational self-efficacy than teachers in the organizational strategies control condition, but it is not statistically significant at an α level of .017, *B* = 0.26, *SE* = 0.11, 98.3% CI [-0.52, 0.01], *p* = .02.

Interest in additional TSR-related resources

The difference between conditions on teachers' desire for TSR-related resources was not statistically significant. Fifty-six percent of teachers assigned to the treatment condition chose to receive additional TSR-related resources, compared to 54% in the learning styles control condition and 44% in the organizational strategies control condition, *p*s = .74 and .36, respectively.

Figure 3.1. Average Effect on Teachers' Immediate Post-Intervention Relational Self-Efficacy



Note: Error bars represent 98.3% confidence intervals.

Discussion

The purpose of this study was to shed some light on why treatment teachers did not have higher relational self-efficacy immediately post-intervention in the original field experiment. The results from this survey experiment suggest that the control activity selection may have unintentionally resulted in an immediate boost in teachers' beliefs about their ability to build relationships with students. Specifically, teachers who reflected on how to teach to students' preferred learning styles appear to feel just as confident in their relationship-building abilities with students as teachers who explicitly reflected on building TSRs. However, I find that a treatment effect emerges when comparing teachers who completed the relational self-efficacy treatment activity to those who completed a control activity designed to be less likely to prompt teachers to think about their interactions with students (i.e., reflecting on their organizational

strategies). Teachers who completed the treatment activity reported a half standard deviation increase in perceptions of their relational self-efficacy compared to teachers who completed the organizational strategies control activity. Teachers who completed the learning styles control activity also increased their relational self-efficacy compared to those in the organizational strategies control condition, but the difference was only marginally significant when using a confidence interval that accounts for multiple tests.

These findings indicate that aspects of the learning styles control activity in the field experiment may have been too closely related to the treatment activity. To gauge the impact of the relational self-efficacy treatment, a better control activity would focus on a topic that does not bring to mind positive relationship-building experiences with students, such as considering how to become better organized in one's job.

Of course, this survey experiment still leaves a number of unanswered questions. For one, if the learning styles activity does in fact increase teachers' relational self-efficacy as much as the treatment activity, why did the effect not persist in the field experiment? This question cannot be answered without conducting another field experiment that includes all three conditions, but there are several conceivable possibilities. Perhaps teachers in the learning styles control condition did experience increased relational self-efficacy and improved perceptions of their TSRs, but to a lesser extent than teachers in the treatment condition. In that case, the estimates reported in the field experiment are underestimating the treatment effect.

Alternatively, social cognitive theory posits that self-efficacy in a domain increases when one has a mastery experience in that domain (Bandura, 1997). Perhaps teachers who reflect on a mastery experience that involves a positive interaction with a student increases momentary beliefs about their ability to build TSRs. But, to experience a durable change, the improved

relational-self efficacy beliefs must be reinforced by subsequent positive interactions with students (Bandura, 1997). The first part of the intervention may have resulted in both teachers in the treatment and learning styles control conditions to reflect on a time they successfully connected with students, thus potentially increasing teachers' confidence in their relationship-building abilities temporarily in both conditions. But, the second and third parts of the intervention meaningfully differ between the two conditions. In the treatment activity, teachers learn about strategies to improve TSRs from other teachers and describe a strategy to build relationships with their most difficult students that they themselves plan to use. When teachers read about strategies to deliver content and describe their own strategy for teaching to students' learning styles, the focus shifts from interactions with students to the curricula design and systematic aspects of teaching. Consequently, teachers in the learning styles control condition do not explicitly consider or outline the steps needed to build stronger TSRs going forward whereas treatment teachers do. Following this logic, boosting relational self-efficacy beliefs will be meaningless if it is not paired with actionable steps for improving TSRs.

This explanation opens the door to another, related question: Is relational self-efficacy the mechanism by which teachers increased their perceptions of their TSRs? The mediation model in the field experiment suggests that the increase in teachers' relational self-efficacy in the treatment condition partially mediated the treatment effect on teachers' perceptions of their TSRs. That said, without re-designing and re-running the field experiment, I cannot rule out that simply completing an activity that encourages teachers to reflect on and develop strategies for building positive relationships with students might be enough to improve teachers' perceptions of their TSRs. Future experimental work might vary the intervention activities to gain insights into what aspects of the intervention affect teachers' beliefs and behaviors.

While online follow-up studies afford willing samples and easy recruitment, they clearly pose additional limitations. Most notably, these surveys will most often be conducted anonymously, outside the confines of a school and therefore we cannot collect any longitudinal or student-related data. In the initial field experiment, we were able to collect school record data and ask teachers to report on the quality of their relationships with individual students, where that was not possible in the current study. Moreover, quality control and fidelity to treatment remain issues, albeit in a different way than field studies. For instance, using Amazon Mechanical Turk to recruit teachers resulted in a number of non-teachers and bots completing the survey. Other education-focused research platforms, like the Character Lab Research Network or Research Together, provide better quality teachers.

Despite the obvious limitations, the present study suggests that the control activity in the initial field experiment may have masked the treatment effect on teachers' relational self-efficacy immediately post-intervention. While many questions remain, this is a first step towards understanding why teachers' relational self-efficacy increased and will improve future iterations of the intervention. Specifically, now it is plausible to conduct a mechanism study that varies the portions of the activity teachers completed to identify the intervention's active ingredients.

In addition to advancing knowledge on how to increase teachers' relational self-efficacy beliefs, I hope this follow-up study also serves as an example for how educational researchers might consider using non-traditional participants and platforms to improve upon their research agenda. I am not advocating that educational research shift back into the lab from the field to answer large research questions. But, through creative study designs, online surveys can complement field experiments by testing competing theories and exploring mechanisms in a relatively quick and inexpensive way.

Conclusion

Broadly, these three papers illuminate how beliefs may be a lever for improving relationships. While the present research focuses on relationships between teachers and students, future research might consider how the concept of relational self-efficacy can be applied to relationships in other domains. Across many different types of relationships, an individual's beliefs about their capacity to form and maintain relationships and may be particularly relevant when considering how beliefs associate with relationship quality.

The first paper introduces the concept of relational self-efficacy and how the beliefs we have about specific relationships might influence outcomes associated with those relationships. When it comes to teachers' relationships with their students, teachers' self-efficacy beliefs do matter. Specifically, I found that teachers' relational self-efficacy—defined as teachers' beliefs about their capability to successfully form, maintain, and (when necessary) repair relationships with students—is associated with the quality of their TSRs. Furthermore, relational self-efficacy does a better job accounting for the relational side of teaching than existing measures of teachers' self-efficacy. Practically, understanding how teachers' beliefs about their relationship building abilities correlate with the quality of their TSRs provides important insights about teachers' and students' classroom experiences. These findings suggest that increasing teachers' relational self-efficacy beliefs may be a promising lever for improving TSRs.

The second paper builds on the correlational findings from Paper 1 and presents results from a randomized field experiment evaluating the impact of a teacher-focused intervention that aimed to increase teachers' relational self-efficacy and downstream TSRs. I find that a short, 20-minute activity designed to bolster middle and high school teachers' confidence in their relationship-building skills with students improves their relational self-efficacy three months

later. The activity also results in teachers perceiving more positive relationships with their students three months later. These findings lend support to the idea that the mere act of bolstering relational self-efficacy may help teachers perceive more positive relationships with their students. Of course, the experiment also raises a number of questions. Most notably, why was there a delayed treatment effect? That is, why did the treatment activity increase teachers' relational self-efficacy compared to the control group after three months, but not immediately? There are a few plausible explanations for the intervention's "sleeper effect" on teachers' relational self-efficacy.

For the third paper, I conducted an online survey experiment to explore one of these reasons. In particular, I focus on the choice of the control group and do so in an online laboratory. The results suggest that the control activity selection (i.e., reflecting on students' learning styles) may have unintentionally resulted in an immediate boost in teachers' beliefs about their ability to build relationships with students. This work highlights the need to understand the mechanisms underlying the treatment effect, while also serves as an example for how educational researchers might consider using non-traditional participants and platforms to improve upon their research agenda. Specifically, online surveys can complement field experiments by testing competing theories and exploring mechanisms in a relatively quick and inexpensive way.

This research makes three important theoretical and practical contributions to the fields of education and psychology by building knowledge about processes that influence teaching and learning.

First, the vast majority of scholars and practitioners agree that TSRs are important (Gehlbach & Robinson, 2016). Yet, there is very little experimental research evaluating

strategies for improving TSRs. My research suggests that intervening upon teachers' beliefs about their relationship-building abilities may be a potential avenue for improving TSRs. As this research program continues, I intend to evaluate the causal impact of improving TSRs in the classroom and measures the downstream impact on teacher and student outcomes.

Second, I build upon a growing body of literature that attempts to improve educational outcomes at scale by changing behavior-relevant beliefs (e.g., growth mindset). While most of the research on belief-related interventions are student-directed (e.g., Paunesku et al., 2015), I take a relatively novel approach by exploring the causal implications of shifting teacher beliefs on both teacher behaviors and student outcomes. These studies, and the ones that follow based on these findings, will further our understanding about the mechanisms that underlie belief and behavior changes.

Finally, despite the preponderance of research on self-efficacy, these three papers are the first to empirically study teachers' relational self-efficacy with students and how it impacts relationship quality. By targeting relational self-efficacy, a behavior-relevant belief, my studies are conducted with a goal of answering the question: How we can improve TSRs? In addition to introducing the concept of relational self-efficacy and gaining knowledge about how teachers' perceived confidence in their ability to build TSRs impacts their relationships with students, I created an intervention that actually does change teachers' conceptions of their TSRs.

If we can provide teachers with the tools and confidence to build positive relationships in their classrooms, then we are setting the stage for teachers to build productive relationships with students and, in turn, increasing the likelihood of successful youth development. By translating this idea into a concrete, evidence-based strategy, there is no shortage of opportunities through which policymakers and practitioners can apply it (e.g., professional development programs,

teaching training curricula, educational initiatives, etc.). Furthermore, because the intervention is low-cost and easy-to-implement, the marginal cost of adding it to existing or new initiatives is low, which will increase take-up. This research contributes knowledge in the fields of education and psychology, while also bringing positive TSRs to the forefront of what it means to be an effective teacher.

Appendix A.

Preregistration: The Association Between Teachers' Relational Self-Efficacy and Teacher-Student Relationships

June 21, 2019

Study Information

1. Title (required)

The Association Between Teachers' Relational Self-Efficacy and Teacher-Student Relationships

2. Authors (required)

Carly D. Robinson

3. Description (optional)

Decades of research on self-efficacy shows that people's beliefs about their ability to succeed in a particular domain impact their performance in that domain (Bandura, 1997), making it one of the most enduring concepts in teaching and learning. Despite its popularity, no one has studied teachers' confidence in their relationship building skills with students. In this longitudinal study, I introduce the concept of teachers' *relational self-efficacy*, which I define as teachers' beliefs about their capability to successfully form, maintain, and (when necessary) repair relationships with students. I investigate how teachers' relational self-efficacy predicts teachers' priorities and subsequent perceptions of the teacher-student relationship (TSR).

4. Hypotheses (required)

Hypothesis 1: Teachers with stronger relational self-efficacy will be more likely to prioritize the role of building TSRs more highly.
Hypothesis 2: Teachers with stronger relational self-efficacy at the beginning of the semester will report more positive TSRs at the end of the semester.

Design Plan

5. Study type (required)

Observational Study.
This project is an observational study. Teachers and students complete surveys at two time points during the school year (the initial survey is administered at the beginning of the semester and the final survey is administered at the end of the semester).

6. Blinding (required)

No blinding is involved in this study as participants are not assigned to conditions.

7. Is there any additional blinding in this study?

Participants are not aware of the hypotheses associated with this study.

8. Study design (required)

This study involves teachers and students completing two surveys at two time points during the school year.

9. Randomization (optional)

This is not a randomized study.
Sampling Plan

10. Existing data (required)

Registration is happening prior to accessing the outcome data. As of the date of submission, data collection has begun but data from the final teacher and student surveys have not been accessed.

11. Explanation of existing data (optional)

The data from the first teacher and student surveys has been collected. I have only opened the dataset to determine which teachers and students completed the survey. No exploration of the data or analysis of any kind has been conducted.

12. Data collection procedures (required)

The study takes place at four schools: two middle schools and two high schools. The school administration selected one class period for teachers to recruit student participation. All teachers who taught students during that period were eligible to participate. Teachers were encouraged to participate by their principal and were told their involvement involved two main research activities (an initial survey and a final survey).

All students were eligible to participate if their teacher was participating. The student data collection was part of a broader school project measuring students' experiences in school.

Each school selected a "start date" for the project, where teachers and students completed the initial survey. The final teacher and student surveys were completed between 2-4 months after the initial surveys.

13. Sample size (required)

The target sample size was 40 teachers and 400 of their students (assuming at least 10 students per teacher). The final sample size depends on how many teachers and students complete both the initial and final surveys.

The unit of analysis is the teacher for hypothesis 1 and the teacher-student dyad for hypothesis 2.

14. Sample size rationale (optional)

The target sample size was chosen based on available financial resources and results from pilot studies.

15. Stopping rule (optional)

There was no stopping rule. Only teachers who taught students during the periods chosen by administrators were eligible to participate.

Variables

16. Manipulated variables (optional)

I will not manipulate any variables in the study.

17. Measured variables (required)

The below table lists the variables included in the study. The **bolded** variables are described in subsequent "Indices" section and will be used to analyze the focal pre-specified hypotheses for this study. The non-bolded variables may be used for exploratory analyses.

Teacher Self-Report Measures:		
	Number of Items by Survey	
	Initial Survey	Final Survey
Relational Self-Efficacy	8	8
Prioritizing the Role of Building TSRs	5	5
Overall Perception of TSRs (Prior)	1	
TSR with Individual Students		8
Expectations for Student		1
Inferred Relational Self-Efficacy for Student		1
TSR Comparisons	2	
TSR Experiences	3	
Instructional Experiences	1	
Other Teachers' Relational Self-Efficacy	1	
Teacher Self-Efficacy Measures (1 per construct)	6	
Social Self-Efficacy	1	
% of Teacher Evaluation based on TSRs	1	

Occupation Satisfaction	2	
Occupation Turnover Intentions	2	
Emotional Exhaustion	2	
Request for more information on TSRs		1
Demographics		
Years student teaching, **years teaching**, age, **gender**, race/ethnicity, education, **grade taught**		

Student Self-Report Measures		
	Number of Items by Survey	
	Initial Survey	Final Survey
Relational Self-Efficacy	5	5
Perception of Teacher Prioritizing the Role of Building TSRs	1	1
Measure of TSR with Teacher	8	8
Overall Perception of TSRs Last Year	1	
Inferred Relational Self-Efficacy for Teacher	2	2
Importance of class	1	1
Utility of class	1	1
Interest	1	1
Self-efficacy	1	1
Belonging	1	4
Effort	1	4
Participation	1	1
Help-seeking	1	1
Perceived teacher expectations	1	3
Enjoyment	1	4
Valuing of TSR	1	1
Demographics		
Age, **gender**, race/ethnicity, language		
School Record Data		
Student Grades		
Student Attendance		
Student Behavioral Data		
Student SES Indicator		
Student Learning Profile		

18. Indices (optional)

Relational Self-Efficacy

I will compute the eight-items designed to measure teachers' relational self-efficacy into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items are:

How confident are you that you can build positive relationships with all your students?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How confident are you that you can support your students emotionally?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How much can you do to make your students enjoy coming to school?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
How much can you do to get your students to trust you?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
To what extent do you feel capable of designing relationship building activities for your classroom?	Not at all capable	Slightly capable	Somewhat capable	Quite capable	Extremely capable
	1	*2*	*3*	*4*	*5*
If a relationship with a student starts out poorly, how confident are you that you can improve that relationship later in the year?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How much can you do to cultivate a positive relationship with students who are not performing well in your class?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
How confident are you that you can build positive relationships with students who come from different backgrounds than you?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*

Prioritizing the Role of Building Teacher-Student Relationships

I will compute the five-items designed to measure the extent to which teachers prioritize the role of building relationships with students into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the five items). The five items are:

How often do you devote prep time toward developing strategies for connecting with students?	Almost never *1*	Rarely *2*	Occasionally *3*	Often *4*	Almost all the time *5*
How much effort do you put into getting to know each of your students?	Almost no effort *1*	A little bit of effort *2*	Some effort *3*	Quite a bit of effort *4*	A great deal of effort *5*
How often do you consider students' interests when planning a lesson?	Almost never *1*	Rarely *2*	Sometimes *3*	Often *4*	Almost all the time *5*
How important is it for you to learn about your students' lives outside of the classroom?	Not at all important *1*	Slightly important *2*	Somewhat important *3*	Quite important *4*	Extremely important *5*
If you had the opportunity to train future teachers, to what extent would you emphasize the importance of building positive teacher-student relationships?	Not at all *1*	A little bit *2*	Somewhat *3*	Quite a bit *4*	A tremendous amount *5*

Teacher Perceptions of the Teacher-Student Relationship

I will compute the eight-items designed to measure teachers' perception of the TSR into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items are:

How much do you enjoy helping <student name> learn?	Do not enjoy at all *1*	Enjoy a little bit *2*	Somewhat enjoy *3*	Enjoy quite a bit *4*	Enjoy a tremendous amount *5*
How caring is <student name> towards you?	Not at all caring *1*	Slightly caring *2*	Somewhat caring *3*	Quite caring *4*	Extremely caring *5*
How often do you say something encouraging to <student name>?	Almost never *1*	Once in a while *2*	Sometimes *3*	Frequently *4*	Almost all the time *5*
How respectful is <student name> towards you?	Not at all respectful *1*	Slightly respectful *2*	Somewhat respectful *3*	Quite respectful *4*	Extremely respectful *5*

How friendly is <student name> towards you?	Not at all friendly *1*	Slightly friendly *2*	Somewhat friendly *3*	Quite friendly *4*	Extremely friendly *5*
How excited would you be to have <student name> again next year?	Not at all excited *1*	Slightly excited *2*	Somewhat excited *3*	Quite excited *4*	Extremely excited *5*
How motivating does <student name> find the activities that you plan for class?	Not at all motivating *1*	Slightly motivating *2*	Somewhat motivating *3*	Quite motivating *4*	Extremely motivating *5*
Overall, how much does <student name> learn from you?	Almost nothing *1*	A little bit *2*	Some *3*	Quite a bit *4*	A great deal *5*

Student Perceptions of the Teacher-Student Relationship

I will compute the eight-items designed to measure students' perception of the TSR into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items (assessed both pre- and post-intervention) are:

How much do you enjoy learning from <teacher name>?	Do not enjoy at all *1*	Enjoy a little bit *2*	Somewhat enjoy *3*	Enjoy quite a bit *4*	Enjoy a tremendous amount *5*
How friendly is <teacher name> towards you?	Not at all caring *1*	Slightly caring *2*	Somewhat caring *3*	Quite caring *4*	Extremely caring *5*
How encouraging is <teacher name> towards you?	Almost never *1*	Once in a while *2*	Sometimes *3*	Frequently *4*	Almost all the time *5*
How respectful is <teacher name> towards you?	Not at all respectful *1*	Slightly respectful *2*	Somewhat respectful *3*	Quite respectful *4*	Extremely respectful *5*
At this point, how excited would you be to have <teacher name> as a <class> teacher again next year?	Not at all friendly *1*	Slightly friendly *2*	Somewhat friendly *3*	Quite friendly *4*	Extremely friendly *5*
How motivating do you find <teacher name>?	Not at all excited *1*	Slightly excited *2*	Somewhat excited *3*	Quite excited *4*	Extremely excited *5*

How caring do you think <teacher name> is towards you?	Not at all motivating *1*	Slightly motivating *2*	Somewhat motivating *3*	Quite motivating *4*	Extremely motivating *5*
Overall, how much do you learn from <teacher name>?	Almost nothing *1*	A little bit *2*	Some *3*	Quite a bit *4*	A great deal *5*

Analysis Plan

19. Statistical models (required)

Hypothesis 1: Teachers with stronger relational self-efficacy will be more likely to prioritize the role of building TSRs.
Regression Model:
$TSRRole_t = \beta_0 + \beta_1 RSE_t + \boldsymbol{X}_t + \alpha_s + u_t + \varepsilon_t$,
where $TSRRole_t$ is the teacher-level outcome, RSE_t is a measure of teachers' relational self-efficacy at time 1, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, and the grade level teachers report teaching), α_s is a school fixed effect, u_t is a classroom random effect, and ε_t is a classroom-level residual.

Hypothesis 2: Teachers with stronger relational self-efficacy at the beginning of the semester will report more positive TSRs at the end of the semester.
Regression Model:
$TSR_{it} = \beta_0 + \beta_1 RSE_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + u_t + \epsilon_{it}$,
where TSR_{it} is the teacher-student dyad level outcome, RSE_t is a measure of teachers' relational self-efficacy at time 1, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, grade level taught), $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender), α_s is a school fixed effect, u_t is a classroom random effect, and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

20. Transformations (optional)

I do not plan on transforming any of the variables being used for my confirmatory hypotheses.

21. Inference criteria (optional)

I will use 97.5% confidence intervals to evaluate my tests. This corresponds to a critical *p*-value of .025 to account for testing of two hypotheses. In line with Cumming's (2014) recommendation, I will evaluate my hypotheses by presenting and discussing confidence intervals and effect sizes, in addition to *p*-values.

22. Data exclusion (optional)

Some participants may engage in straight-line responding. Using the approach Barge and Gehlbach (2012) employed, I will remove the responses of any participants who give identical responses on eight or more sequential survey items. On the section where teachers respond to items about individual students, I will remove the responses of any teachers who give identical item responses on three or more sequential students.

23. Missing data (optional)

Given that my hypotheses rely on self-report measures, I will exclude participants on specific tests who respond to less than half the items on the relevant outcome scale for that test.

24. Exploratory analysis (optional)

Exploratory Hypothesis 1: Students of teachers with stronger relational self-efficacy at the beginning of the semester will report more positive TSRs at the end of the semester.
Regression Model:
$TSR_{it} = \beta_0 + \beta_1 RSE_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + u_t + \epsilon_{it}$,
where TSR_{it} is the teacher-student dyad level outcome, RSE_t is a measure of teachers' relational self-efficacy at time 1, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, grade level taught), $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender), α_s is a school fixed effect, u_t is a classroom random effect, and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

Additional Exploratory Analyses: I am collecting additional measures to use for exploratory analyses.
Other

25. Other (Optional)

References

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.

Barge, S., & Gehlbach, H. (2012). Using the theory of satisficing to evaluate the quality of survey data. Research in Higher Education, 53(2), 182-200. doi:10.1007/s11162-011-9251-2

Cumming, G. (2014). The new statistics: Why and how. Psychological Science, 25(1), 7-29. doi:10.1177/0956797613504966

Appendix B.
Preregistration: Increasing Teachers' Relational Self-Efficacy

June 21, 2019

Study Information
1. Title (required)

Increasing Teachers' Relational Self-Efficacy

2. Authors (required)

Carly D. Robinson

3. Description (optional)

This project explores whether shifting teachers' beliefs about their relationship-building abilities can impact teacher-student relationships (TSRs). It is well known that students with more positive TSRs attain a myriad of more desirable outcomes than their counterparts with less positive relationships. This study addresses the question of how we can improve TSRs in the classroom. To improve TSRs, I target teachers' behavior-relevant beliefs. Specifically, I designed an intervention to improve teachers' relational self-efficacy (i.e., teachers' beliefs about their capability to successfully form, maintain, and--when necessary--repair relationships with students). This study explores whether the intervention increases (1) middle and high school teachers' relational self-efficacy, (2) how much teachers prioritize the role of building TSRs, and (3) teachers' and their students' perceptions of their TSRs.

4. Hypotheses (required)

Hypothesis 1: Teachers assigned to the treatment condition will report higher levels of relational self-efficacy as compared to those assigned to the control group. This finding will emerge (a) immediately post-intervention and (b) at the end of the semester.
Hypothesis 2: Teachers assigned to the treatment condition will report prioritizing the role of building TSRs at the end of the semester as compared to those assigned to the control group.
Hypothesis 3: Teachers assigned to the treatment condition will report having more positive TSRs at the end of the semester as compared to those assigned to the control group.
Design Plan

5. Study type (required)

Experiment.
This project is a randomized field experiment. Teachers are randomly assigned to one of two experimental conditions, either (1) the control condition or (2) the treatment condition.

6. Blinding (required)

Teachers do not know the condition to which they have been assigned. Other school staff and administrators are also blind to condition assignment.

7. Is there any additional blinding in this study?

No.

8. Study design (required)

This study consists of a 1x2 between-subject design, where teachers are randomly assigned to one of two experimental conditions. In both conditions, teachers and students in their advisory class complete two surveys. The first teacher survey differs based on the experimental conditions the teacher was assigned to:

1. Control: Teachers in the control condition complete a 3-part activity designed to increase their self-efficacy in teaching to students' "learning styles."
2. Treatment: Teachers assigned to the treatment condition complete a 3-part activity designed to increase their relational self-efficacy.

9. Randomization (optional)

I performed a clustered stratified randomization to assign teachers to either the control or treatment condition. The stratification variables were school and grade level. The randomization occurred in Stata using the block_and_cluster_ra command.

Sampling Plan

10. Existing data (required)

Registration is happening prior to accessing the outcome data. As of the date of submission, data collection has begun but data from the final teacher and student surveys have not been accessed.

11. Explanation of existing data (optional)

The data from the first teacher and student surveys has been collected. I have only opened the dataset to determine which teachers and students completed the survey. No exploration of the data or analysis of any kind has been conducted.

12. Data collection procedures (required)

The study takes place at two schools: a middle school and a high school. All teachers who taught an advisory class were eligible. Teachers were encouraged to participate by their principal, and they will receive a $50 gift card for participating in the two main research activities (an initial survey and a final survey).

Students participated with their advisory teacher during the advisory class period. All students were eligible to participate. The student data collection was part of a broader school project measuring students' experiences in school and advisory.

The timeline proceeded as follows:

a) The initial teacher survey was completed between March 6, 2019 and March 19. 2019.
b) The initial student survey was completed between March 6, 2019 and April 5, 2019.
c) Teachers received a copy of their responses on the first survey between April 15, 2019 and April 23, 2019 (and had the option to participate in a voluntary mid-point survey).
d) The final student survey administration will occur from May 13, 2019 through the end of the school year.
e) The final teacher survey administration will occur from May 15, 2019 through the end of the school year.

13. Sample size (required)

The target sample size was 50 teachers and 500 of their students (assuming at least 10 students per teacher). The sample currently consists of 53 teachers (19 middle school teachers; 34 high school teachers) and 579 students (228 middle school students; 351 high school students). The final sample size depends on how many teachers and students complete the final surveys.

The unit of analyses is the teacher for hypotheses 1 and 2 ($N = 53$), and the teacher-student dyad for hypothesis 3 ($N = 579$).

14. Sample size rationale (optional)

The target sample size was chosen based on available financial resources, results from pilot studies, and a power calculation. This sample size is sufficient to have 80% power to detect an effect size of 0.3-standard deviations on the teacher-student dyad outcomes.

15. Stopping rule (optional)

There was no stopping rule. Only advisory teachers in the two schools were eligible to participate.

Variables

16. Manipulated variables (optional)

I will not manipulate any variables in the study beyond randomly assigning participants to one of two experimental conditions (see Section 8 for a description of the experimental conditions).

17. Measured variables (required)

The below table lists the variables included in the study. The **bolded** variables are described in subsequent "Indices" section and will be used to analyze the focal pre-specified hypotheses for this study. The non-bolded variables may be used for exploratory analyses.

Teacher Self-Report Measures:				
	Number of Items by Survey			
	Pre-Intervention	Post-Intervention		
	Initial Survey	Initial Survey	Midpoint Survey	Final Survey
Relational Self-Efficacy	1	8	1	8
Prioritizing the Role of Building TSRs	1			5
Overall Perception of TSRs	1	1	1	
TSR with Individual Students	1			8
Expectations for Student				1
Inferred Relational Self-Efficacy for Student				1
TSR Comparisons	2			
TSR Experiences	5			1
Instructional Experiences	4			1
Other Teachers' Relational Self-Efficacy	1			
Importance of TSR	1			
Usefulness of Advisory	1			
Teacher Self-Efficacy Measures (1 per construct)		6		
Social Self-Efficacy		1		
TSR Responsibility		1		1
% of Teacher Evaluation based on TSRs		1		
Occupation Satisfaction		2		2
Occupation Turnover Intentions		2		2
Emotional Exhaustion		2		2
Teacher Attendance Related Questions		7		1
Request for more information on TSRs		1		1
Carried out strategy or not			1	
Interest in sharing strategy (from intervention activity)			1	
Demographics				
Years student teaching, **years teaching**, age, **gender**, race/ethnicity, education, **grade taught**				

Student Self-Report Measures		
	Number of Items by Survey	
	Pre-Intervention	Post-Intervention
	Initial Survey	Final Survey
Relational Self-Efficacy	5	5
Perception of Teacher Prioritizing the Role of Building TSRs	1	1
Measure of TSR with Teacher	8	8
Overall Perception of TSRs Last Year	1	
Inferred Relational Self-Efficacy for Teacher	2	2
Importance of class	1	1
Utility of class	1	1
Interest	1	1
Self-efficacy	1	1
Belonging	1	4
Effort	1	4
Participation	1	1
Help-seeking	1	1
Perceived teacher expectations	1	3
Enjoyment	1	4
Valuing of TSR	1	1
TSR Responsibility	1	1
Rank importance of TSR	1	1
TSR Growth Mindset	1	1
Demographics		
Age, **gender**, race/ethnicity, language		
School Record Data		
Student Grades		
Student Attendance		
Student Behavioral Data		
Student SES Indicator		
Student Learning Profile		
Student Test Scores		
Teacher Attendance		

18. Indices (optional)

Relational Self-Efficacy

I will compute the eight-items designed to measure teachers' relational self-efficacy into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items are:

How confident are you that you can build positive relationships with all your students?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How confident are you that you can support your students emotionally?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How much can you do to make your students enjoy coming to school?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
How much can you do to get your students to trust you?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
To what extent do you feel capable of designing relationship building activities for your classroom?	Not at all capable	Slightly capable	Somewhat capable	Quite capable	Extremely capable
	1	*2*	*3*	*4*	*5*
If a relationship with a student starts out poorly, how confident are you that you can improve that relationship later in the year?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*
How much can you do to cultivate a positive relationship with students who are not performing well in your class?	Almost nothing	A little bit	A moderate amount	Quite a bit	A great deal
	1	*2*	*3*	*4*	*5*
How confident are you that you can build positive relationships with students who come from different backgrounds than you?	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Extremely confident
	1	*2*	*3*	*4*	*5*

Prioritizing the Role of Building Teacher-Student Relationships

I will compute the five-items designed to measure the extent to which teachers prioritize the role of building relationships with students into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the five items). The five items are:

How often do you devote prep time toward developing strategies for connecting with students?	Almost never *1*	Rarely *2*	Occasionally *3*	Often *4*	Almost all the time *5*
*How much effort do you put into getting to know each of your students?	Almost no effort *1*	A little bit of effort *2*	Some effort *3*	Quite a bit of effort *4*	A great deal of effort *5*
How often do you consider students' interests when planning a lesson?	Almost never *1*	Rarely *2*	Sometimes *3*	Often *4*	Almost all the time *5*
How important is it for you to learn about your students' lives outside of the classroom?	Not at all important *1*	Slightly important *2*	Somewhat important *3*	Quite important *4*	Extremely important *5*
If you had the opportunity to train future teachers, to what extent would you emphasize the importance of building positive teacher-student relationships?	Not at all *1*	A little bit *2*	Somewhat *3*	Quite a bit *4*	A tremendous amount *5*

* indicates the item was also asked pre-intervention and serves as a pre-intervention covariate.

Teacher Perceptions of the Teacher-Student Relationship

I will compute the eight-items designed to measure teachers' perception of the TSR into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items are:

How much do you enjoy helping <student name> learn?	Do not enjoy at all *1*	Enjoy a little bit *2*	Somewhat enjoy *3*	Enjoy quite a bit *4*	Enjoy a tremendous amount *5*
How caring is <student name> towards you?	Not at all caring *1*	Slightly caring *2*	Somewhat caring *3*	Quite caring *4*	Extremely caring *5*
How often do you say something encouraging to <student name>?	Almost never *1*	Once in a while *2*	Sometimes *3*	Frequently *4*	Almost all the time *5*
How respectful is <student name> towards you?	Not at all respectful	Slightly respectful	Somewhat respectful	Quite respectful	Extremely respectful

	1	*2*	*3*	*4*	*5*
How friendly is <student name> towards you?	Not at all friendly *1*	Slightly friendly *2*	Somewhat friendly *3*	Quite friendly *4*	Extremely friendly *5*
How excited would you be to have <student name> again next year?	Not at all excited *1*	Slightly excited *2*	Somewhat excited *3*	Quite excited *4*	Extremely excited *5*
How motivating does <student name> find the activities that you plan for class?	Not at all motivating *1*	Slightly motivating *2*	Somewhat motivating *3*	Quite motivating *4*	Extremely motivating *5*
Overall, how much does <student name> learn from you?	Almost nothing *1*	A little bit *2*	Some *3*	Quite a bit *4*	A great deal *5*

One-item was used to measure teachers' pre-intervention perceptions of the TSR with each student. The item is:

At this point in the year, how positive would you say your relationship is with <student name>?	Not at all positive *1*	Slightly positive *2*	Somewhat positive *3*	Quite positive *4*	Extremely positive *5*

Student Perceptions of the Teacher-Student Relationship

I will compute the eight-items designed to measure students' perception of the TSR into one index. Each item will be weighted equivalently (i.e., I will calculate participants' mean score across the eight items). The eight items (assessed both pre- and post-intervention) are:

How much do you enjoy learning from <teacher name>?	Do not enjoy at all *1*	Enjoy a little bit *2*	Somewhat enjoy *3*	Enjoy quite a bit *4*	Enjoy a tremendous amount *5*
How friendly is <teacher name> towards you?	Not at all caring *1*	Slightly caring *2*	Somewhat caring *3*	Quite caring *4*	Extremely caring *5*
How encouraging is <teacher name> towards you?	Almost never *1*	Once in a while *2*	Sometimes *3*	Frequently *4*	Almost all the time *5*
How respectful is <teacher name> towards you?	Not at all respectful *1*	Slightly respectful *2*	Somewhat respectful *3*	Quite respectful *4*	Extremely respectful *5*

At this point, how excited would you be to have <teacher name> as a <class> teacher again next year?	Not at all friendly *1*	Slightly friendly *2*	Somewhat friendly *3*	Quite friendly *4*	Extremely friendly *5*
How motivating do you find <teacher name>?	Not at all excited *1*	Slightly excited *2*	Somewhat excited *3*	Quite excited *4*	Extremely excited *5*
How caring do you think <teacher name> is towards you?	Not at all motivating *1*	Slightly motivating *2*	Somewhat motivating *3*	Quite motivating *4*	Extremely motivating *5*
Overall, how much do you learn from <teacher name>?	Almost nothing *1*	A little bit *2*	Some *3*	Quite a bit *4*	A great deal *5*

Analysis Plan

19. Statistical models (required)

Hypothesis 1: Teachers assigned to the treatment condition will report higher levels of relational self-efficacy as compared to those assigned to the control group. This finding will emerge (a) immediately post-intervention and (b) at the end of the semester.
Regression Model:
$RSE_t = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \alpha_s + \varepsilon_t,$
where RSE_t is the teacher-level outcome, $Treatment_t$ is an indicator that teacher *t* was exposed to the treatment condition, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, the grade level teachers report teaching, teachers' pre-intervention overall assessment of their TSRs, and teachers' pre-intervention assessment of their relational self-efficacy), α_s is a school fixed effect, and ε_t is a classroom-level residual.

Hypothesis 2: Teachers assigned to the treatment condition will report prioritizing the role of building TSRs at the end of the semester as compared to those assigned to the control group.
Regression Model:
$TSRRole_t = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \alpha_s + \varepsilon_t,$
where $TSRRole_t$ is the teacher-level outcome, $Treatment_t$ is an indicator that teacher *t* was exposed to the treatment condition, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, the grade level teachers report teaching, and teachers' pre-intervention prioritizing of TSRs), α_s is a school fixed effect, and ε_t is a classroom-level residual.

Hypothesis 3: Teachers assigned to the treatment condition will report having more positive TSRs at the end of the semester as compared to those assigned to the control group.
Regression Model:

$TSR_{it} = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + \varepsilon_{it}$,
where TSR_{it} is the teacher-student dyad level outcome, $Treatment_t$ is an indicator that teacher *t* was exposed to the treatment condition, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, grade level taught, teachers' pre-intervention assessment of their TSRs with each student), $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender), α_s is a school fixed effect, and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

20. Transformations (optional)

I do not plan on transforming any of the variables being used for my confirmatory hypotheses.

21. Inference criteria (optional)

I will use Fisher Randomization Tests to obtain *p*-values for the null hypotheses of no impact for each of my primary outcome variables and use 98.3% confidence intervals to evaluate my tests. This corresponds to a critical *p*-value of .017 to account for testing three hypotheses. In line with Cumming's (2014) recommendation, I will evaluate my hypotheses by presenting and discussing confidence intervals and effect sizes, in addition to *p*-values.

22. Data exclusion (optional)

1. I will use demographic data to confirm that random assignment has worked. If, by chance, the randomization fails to produce equitable samples (as determined by a simple *F*-test), I will correct for this potential imbalance by including the relevant covariate.

2. Teachers will be excluded if they did not engage in the intervention (i.e., complete the first survey through the control or treatment activities).

3. Some participants may engage in straight-line responding. Using the approach Barge and Gehlbach (2012) employed, I will remove the responses of any participants who give identical responses on eight or more sequential survey items. On the section where teachers respond to items about individual students, I will remove the responses of any teachers who give identical item responses on three or more sequential students.

23. Missing data (optional)

Given that my hypotheses rely on self-report measures, I will exclude participants on specific tests who respond to less than half the items on the relevant outcome scale for that test.
If any of covariates are missing for more than 10% of the sample, I will exclude the variable from analyses or control for the missing values.

24. Exploratory analysis (optional)

Exploratory Hypothesis 1: Students of teachers assigned to the treatment condition will report perceiving a more positive TSR at the end of the semester as compared to students in the control group.
Regression Model:
$TSR_{it} = \beta_0 + \beta_1 Treatment_t + \boldsymbol{X}_t + \boldsymbol{X}_i + \alpha_s + \varepsilon_{it}$,
where TSR_{it} is the teacher-student dyad level outcome, $Treatment_t$ is an indicator that teacher *t* was exposed to the treatment condition, $\boldsymbol{X}_t$ is a vector of relevant teacher-level covariates (teacher gender, the number of years teachers report having taught, and grade level taught), $\boldsymbol{X}_i$ is a vector of relevant student-level covariates (student gender and students' pre-intervention assessment of their TSR with the target teacher), α_s is a school fixed effect, and ε_{it} is a residual clustered at the classroom level to account for the nesting of students within classrooms.

Additional Exploratory Analyses: I am collecting additional measures to use for exploratory analyses. For example, I intend to investigate if the effect is moderated by student characteristics, teacher characteristics, or student academic performance. I will assess whether there is an impact on student academic and behavioral outcomes.

Other

25. Other (Optional)

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