



The Mediating Role of Student Motivation in the Linking of Perceived School Climate and Achievement in Reading and Mathematics

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While the current literature provides valuable insight into how school climate and student motivation impact academic achievement, research examining the mediating effects of motivation in the linking of school climate perceptions and achievement is limited. The current study employed structural equation modeling to examine a model that illustrates the role of self-efficacy and intrinsic motivation in the linking of student perceptions of school climate (teacher/student relationship, order/safety/discipline, fairness/clarity of school rules) to reading and mathematics achievement. Analysis used data from the Educational Longitudinal Study of 2002 (ELS: 2002, 2004) that were gathered in a survey conducted by the National Center for Education Statistics (2004) and are representative of a national sample of 14,639 10th grade students. The results showed that the hypothesized model fit the data well supporting the hypothesis that student self-efficacy and intrinsic motivation play a mediating role in the linking of perceptions of school climate with reading and mathematics achievement. Additionally, students' perceptions of school climate related significantly with both achievement outcomes, and perceptions of school climate concerning teacher/student relationship related significantly with all motivation variables both self-efficacy and intrinsic motivation.

Keywords: self-efficacy, school climate, intrinsic motivation, academic achievement, mediation effect

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INTRODUCTION

Within the realm of educational research, attention has been given to academic achievement due to its impact on students' school experiences. Given the significant impact of achievement, a body of research has been dedicated to identifying the factors, both environmental and personal, that influence student academic achievement. A variety of factors that fall into these two categories have been examined. Two significant lines of research include the study of (a) characteristics of schools' climates reflecting relationships as well as norms and values and (b) personal motivational processes, such as self-efficacy and intrinsic motivation. It has been indicated in existing studies that both school climate and student motivation consistently relate with academic achievement (e.g., Roeser and Eccles, 1998; Caraway et al., 2003; Hardre and Reeve, 2003; Gilman and Anderman, 2006; Stewart, 2008; Gustafsson and Nilsen, 2016; Scherer and Nilsen, 2016).

While the current body of research provides valuable insight into how school climate and student motivation impact academic achievement, less is known about the relations between school climate and motivation and about the mechanisms that link school climate and achievement. The current body of research that examines the relations between these variables presents with limitations. First, research examining the influence of school environment on student motivation is limited (Urduan and Schoenfelder, 2006). The research that has been conducted in this area tends to focus more on how teacher/student relationships promotes student motivation (Roeser and Eccles, 1998; Ferrer-Caja and Weiss, 2000; Ryan and Deci, 2000b; Montalvo et al., 2007). Less attention is given to how other dimensions of school climate relate to student motivation, especially those that represent schools' norms and values, such as disciplinary climate and sense of safety. Thus, further study of a wider range of school climate variables that influence student academic self-efficacy and intrinsic motivation is warranted.

Second, the roles of self-efficacy and intrinsic motivation in the linking of school climate and academic achievement have received little attention (Mercer et al., 2011) even though it has been proposed that the linking of environmental factors with student outcomes can occur through students' motivation (Bandura, 1986). Those who have examined motivation in this role have found that self-efficacy and intrinsic motivation influence the linking of various school-related factors, such as leadership style (Charbonneau et al., 2001), victimization at school (Thijs and Verkuyten, 2008), homework (Zimmerman and Kitsantas, 2005), and challenging, caring, and mastery-oriented classrooms (Fast et al., 2010), with achievement. While these studies lend insight into the roles that these motivation constructs play in the linking of school climate and achievement, the current body of research as a whole includes few studies of this nature and would benefit from additional examination of the relations between these variables.

THE PRESENT STUDY

The current study addresses these limitations by examining the relations between school climate, student motivation, and achievement. More specifically, it tests a model that examines the manner in which multiple dimensions of academic motivation (self-efficacy in reading and math; intrinsic motivation in reading and math) link various dimensions of perceived school climate (order/safety/discipline; fairness/clarity of rules; teacher/student relationship) and achievement in reading and math (see **Figure 1**). Thus, the study will contribute to current research by measuring not only the direct influence of school climate on motivation but also the process through which school climate links with academic achievement through motivation. In sum, the following research questions will be addressed:

1. Do student perceptions of teacher/student relationship, order/safety/discipline, and fairness/clarity of school rules directly relate with student self-efficacy and intrinsic motivation in reading and math?

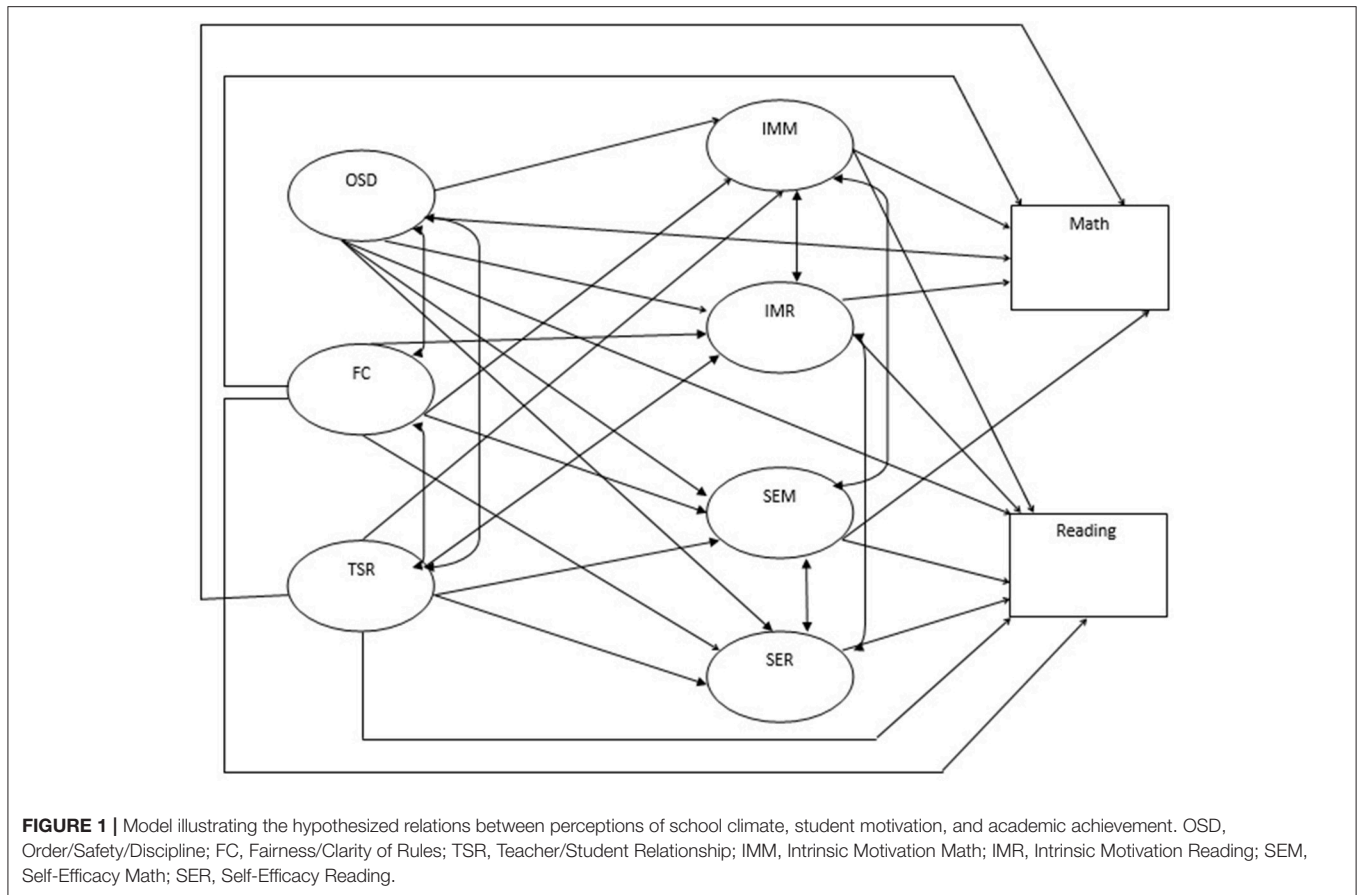
2. Do student self-efficacy and intrinsic motivation in reading and math play a mediating role in the linking of student perceptions of teacher/student relationship, order/safety/discipline, fairness/clarity of school rules, and academic achievement in reading and math?

More specifically, there are four distinct sets of relations the current study seeks to explore. The first set of relations are the direct links between students' perceived school climate (teacher/student relationship, order/safety/discipline, fairness/clarity of school rules) and motivational beliefs (self-efficacy and intrinsic motivation in reading and math), while the second set focuses on the relation between student school motivation (self-efficacy and intrinsic motivation in reading and math) and academic achievement in reading and math. The third set of relations assesses the links between students' perceived school climate (teacher/student relationship, order/safety/discipline, fairness/clarity of school rules) and math/reading achievement while taking into account of students' motivational beliefs known as the direct effect. The last set of relations assesses the mediating effects of student's motivational beliefs (self-efficacy and intrinsic motivation in reading and math) in linking students' perceived school climate (teacher/student relationship, order/safety/discipline, fairness/clarity of school rules) and math/reading achievement, known as the indirect effect.

THEORETICAL FRAMEWORK

Theorists who examine human behavior from the perspectives of social cognitive theory, cognitive evaluation theory, and self-determination theory all recognize the influence of both environmental and personal factors (Ryan and Deci, 2000b; Bandura, 2001). These theoretical perspectives hold in common the view that external contexts not only relate directly to behavior but also influence behavior through individuals' cognitive processes of appraisal and evaluation (Bandura, 1978; Deci et al., 2001). These occur within the social environment in relation to both social relationships and social structures and contribute to the development of perceptions of both self and environment that lead individuals to demonstrate motivated behaviors such as effort, persistence, resilience (Pajares, 1996b), and the desire to seek and master challenges (Pintrich and Schunk, 2002).

Self-efficacy is described as individuals' perceptions and beliefs regarding their personal capabilities and what they expect that they can achieve with these capabilities (Linnenbrink and Pintrich, 2002). Intrinsic motivation describes individuals' desire to engage in activities simply for the sake of the engagement (Schunk and Zimmerman, 2006) because they find the activities interesting and enjoyable (Ryan and Deci, 2000b). Both the appraisal of relationships that occur within the social environment and appraisals of structures within the social environment which represent the broader systems that direct behavior such as rules, norms, and social practices (Bandura, 2001) are significant in the development and maintenance of personal motivational processes including both self-efficacy and intrinsic motivation. The recognition of the influence of



social relationships and structures within educational settings is relevant, for it is within these social contexts that students receive valuable information regarding their behaviors (Bandura, 1997b; Ryan and Deci, 2000a,b).

SCHOOL MOTIVATION

Self-efficacy beliefs are domain-specific rather than global (Bandura, 1986; Linnenbrink and Pintrich, 2002). Thus measurement of this construct in academic studies varies according to the variable being examined (Pajares, 1996a). Education researchers often examine the domains of reading self-efficacy (Lau, 2009; Fan and Williams, 2010; Prat-Sala and Redford, 2010), writing self-efficacy (Prat-Sala and Redford, 2010), and math self-efficacy (Fan et al., 2009; Fan and Williams, 2010). Research is often conducted in educational contexts because students' competency beliefs are considered to be significant factors in their success or failure at school (Caraway et al., 2003; Pajares, 2003; Zimmerman and Kitsantas, 2005; Long et al., 2007; Turner et al., 2009) in that they affect student effort, persistence, resilience, and affective reactions (Pajares, 1996b).

Academic self-efficacy has been found to positively relate to general measures of academic achievement, such as grade point average, across grade levels for middle school (Long et al., 2007),

high school (Caraway et al., 2003; Zimmerman and Kitsantas, 2005), and college students (Zajacova et al., 2005; Turner et al., 2009). Positive relations with achievement have also been found in specific academic content areas, including reading and math. For example, it has been found that this motivation construct is a significant predictor of grades (Wigfield and Eccles, 2002), test scores (Fan et al., 2009; Mercer et al., 2011), and various curriculum-based measures (Mercer et al., 2011) in these subject areas.

Intrinsic motivation drives individuals to pursue those topics of interest as well as their related activities (Unrau and Schlackman, 2006) and compels individuals to seek and master challenging tasks in order to validate competence (Pintrich and Schunk, 2002). In the academic setting, it is often measured as enjoyment (Taboada et al., 2009; Fan and Williams, 2010), level of involvement (Logan et al., 2011), and intrinsic interest in course work (Linnenbrink and Pintrich, 2002; Shores and Shannon, 2007). This motivation construct, like self-efficacy, has been examined in a domain-specific manner. Those who have examined intrinsic motivation in this way have measured this construct within the domains of both reading and math (Shores and Shannon, 2007; Fan and Williams, 2010).

The examination of intrinsic motivation is significant to educators in that increased levels of this construct have consistently been found to result in higher learning and creativity

(Ryan and Deci, 2000a). For example, a positive relation between intrinsic motivation and grade point average has been found across grade levels (Gilman and Anderman, 2006; Turner et al., 2009) and in various regional settings (Hardre and Reeve, 2003). Performance in both reading and math is also positively affected by greater intrinsic motivation. This has been found in both assessment scores (Shores and Shannon, 2007; Taboada et al., 2009; Logan et al., 2011) and grades (Shores and Shannon, 2007) in these subject areas.

SCHOOL CLIMATE

School climate represents individuals' evaluation of the broad environment of their social context and structure in school, which reflects school norms, values, and relationships (Roeser et al., 1996; Ma and Klinger, 2000; Kuperminc et al., 2001; Benner et al., 2008). It is described as encompassing both the character and quality of a school which are influenced by its physical and organizational structure as well as its values and relationships (Koth et al., 2008; Cohen et al., 2009). Because of the multitude of factors that contribute to the overall construct of school climate, researchers have concluded that this construct is multidimensional in nature (Kuperminc et al., 1997; Verkuyten and Thijs, 2002) and have studied various aspects of this construct when studying it (Cohen et al., 2009; Zullig et al., 2010; Wang and Degol, 2015).

Three dimensions of school climate that reflect these values and relationships stand out in the literature as they have been often identified and examined. These dimensions are fairness of school rules (Haynes et al., 1993; Brand et al., 2003), order, safety, and discipline (Haynes et al., 1993; Kuperminc et al., 2001; Furlong et al., 2005), and student/teacher relationships (Haynes et al., 1993; Griffith, 2000). It has been recommended that these dimensions of school climate be examined individually (Kuperminc et al., 1997; Verkuyten and Thijs, 2002) because it is likely that the specific components of social environments are differentially salient to the individuals who function within these environments (Felner et al., 1985).

Students' perceptions of more positive school climate have been found to relate to both overall achievement and achievement in various academic content areas. For example, relationships with teachers, when measured as positive teacher regard and perceptions of teacher support, have been found to relate positively with student grades (Felner et al., 1985; Roeser and Eccles, 1998). At the same time, less favorable school climate variables, such as perception of school social problems and sense of not being safe, related inversely with grade point average (Stewart, 2008). Students' perceptions of a stable, safe, and fair disciplinary climate (Ma and Klinger, 2000) and caring and supportive relationships (Battistich et al., 1995) were found to positively relate to math, science, and writing performance for middle school and elementary students. Similarly, when school climate was measured from a negative perspective, it was found that perceptions of hostile relationships within the school showed inverse relations to both reading and math achievement (Ripski and Gregory, 2009).

Yet other studies have indicated conflicting results. First, contrary to the negative relation of hostility to student achievement, students' perceptions of unfair rules have been found to relate positively to reading and math achievement (Ripski and Gregory, 2009). Additionally, it has been indicated that there is a reciprocal relation between students' perceptions of school climate and achievement. For example, higher achievement was actually a predictor of more positive perceptions of fairness and interracial climate (Benner et al., 2008) in contrast to the more commonly found relation where school climate is the predictor.

SCHOOL CLIMATE AND MOTIVATION

While the relations between other aspects of school climate and motivation have not been extensively examined, the research that has been conducted in this area has shown that both the quality of the learning environments and the relationships with students that are promoted by teachers relate with students' academic motivation. For example, classrooms perceived as being positive, supportive, and warm were found to associate with more positive efficacy beliefs for both elementary (McMahon et al., 2009) and high school (Ferrer-Caja and Weiss, 2000; Montalvo et al., 2007) students. Similarly, when teachers conveyed that they believed in their students' abilities, these students experienced positive changes in their academic competence beliefs (Roeser and Eccles, 1998). Further, students with caring and supportive teachers were found to be more intrinsically motivated toward school than students with teachers who were reported as uncaring (Ryan and Deci, 2000b). Similarly, 6th and 7th grade students who reported teachers as demonstrating more warmth and support also reported higher levels of academic intrinsic motivation than did students who perceived their teachers as being colder and less supportive (Eccles et al., 1993). In addition, applying self-determination theory, research had found that perceived competence yielded a strong mediation effect on the relationship between perceived autonomy support from teachers and competitive performance (Halvari et al., 2009). Scherer and Nilsen (2016) studied the relations among different aspects of school climate, instructional quality, and students' achievement motivation for the TIMSS 2011 grade eight mathematics data sets comprising 50 countries and presented a partial mediation of instructional quality between school climate and achievement motivation in some countries.

METHOD

Data Set

Data from the Educational Longitudinal Study of 2002 (ELS: 2002, 2004) were used for this study. This is a public file provided by the National Center for Education Statistics (2004) and is a nationally representative sample of 10th grade students. Data were collected through a two-stage complex design in which schools were first selected using probability proportional to size (PPS), and then 26 students per school were selected using stratified systematic sampling procedures. In order to adjust for oversampling and nonresponse, weights were applied to prevent

incorrect estimates. The final study sample consisted of 14,639 10th-graders. Of these participants, approximately 50% were female and 50% were male; 23% of students were from a low-income family; 57% were White, 13% were African American, 15% were Hispanic, 10% were Asian students, and the remaining students were Native American, Hawaiian, multiracial, or of other races.

Variables

Perceived School Climate

Three dimensions of school climate were examined: (a) students' perceptions of order/safety/discipline (OSD); (b) students' perceptions of fairness/clarity of school rules (FC); and (c) students' perceptions of teacher/student relationship (TSR). Items used for these scales (see **Table 1**) were adapted from the California School Climate and Safety Survey-Short Form (CSCSS-SF; Rosenblatt and Furlong, 1997; Furlong et al., 2005) and were rated by students according to the degree to which they agreed with the statement. Items were reverse coded where needed so that a higher value would indicate a more positive perception of each school climate variable. In past research, each scale has shown acceptable to good reliability and validity with internal consistency estimations indicating Cronbach's alphas ranging from 0.67 to 0.73 (Fan et al., 2011). Additionally, principal components analysis using varimax rotation showed moderate to high component loadings indicating that the school climate items measured the constructs well (National Center for Education Statistics, 2003; Fan et al., 2011).

Academic Motivation

Four areas of academic motivation were examined: (a) self-efficacy in math (SEM), (b) self-efficacy in reading (SER), (c) intrinsic motivation in math (IMM), and (d) intrinsic motivation in reading (IMR). These items (see **Table 2**) were adapted from the Program for International Student Assessment (PISA, National Center for Education Statistics, 2003) that is comprised of a variety of psychological scales including those that address intrinsic interest and self-efficacy. The items that comprised the intrinsic interest scale in the ELS: 2002 were adapted from the self-report Scale of Intrinsic Versus Extrinsic Orientation (Harter, 1981). The self-efficacy items were adapted from PISA and slightly modified to measure self-efficacy in reading and math rather than global self-efficacy (National Center for Education Statistics, 2003). Students responded to motivation items by rating how often they experienced the feelings/behaviors expressed in the item statements or the degree to which they agreed with the item statements. Items were reverse coded where needed so that a higher value would indicate a higher level of each motivation variable. Each motivation scale shows acceptable to good reliability (National Center for Education Statistics, 2003; Fan and Williams, 2010) and validity (Fan and Williams, 2010). Coefficient alphas for the math interest scale for the PISA countries ranged from 0.71 to 0.90 and the reading interest scale alpha coefficients ranged from 0.78 to 0.90 (National Center for Education Statistics, 2003).

Achievement in Mathematics and Reading

Student mathematics and reading Item Response Theory (IRT) scores served as the dependent criteria for our study. IRT scores accounted for test question difficulty, discriminating ability, omitted items, and guessing. IRT scoring has been reported to have several advantages over raw number-right scoring by reducing student guessing, estimating omitted items and placing the tests with different difficulty on the same scale (ELS: 2002, 2004). Generally, IRT scale scores represented the estimated number of items students would have answered correctly. The students were given 72 mathematics questions measuring skill knowledge, comprehension, and problem solving in various areas of mathematics (e.g., arithmetic, algebra, geometry, probability) and 51 reading questions based on passages followed by questions regarding reproduction of detail, comprehension, and inference. Both math IRT Score ($M = 38.05$, $SD = 12.05$) and reading IRT score ($M = 29.92$, $SD = 9.85$) were computed as the probabilities of correct answers, summed over all items in the pools.

Plan of Analysis

First, multiple imputation using SPSS 19 (IBM Corp., 2010) was conducted to handle the missing data. No pattern was observed for the missing data. Three imputed data sets were generated (Rubin, 1987). Next, analysis was conducted using the Mplus 7.3 statistical program (Muthen and Muthen, 2010) to implement structural equation modeling (SEM) using a structural regression (SR) model to assess a multiple predictors multiple mediation model. A two-step process was conducted to test hypotheses for both measurement and structural models as recommended (Anderson and Gerbing, 1988) by using robust weighted least squares (WLS) approach. In step one, confirmatory factor analysis was used to assess whether the observed variables measured the latent constructs well. While past research has indicated that these scales show good construct validity (Fan and Williams, 2010; Fan et al., 2011), this step was included because these scales have not been used in numerous studies and so verification of construct validity was warranted. In step two, the fit of the hypothesized structural model (see **Figure 1**) was assessed. Last, a multiple predictors multiple mediation model was assessed to evaluate the indirect effects of school climate on math and reading achievement through students' school motivation.

A four-index strategy was used to determine a good model fit and included the use of the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA) along with its associated 90% confidence interval (CI) to assess model fit (Hu and Bentler, 1999). The A CFI of >0.95 , a RMSEA <0.06 , and a TLI > 0.95 was used to indicate a strong model fit; a CFI that nears 0.90, a RMSEA that nears 0.08, and a TLI nears 0.90 was used to indicate an acceptable model fit (Hu and Bentler, 1999). Due to the large sample used in this study and the tendency of large samples to affect the chi-square statistic resulting in the rejection of an acceptable model (Schumacker and Lomax, 2004), this statistic was not considered when determining the goodness of model fit.

TABLE 1 | School climate items, means, standard deviations, and standardized factor loading.

| Factor | Label | Item | Mean | SD | Standardized factor loading |
|-------------------------------------|-------|---|------|-------|-----------------------------|
| ORDER/SAFETY/DISCIPLINE | | | | | |
| 1 = <i>Strongly agree</i> | OSDa | Other students often disrupt class | 2.11 | 0.730 | 0.433 |
| 2 = <i>Agree</i> | OSDb | In class often feels put down by students | 3.08 | 0.712 | 0.523 |
| 3 = <i>Disagree</i> | OSDc | Does not feel safe at this school | 3.27 | 0.725 | 0.709 |
| 4 = <i>Strongly disagree</i> | OSDd | Disruptions get in the way of learning | 2.55 | 0.833 | 0.442 |
| | OSDe | Misbehaving students often get away with it | 2.44 | 0.803 | 0.576 |
| | OSDf | There are gangs in school | 2.94 | 0.903 | 0.541 |
| | OSDg | Racial/ethnic groups often fight | 3.03 | 0.849 | 0.549 |
| TEACHER/STUDENT RELATIONSHIP | | | | | |
| 1 = <i>Strongly agree</i> | TSRa | Students get along well with teachers | 2.20 | 0.593 | 0.593 |
| 2 = <i>Agree</i> | TSRb | The teaching is good | 2.06 | 0.653 | 0.754 |
| 3 = <i>Disagree</i> | TSRc | Teachers are interested in students | 2.12 | 0.698 | 0.780 |
| 4 = <i>Strongly disagree</i> | TSRd | Teachers praise effort | 2.24 | 0.754 | 0.616 |
| | TSRe | In class often feels put down by teachers | 1.87 | 0.695 | 0.601 |
| FAIRNESS/CLARITY OF RULES | | | | | |
| 1 = <i>Strongly agree</i> | FCa | Everyone knows what school rules are | 1.99 | 0.666 | 0.560 |
| 2 = <i>Agree</i> | FCb | Students know punishment for broken rules | 2.22 | 0.703 | 0.596 |
| 3 = <i>Disagree</i> | FCc | School rules are fair | 2.49 | 0.775 | 0.671 |
| 4 = <i>Strongly disagree</i> | FCd | Punishment same no matter who you are | 2.33 | 0.891 | 0.666 |
| | FCe | School rules are strictly enforced | 2.23 | 0.713 | 0.489 |

Descriptive statistics are unweighted. $p < 0.001$ for all factor loadings.

RESULTS

Descriptive Statistics

Table 1 provides means and standard deviations for school climate items. The results indicated that 10th grade students tended to agree that their schools were orderly and safe and that students who misbehaved received discipline. An examination of the means of each indicator revealed that these students viewed safety more positively than they viewed order in their schools. Additionally, students tended to agree that relationships with teachers were positive. They most highly rated teachers' praising of students' efforts and getting along well with students. Finally, the results indicated that students tended to agree that school rules were clearly stated and fairly enforced with fairness of rules being rated the most positively.

Table 2 provides means and standard deviations for motivation items. The results indicated that 10th grade students tended to report sometimes or often perceiving themselves as able to do well in math and reading. An examination of individual indicators revealed that these students held the most positive perceptions of themselves as able to do an excellent job on assignments and tests in both math and reading as well as to master skills taught in these classes. Their self-efficacy for understanding difficult texts and classes in these subject areas was lower in comparison. In regard to intrinsic motivation, students tended to disagree or agree that they found interest and enjoyment in both math and reading. Students more often reported that math and reading were fun than that they became absorbed in these subject areas.

Structural Equation Analysis

Measurement Model

The measurement model featured 32 indicators (15 motivation items and 17 school climate items), seven latent variables and two observed achievement variables. We allowed saturated structural relations and no error covariances among indicators when assessing the measurement model. Confirmatory factor analysis indicated a good fit for the measurement model, $\chi^2_{(508)} = 19330.113$, $p < 0.001$, CFI = 0.932, TLI = 0.925, RMSEA = 0.050 with CI of (0.050, 0.051), verifying that the indicators measured the latent constructs well. Standardized factor loadings for the school climate constructs were acceptable to good and ranged from 0.433 to 0.780; standardized factor loadings for the motivation variables were moderate to strong ranging from 0.598 to 0.923 (see Tables 1, 2). The factor loadings showed that each item loaded significantly and substantially on the factor it was designed to represent.

Structural Model

Given that the measurement model fit the data well, we next tested the overall structural model along with the indirect effects. Analysis of the structural model indicated that the fit of the data to the model was excellent, $\chi^2_{(495)} = 9752.355$, $p < 0.001$, CFI = 0.967, TLI = 0.962, RMSEA = 0.036 with CI of (0.035, 0.036). No error covariances were added to the model. The results indicated that our priori structural model provides meaningful explanation of the data. All significant standardized parameter estimates are shown in Figure 2. All correlations among school climate constructs and the four correlations among student motivation constructs turned out to be significant.

TABLE 2 | Student motivation items, means, standard deviations, and standardized factor loading.

| Factor | Label | Item | Mean | SD | Standardized factor loading |
|-------------------------------------|-------|---|------|-------|-----------------------------|
| SELF-EFFICACY—MATH | | | | | |
| 1 = <i>Almost never</i> | SEMa | Can do excellent job on math tests | 2.55 | 0.925 | 0.858 |
| 2 = <i>Sometimes</i> | SEMb | Can understand difficult math texts | 2.37 | 0.934 | 0.865 |
| 3 = <i>Often</i> | SEMc | Can understand difficult math class | 2.47 | 0.964 | 0.879 |
| 4 = <i>Almost always</i> | SEMd | Can do excellent job on math assignments | 2.63 | 0.942 | 0.897 |
| | SEMe | Can master math class skills | 2.67 | 0.937 | 0.897 |
| SELF-EFFICACY—READING | | | | | |
| 1 = <i>Almost never</i> | SERa | Can understand difficult English texts | 2.61 | 0.885 | 0.824 |
| 2 = <i>Sometimes</i> | SERb | Can understand difficult English class | 2.64 | 0.919 | 0.869 |
| 3 = <i>Often</i> | SERc | Can do excellent job on English assignments | 2.85 | 0.880 | 0.894 |
| 4 = <i>Almost always</i> | SERd | Can do excellent job on English tests | 2.79 | 0.889 | 0.907 |
| | SERe | Can master skills in English class | 2.75 | 0.886 | 0.882 |
| INTRINSIC MOTIVATION—MATH | | | | | |
| 1 = <i>Strongly agree</i> | IMMa | Gets totally absorbed in mathematics | 2.49 | 0.808 | 0.598 |
| 2 = <i>Agree</i> | IMMb | Thinks math is fun | 2.79 | 0.840 | 0.884 |
| 3 = <i>Disagree</i> | | | | | |
| 4 = <i>Strongly disagree</i> | | | | | |
| INTRINSIC MOTIVATION—READING | | | | | |
| 1 = <i>Strongly agree</i> | IMRa | Thinks reading is fun | 2.49 | 0.904 | 0.923 |
| 2 = <i>Agree</i> | IMRb | Reads in spare time | 2.51 | 0.915 | 0.865 |
| 3 = <i>Disagree</i> | IMRc | Gets totally absorbed in reading | 2.27 | 0.910 | 0.782 |
| 4 = <i>Strongly disagree</i> | | | | | |

The descriptive statistics are unweighted. $p < .001$ for all factor loadings.

The association between school climate and motivation.

Results indicated that the relations between perceptions of teacher/student relationship and all four motivation constructs were significant and positive. Additionally, students' perceptions of fairness/clarity of school rules related positively to intrinsic motivation in math. However, negative relations between students' perceptions of order/safety/discipline and intrinsic motivation in math and reading were found. Negative relations were found between students' perceptions of fairness/clarity of school rules and self-efficacy in math and reading.

The association between motivation and achievement.

An examination of the relations between self-efficacy and achievement showed that self-efficacy in math related positively with both math and reading achievement, while self-efficacy in reading related positively with reading achievement. Intrinsic motivation in math related negatively with reading and math achievement, while intrinsic motivation in reading related positively with both achievement outcomes.

The association between school climate and achievement (direct effect).

The results indicated that students' perceptions of teacher/student relationship related positively with both math and reading achievement. In addition, the relations between the remaining school climate dimensions, perceptions of fairness/clarity of rules and order/safety/discipline, and achievement were significant. Students' perceptions of fairness/clarity of rules related negatively with both

math and reading achievement, while their perceptions of order/safety/discipline related positively with both achievement outcomes.

Motivation in linking school climate and achievement (indirect effect)

The results of the multiple predictors multiple mediation model detected various significant indirect effects. In sum, the student motivation variables seemed to have yielded significant overall mediation effects in linking students' perceived fairness and clarity of rules as well as teacher-student relationship to both math and reading achievements (see **Table 3**). More specifically, students' perceived teacher-student relationship indirectly impacted their math and reading achievement through its relations with students' self-efficacy in math and intrinsic motivation in math and reading respectively. Students' perceived school fairness and clarification indirectly influenced their math and reading achievement through its relations with students' self-efficacy in math as well as intrinsic motivation in math. Moreover, the overall indirect effects of students' intrinsic motivation in math and reading in linking students' perceived school order and safety to their math and reading achievement were significant. In addition, students' perceived fairness and clarification as well as teacher-student relationship indirectly influenced their reading achievement respectively through students' perceived confidence in reading.

In other words, students who perceived more positively about their teacher-student relationship tended to have higher

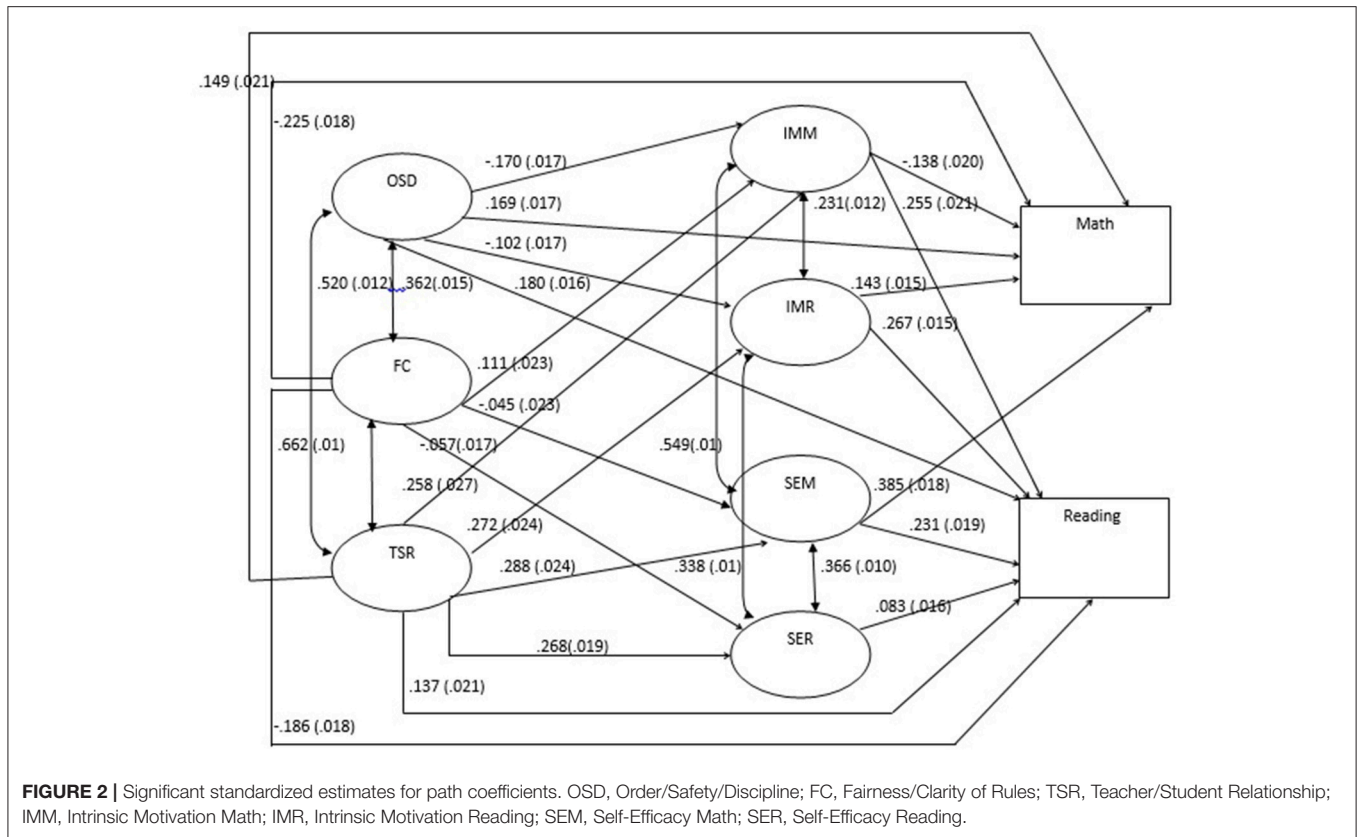


TABLE 3 | Indirect effects for the multiple mediator models.

| Antecedent | Math achievement | | | | | Reading achievement | | | | |
|------------------------------|------------------|----------|---------|-------|----------|---------------------|----------|---------|---------|----------|
| | IMM | IMR | SEM | SER | Overall | IMM | IMR | SEM | SER | Overall |
| Order/Safety/Discipline | 0.023** | -0.015** | 0.002 | 0.000 | 0.011 | 0.043** | -0.023** | 0.001 | 0.001 | 0.019* |
| Fairness/Clarity of Rules | -0.015** | 0.000 | -0.016* | 0.000 | -0.031** | -0.028** | 0.001 | -0.011* | -0.005* | -0.043** |
| Teacher/Student Relationship | -0.036** | 0.039** | 0.103** | 0.001 | 0.107** | -0.066** | 0.073** | 0.067** | 0.022** | 0.096** |

IMM, Intrinsic Motivation Math; IMR, Intrinsic Motivation Reading; SEM, Self-Efficacy Math; SER, Self-Efficacy Reading; *Indicates $p < 0.05$; **Indicates $p < 0.001$.

confidence in their academic abilities in both math and reading as well as greater interest in reading, and in turn were likely to have higher math and reading achievement. On the contrary, students who perceived more positively about their teacher-student relationship tended to have higher confidence in their academic abilities in both math and reading as well as greater interest in reading and were more likely to obtain higher math and reading achievement. Also, students who perceived more positively about the school fairness and clarification tended to have greater interest in both math and reading and were less likely to perform well in math but more likely to perform well in reading. Students who perceived more positively about school order and safety tended to lower levels of interest in both math and reading and were more likely to obtain higher math achievement but lower reading achievement.

DISCUSSION

The current study provides valuable insight into one of the underlying mechanisms that explains the associations between students' perceived school climate and their achievement through the role of students' school motivation. Findings suggest that strategies seeking to promote students' achievement that rely solely on their perceived school climate without considering students' motivational beliefs and interest are incomplete. The study expands the extant research by showing possible pathways that promote student achievement. Among all the pathways, several are of particular interests. In one pathway, students tend to have greater math and reading achievement when they perceive more positively about their teacher-student relationship and thus are likely to have greater confidence in their academic abilities in both subjects as well as greater interest in reading. In

another pathway, when students perceive greater levels of fairness and clarification of rules in school, they tend to be less confident in their abilities in math and reading and thus become less likely to receive higher achievement scores in both subjects. Moreover, when students perceive higher levels of order and safety in school, they are less likely to feel genuinely interested in reading and thus less likely to have lower reading achievement. In general, these findings support our theoretical hypotheses that school climate as external context relates to students' academic outcomes through individual's cognitive perceptions.

School Climate and Achievement

The results of the study indicated that when their teachers were interested in them, praised their effort, and engaged in positive interactions with them, 10th grade students were more likely to achieve at higher levels in reading and math. In addition, when they perceived that their schools maintained orderly and safe environments, they achieved at higher levels in these academic content areas. However, when 10th grade students perceived that school rules were clearly stated and fairly enforced, they demonstrated lower levels of achievement in reading and math. The negative relation between fairness/clarity of school rules and both achievement variables was unexpected and contradictory to the finding of Ma and Klinger (2000), but consistent with the finding from Ripski and Gregory (2009). Ripski and Gregory (2009) proposed that students' perceptions of fairness/clarity of school rules might be more closely connected with personal experiences in the classroom, while standardized assessments are more impersonal and less connected with students' classroom experiences. That is, even though classrooms are perceived positively in terms of fairness and clarity of rules, the positive relations might not be evidenced in achievement measures that are not directly related to these classroom experiences. If achievement in reading and math were measured as grades for the class, the direction of the relations might change. Due to still limited research in this area, additional studies are warranted in order to build the body of research that examines students' perceptions of fairness/clarity of rules and its relation to achievement and to reconcile these inconsistent findings.

Motivation and Achievement

The present results revealed that 10th grade students who perceived greater ability to understand math materials and perform well on math tasks were found to perform better on standardized math and reading assessments. Those who reported greater ability in reading were found to do better on these assessments in reading but not in math. In addition, those who reported greater interest in reading demonstrated higher levels of achievement in both subject areas. However, 10th grade students who reported greater interest in math demonstrated lower levels of achievement in reading and math. The negative relation between intrinsic motivation in math and achievement in reading might be explained by students' preference and perceived ability in different academic content areas. In other words, students who are more intrinsically motivated in math might prefer this academic area over reading and feel more competent in math than in reading.

The negative relation found between intrinsic motivation in math and math achievement was unexpected. One possible explanation is that students' reports of interest and enjoyment of math might be reflective of more personal classroom experiences that are influenced by educators' efforts to create situational interest. How students understood the nature of the items assessing intrinsic motivation in math might be very different. For example, some students might consider math in general fun and interesting, but find current math topics being taught or math class activities boring and uninteresting due to environmental contexts such as poor instructional strategies or poor teacher-student relationship. Thus, it is recommended that future examination include intrinsic motivation measures that are adjusted to more closely reflect students' classroom experiences. In addition, its relation with achievement might be better measured with grades that are based upon performance in the classroom.

School Climate and Motivation

Perceptions of teacher/student relationship were found to relate positively with self-efficacy and intrinsic motivation in both reading and math as hypothesized. This finding suggests that educators can influence students' perceptions of self-efficacy and intrinsic motivation at school through their thoughtful interactions with students. It is consistent with an extant body of research indicating the manner in which teachers interact with students and the type of classroom environment they maintain are critical in supporting student motivation (e.g., Schunk et al., 2008). Research has also shown that it is not only the direct interactions between teachers and students but also the classroom environments maintained by teachers that influence student motivation. It is thus important that teachers provide the verbal feedback and classroom environments that influence student motivation because they enhance current experiences in school and affect important future educational decisions.

Fairness/Clarity of Rules, Order/Safety/Discipline, and Motivation

These school climate constructs are considered together in the examination of their relations with motivation because they in common reflect the climate of the overall school as well as that of the classroom. They are also both related negatively to motivation. Negative relations between fairness/clarity of rules and self-efficacy in reading and between order/safety/discipline and intrinsic motivation were found. Limited research examining these variable relations is currently available. However, the findings of the current study conflict with those reported in a previous study that examined similar variables. McMahon et al. (2009) found that lower levels of perceived friction predicted greater self-efficacy. However, this was measured according to students' perceptions of the classroom climate rather than their perceptions of the school climate. The current study differs in that the items that comprised these school climate factors extend beyond the classroom and measure students' perceptions of their schools. Yet, the motivation measures are more reflective of perceptions of classroom experiences. Future research examining

these dimensions of school climate might define this variable in a way that more closely reflects students' perceptions of their classroom experiences.

Limitations of the Current Study

While contributing to the existing body of literature that examines the relations among school climate, motivation, and achievement, the study has several limitations. First, the study is a cross-sectional study which does not generate causal inferences. Because both motivation, school climate measures as well as achievement used in the study were collected at the same time wave, we are not able to conduct a longitudinal investigation and make any causal conclusions about the relations. Future studies investigating such relations using data from multiple time points will provide valuable information to the literature. Second, the sample used in the current study includes only 10th grade students. While the study of adolescents is considered important due to the changes that occur in motivation at this stage (Gottfried et al., 2001; Lepper et al., 2005; Otis et al., 2005; Unrau and Schlackman, 2006; Lau, 2009), the inclusion of this age group does not allow for generalization of the findings to students of other ages. For example, to the relations among students' perceived school climate, motivation and academic achievement might differ for younger students in elementary schools. Future research further testing these relations for different student

populations will provide valuable information to the literature. Moreover, future research addressing the size of the effects on the relationships among students' academic achievement, school motivation and perception of school climate will be a valuable addition to the literature. Notwithstanding, the findings of the present study complements and extends earlier studies by examining the underlying mechanism among school climate, student motivation and achievement, demonstrating a unique and useful perspective for understanding how we might be better promoting student achievement.

ETHICS STATEMENT

The IRB form of this study was approved by the committee of University of Houston.

AUTHOR CONTRIBUTIONS

WF made substantial contributions to the conception and design, and the acquisition of data, and the analysis and interpretation of data, participated in drafting the article and revising it critically for important intellectual content, gave final approval of the version to be submitted and any revised version. CW participated in data analysis, results interpreting, drafting the article, and revising it critically for important intellectual content.

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Conflict of Interest Statement: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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