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Effects of a Teacher Professional Development Intervention on Peer Relationships in Secondary Classrooms

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Abstract

We investigated the effects of My Teaching Partner—Secondary (MTP-S), a teacher professional development intervention, on students' peer relationships in middle and high school classrooms. MTP-S targets increasing teachers' positive interactions with students and sensitive instructional practices and has demonstrated improvements in students' academic achievement and motivation. The current study tested the prediction from systems theory that effects of MTP-S on students would extend beyond the academic domain—that is, the ecology of teachers' behaviors towards students should also influence the ecology of students' behaviors towards one another. Participants were 88 teachers (43 randomly assigned to MTP-S and 45 assigned to a control group that received the regular professional development offerings in their school) and 1423 students in their classrooms. Observations and student self-report of classroom peer interactions were collected at the start and at the end of the course. Results indicated that in MTP-S classrooms, students were observed to show improvement in positive peer interactions, although this pattern was not found in self-report data. However, moderation analyses suggested that for students with high disruptive behavior at the start of the course, teacher participation in MTP-S mitigated a typical decline towards poorer self-reported peer relationships. The relevance of findings for the social ecology of classrooms is discussed.

The influence of teacher practices on secondary school students is typically studied in relation to academic achievement and motivational outcomes (Roeser, Eccles, & Sameroff, 2000), and not in relation to students' peer interactions. Particularly at the secondary level, teachers perceive their function as imparting academic content and not as facilitating good social relationships with peers (e.g., Lynch & Cicchetti, 1997). Yet, adolescents are influenced by their peers in ways that affect academic success. For example, being part of a peer group that values academic performance predicts adolescents' own increased academic motivation, work habits, and high school completion in subsequent years (Berndt & Keefe, 1995), which underscores potential value in teachers' attention to students' peer

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relationships. Systems theory would postulate links between teachers' practices and students' interactions with their classroom peers, but empirical tests of this proposition are few, particularly at the secondary school level.

Theoretical Rationale for Links Between Academic and Social Classroom Ecologies

According to systems theory, transactions occur between the multiple structures within every environment (Bronfenbrenner, 1979; Seidman, 1988). Therefore, the ecology of teachers' behaviors towards students should theoretically relate to the ecology of students' behaviors towards one another in that classroom. Interpersonal transactions between members within the environment are key to characterizing a setting (Tseng & Seidman, 2007), and interpersonal interactions could be effective targets for intervention (Seidman & Tseng, 2011). Moreover, a systems framework that considers the reciprocal influences between teachers and students could best characterize classroom processes and teacher–student interactions should affect student–student interactions (Jones, Brown, & Aber, 2008; Pianta, 1999).

Consistent with the framework that interpersonal transactions across settings are pertinent to the lives of secondary school students, research has found that adolescents' social relationships with teachers, with family, with peers, and with their neighborhood community combine additively and interactively to predict adjustment (Gregory & Weinstein, 2004; Pedersen et al., 2005; Roberts et al., 2000). Further, there is a growing literature about ways in which teacher–student interpersonal relationships, not just teachers' academic instruction, contribute to adolescents' academic achievement and motivation (Pianta & Allen, 2008; Roeser et al., 2000). However, empirical tests are limited of the specific hypothesis that the ecology of teacher–student interactions has effects beyond students' academic functioning and extends to students' social ecology with their peer group in that classroom.

Teacher Practices and Student–Peer Interactions

There is a small body of literature involving elementary school youth suggesting that teachers promote students' good peer interactions in the classroom by (a) having warm relationships with students themselves, and (b) using instructional practices that sensitively engage all students in the material. Positive teacher–student relationships may set a model for peers to follow in their treatment of each other, because the teacher is demonstrating that all students have value (Mikami, Lerner, & Lun, 2010). Peers who observed a teacher praising a child, when the praise was experimentally manipulated (White, Jones, & Sherman, 1998) or in naturalistic designs (Hughes, Cavell, & Wilson, 2001), increased their liking of that child. Peers' perceptions that a teacher had a good relationship with a child predicted subsequent increases in their acceptance of that child (Hughes & Kwok, 2006). Finally, teachers observed to have warm relationships with students, as assessed by the Classroom Assessment and Scoring System (CLASS; Pianta, La Paro, & Hamre, 2007), had students with higher teacher-rated social competence (Mashburn et al., 2008) and more observed social conversation with peers (Rimm-Kaufman, La Paro, Downer, & Pianta, 2005).

Instructional practices that sensitively engage all students in the material may also set the stage for positive classroom peer interactions because these practices send the message that all students are valued while minimizing academic hierarchy, which may similarly discourage a social hierarchy (Cohen & Lotan, 1995; Mikami et al., 2010). Elementary school teachers' practices that catered to students' diverse learning needs (Donohue, Perry, & Weinstein, 2003), as well as that dismantled academic status hierarchies (Mikami, Griggs,

Reuland, & Gregory, 2011), each predicted students having better peer relationships over the course of a school year. Moreover, meta-analytic research associated cooperative learning with children's positive interactions with peers (Roseth, Johnson, & Johnson, 2008).

Teacher practices associated with good peer interactions have rarely been examined in secondary school, as opposed to in the primary grades. This likely reflects the trend for secondary school teachers to emphasize academic learning; yet such an exclusionary focus may be misguided, given the theoretical rationale for the ecology of teacher–student interactions to relate to the ecology of peer–peer interactions at all age levels (Bronfenbrenner, 1979). Notably, Chang et al. (2004) have found that teacher practices affected patterns of peer acceptance among Chinese middle school students. The authors theorized that Chinese students may remain more influenced by their teachers at older ages and questioned the robustness of the finding for a Western sample, but previous research with an American middle school sample found that training teachers in a cooperative learning intervention improved student self-report of positive peer relationships in the classroom (Mikami, Boucher, & Humphreys, 2005).

Additional examination is needed of the interface between the ecology of teacher–student interactions and the ecology of student–student interactions in secondary school. One important limitation in the existing literature is the near-exclusive reliance on student self-reports of their peer interactions, which captures student-reported experiences of peer exclusion that an observer would fail to see (Olweus, 1992) and which potentially allows examinations of the variability between students' reports. However, self-report data are subject to bias such as students' comfort level with disclosure (which may be facilitated via treatment, paradoxically leading to increased self-reports of peer problems after intervention) and understanding of the question. Therefore, also including observational data would be a stronger study design (Cornell, Sheras, & Cole, 2006). Extending existing findings with elementary students to an older age group would further the hypothesis that the ecologies of teacher–student relationships and student–student relationships continue to interface.

At-Risk Students

Youth with disruptive behavior problems merit special attention in research about social difficulties in school. It is well documented among middle and high school samples that these students fail to get along with normative, mainstream peers in their classrooms (e.g., Bagwell, Molina, Pelham, & Hoza, 2001). Among populations of youth with disruptive behavior disorders, peer troubles add incrementally to the likelihood of academic failure and school dropout in adolescence, even after statistical control of academic achievement (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; Mikami & Hinshaw, 2006). Further, students who have disruptive behaviors commonly have poor, conflictual relationships with their teachers (Mikami, Chi, & Hinshaw, 2004; Stormont, 2001).

There is suggestive evidence that students with disruptive behavior problems also experience *declining* peer relationship quality over the course of a school year, at least among elementary school students. That is, after statistical control of peer status in fall, elementary school children high in disruptive behavior problems showed increasing peer difficulties over the following 9 months (Mikami et al., 2011). Yet, using a correlational design, teacher practices that dismantled academic status hierarchies and that sensitively engaged students with diverse learning needs predicted mitigation of the typical decline in peer status experienced by children with disruptive problems (Mikami et al., 2011). Although the effect of teacher practices on peer status is interesting, replication is needed

with a randomized design in which teachers are trained to change their practices, as is investigation of whether results equally apply to secondary school students.

My Teaching Partner—Secondary

My Teaching Partner—Secondary (MTP-S; Pianta & Allen, 2008) is an intervention designed to improve student–teacher relationships. The MTP-S intervention provides teachers consultation targeted to increase their (a) emotionally supportive, warm relationships with students, and (b) use of instructional and classroom management strategies that sensitively assist all students in becoming cognitively engaged and challenged by the material. For instance, MTP-S teachers are coached to inquire about students' extracurricular interests (to build a positive relationship), to incorporate these interests when teaching course material (to engage students by helping them see the relevance of what they are learning), and to use manipulatives and varied instructional formats (to sensitively reach students' with varied learning needs). MTP-S is the secondary school adaptation of an intervention empirically validated in prekindergarten (Pianta, Mashburn, Downer, Hamre, & Justice, 2008). Preliminary findings from a randomized controlled trial suggest that teacher participation in MTP-S contributes to increases in students' academic achievement assessed via standardized testing (Allen, Pianta, Gregory, Mikami, & Lun, in press) as well as improvements in students' observed in-class engagement (Gregory, Allen, Mikami, Hafen, & Pianta, 2011).

It is important to note that MTP-S is not a peer relationship intervention; rather, it focuses on improving teacher–student relationships and on training teachers to provide instruction that is cognitively engaging and challenging for youth with diverse academic needs. The consultation for intervention teachers is organized around the dimensions of the CLASS (Pianta et al., 2007), which is the observation system of teacher practices empirically validated to relate to students' motivation and achievement in primary grades (Curby et al., 2009; Hamre & Pianta, 2005) as well as in secondary school (Allen et al., 2011). However, change in peer relationships as a result of MTP-S would support systems theory and the understudied idea that secondary school teachers can affect students' peer relationships through their own behaviors towards students.

Purpose

The purpose of the current study was to test, using multiple measures, the effects of MTP-S on the peer relationships of secondary school students. MTP-S is a teacher professional development intervention focused on improving positive teacher–student interactions and providing sensitive academic instruction that cognitively engages and challenges adolescents with diverse learning needs. We hypothesized that teacher participation in MTP-S would predict increases in the average levels of students' observed and self-reported positive peer interactions with one another during class. We additionally hypothesized that students with disruptive behavior would be most at risk for difficult peer interactions in their classroom, but that teacher participation in MTP-S would lessen the trajectory towards poor peer interactions for this high-risk student group.

Method

Participants

Participants were 88 secondary school teachers, 43 who were randomly assigned to receive the MTP-S intervention, and 45 who formed a control condition and received the regular professional development offered by their school (largely workshops). As shown in Table 1, participating teachers were predominantly white and female with varied years of teaching

experience. Teachers were recruited from 12 schools across predominantly rural and suburban areas in the southeastern United States. The number of teachers per school ranged from 3 to 15 ($M = 8$). About 61% taught in middle schools and the remaining 39% taught in high schools. The average percentage of students at these schools receiving free or reduced-price lunch was 39.8% ($SD = 11.2\%$).

Most of the teachers ($n = 67$) taught the same students across the school year, which we referred to as a "traditional" course structure. However, 21 teachers switched students midacademic year, which we referred to as a "block" course structure. Traditional teachers selected one course and block teachers selected a fall course and a spring course as focal classes for the MTP-S intervention and for the evaluation measures. Focal classes contained language arts/social studies (56%) and math/science (44%) content. Classroom demographics are presented in Table 1.

Measures

Observed positive peer interactions (baseline and post-test)—Classroom videotapes were scored by a team of coders who were kept unaware of all other study data, including whether the classroom had been assigned to the MTP-S or control condition. Coders scored the presence of students' positive interactions with their classroom peers using a scoring procedure adopted from the CLASS coding system of secondary school classroom quality (Pianta et al., 2007). The CLASS has been found to be highly reliable over time (Malmberg, Hagger, Burn, Mutton, & Colls, in press) and valid in relation to students' scores on standardized achievement tests in secondary samples (Allen et al., 2011). Notably, the measure of observed positive peer interactions was derived from the Positive Climate scale on the CLASS in which the positive, cooperative, and warm nature of both teacher–student and student–student interactions are considered jointly, with more weight given to teacher–student interactions. We sought to focus on the positive, cooperative, and warm nature of student–student interactions only.

The positive peer interactions scale ranged from 1 to 7, whereby 1 and 2 indicated low-range; 3, 4, or 5 indicated midrange; and 6 or 7 indicated high-range positive peer interactions. Classrooms receiving a 6 or 7 had students who showed a high degree of warm, genuine positive affect towards one another, who volunteered to help one another, who collaborated well and respectfully with one another during class projects or discussions, and who sought each other out for interaction. Notably, students must have demonstrated this not just with their clique of friends, but across the class as a whole. Classrooms receiving a 3, 4, or 5 had students with general positive effect, but lacking the degree of warmth or exuberance to be with classroom peers as would students in classrooms scoring 6 or 7; or perhaps, students appeared enthusiastic to be with their clique but this did not spread across the class as a whole. Classrooms scoring 1 or 2 may have had no peer interactions at all, or students may have ignored one another or seemed indifferent to peers. We note that we also coded the presence of negative peer interactions (thought to be a different construct than just the absence of positive peer interactions), but the low reliability of this code precluded its use.

Coders received training on this system (and on the CLASS) in a 2-day workshop. Each coder passed a reliability test for positive peer interactions along with the other CLASS dimensions, in which they scored within one point of the master codes in at least four out of five video segments. In addition, coders met regularly during the year in order to prevent drift. Each videotape during a time point (e.g., baseline or post-test) was divided into two 20-min segments. Two coders were randomly assigned to watch the first segment, and a different two coders watched the second segment. Each coder independently scored the segment and the classroom's final score on positive peer interactions at a time point was the

average of all four coders' scores. According to Cicchetti (1994), intraclass correlation coefficients (ICCs) below .40 reflect "poor " agreement, ICCs from .40 to .59 reflect "fair " agreement, ICCs from .60 to .74 reflect "good" agreement, and ICCs .75 and higher reflect "excellent " agreement. Our inter-rater reliability was acceptable (ICC = .65).

Student self-report of positive peer interactions (baseline and post-test)—We used a measure found to have intervention effects in a previous school-based intervention study with middle school youth that aimed to increase their cooperative interactions with the peers in that classroom (Mikami et al., 2005). We thought this measure would potentially be most sensitive to MTP-S, which is also a school-based intervention with secondary school youth that was theorized to affect their cooperative interactions with classroom peers. We were not aware of other measures for adolescents that assess the quality of their cooperative interactions with the peers in that classroom specifically (as opposed to self-perceptions of loneliness or victimization at school in general, or peers' perceptions of that adolescent as popular). There is a long tradition of self-report of adolescents' feelings of victimization by peers beginning with Olweus (1992), who argues that the adolescent him/herself is the individual most aware of the extent to which s/he is marginalized or teased by classmates. Students answered 4 items specific to the focal course using a 5-point Likert scale. (Sample items: "How many students in this class do you get along with? " "How many students in this class put you down, tease you, or pick on you? " 5 = *all*; 4 = *most* (75%); 3 = *about half*; 2 = *few* (25%); 1 = *none*.) Internal consistency (α) in Mikami et al. (2005) was .72, and in the current sample it was .63.

Student self-report of disruptive behavior (baseline)—Disruptive behavior was assessed using 4 items that compose the disruptive behavior subscale on the Patterns of Adaptive Learning, which has demonstrated high internal consistency (α = .83; Midgley et al., 2000). Previous research using this sub-scale has shown that students' own perceptions of their disruptive behavior are associated with teachers' perceptions of similar behavior (Gregory & Ripski, 2008), to teacher practices (Gregory & Ripski, 2008), and to the social environment of the classroom (Ryan & Patrick, 2000). Students answered each item on a 5-point Likert scale (e.g., "I sometimes get in trouble with my teacher during class "; 1 = *not at all true*; 3 = *sometimes true*; 5 = *very true*). In our sample, internal consistency (α) was also .83.

Procedure

The research study was presented to teachers in the spring preceding the fall academic year in which the intervention commenced. To meet study inclusion criteria, teachers were required to work in secondary school and needed to be able to select a focal course for which (a) the participating teacher was the primary instructor, and (b) an end-of-course standardized exam was administered to assess student learning. Although 114 teachers initially expressed interest in the study, 26 later decided against participating (n = 23 prior to any contact with the program and n = 3 after the fall workshop had been completed, but before any further intervention or collection of data in the current study had occurred). Teachers provided written consent and study procedures were approved by a university institutional review board. Once teachers had consented and had selected a focal course, parents of students in that course were asked to provide consent, and students were asked to provide assent to participate in the study. Over 75% of eligible students agreed to participate, for a total student n of 1423.

Teachers within each school were grouped by focal course subject (i.e., math/science, language arts/social studies). Then, within each subject in each school, teachers were randomly assigned to the MTP-S intervention condition or to a control group (50%

probability of being assigned to each condition). This stratification procedure was done in an attempt to evenly distribute demographic variables, school-level variables, and course subject. As expected, no significant differences were found between the MTP-S and the control group on any of the teacher or classroom demographics found in Table 1. However, stratification within schools increased the possibility that contamination between treatment and control conditions would occur. We attempted to minimize contamination by not informing teachers of their colleagues' program status and not including teachers who team taught. No school-wide faculty meetings included intervention content. Therefore, there were no formal school structures or dissemination of information that would facilitate sharing of the intervention across study condition.

All teachers (MTP-S and control) received a 1-day study orientation workshop immediately prior to the start of the academic year in the fall. Teachers were instructed in procedures to obtain student assent/parent consent and in the process of data collection. All teachers (MTP-S and control) were requested to follow a standard protocol for videotaping their classes and for collecting student self-report questionnaires in order to yield the study data.

The MTP-S intervention took place throughout the academic year (fall to spring). MTP-S teachers videotaped a typical session in their focal course and sent the tape to the study. Consultants, who were master teachers trained in the CLASS observation system of high-quality teaching (Pianta et al., 2007) and in the MTP-S intervention, selected brief video segments to post on a private webpage where teachers logged in and were asked to observe their own behavior and student reactions, and to reflect upon the connection between the two. This was followed by a 20–30-min phone conference between the teacher and the consultant to discuss instructional strategies that would enhance positive teacher–student relationships and teachers' ability to sensitively engage and cognitively challenge students with diverse learning needs. The video segments chosen and the questions posed by the consultant were meant to advance the teacher's development in the dimensions of the CLASS (Pianta et al., 2007). The cycle (teacher videotapes, consultant reviews) continued approximately twice a month for the duration of the school year. MTP-S teachers were also directed to video exemplars of high-quality teaching on the MTP-S website. See Pianta and Allen (2008) for further details about the intervention process and philosophy. Control group teachers taped six classroom segments spaced evenly across the school year and timed to coincide with MTP-S teacher tapings. However, control teachers received no feedback, nor did they have access to the video exemplars on the MTP-S website.

Students in the teacher's focal course completed questionnaires about their behaviors and their perceptions of the classroom. Teachers distributed the questionnaires to students during class time and informed students that their answers would be kept confidential from the teacher. Students placed completed questionnaires into an envelope located away from the teacher that was returned to the study at the immediate end of the questionnaire period. For focal courses with a traditional structure (where the same students remained in that classroom all year; $n = 67$), questionnaire periods occurred at the start of the school year in the fall, midyear (beginning of January), and at the end of the year in the spring. For focal courses with block structure (where new students were enrolled each semester; $n = 21$), questionnaires were completed at the start and end of the first semester (i.e., the start of the school year and in December), and again at the start and at the end of the second semester (i.e., the beginning of January and in spring). This was necessary because the entire class roster switched between fall and spring semester for block structure courses.

In data analysis, what we considered to be the baseline (initial) data point differed between teachers who kept the same students all year (traditional structure) and teachers who switched students midyear (block structure). For teachers with a traditional course structure,

we considered the first videotaping time in the fall, as well as the fall questionnaire collection period, to be the baseline measures. For teachers with a block structure, we considered the videotape and the questionnaire period that occurred at the start of the spring semester with the new class to be the baseline measures. For all teachers regardless of whether they had a traditional or block structure, the post-test (outcome) data point was the last videotaping time in the spring and the last questionnaire collection period in the spring. Our choice to use the beginning of spring semester measure as the baseline for block structure courses provides a more stringent test of intervention effectiveness, because these teachers would already have received one semester of intervention before the baseline measure was taken (and therefore, some MTP-S-related changes may already have occurred).

Data Analytic Plan

Although 88 teachers began the study at the start of the school year, with 1423 consented students in their classrooms, at the baseline assessment point 85 teachers completed the classroom videotape and 80 teachers (with 1107 students) completed the student questionnaires. At the post-test assessment, 74 teachers completed the classroom videotape and 83 teachers (with 1086 students) completed the student questionnaires. At baseline, there were no differences between teachers who did versus did not have observation data, as well as between teachers who did versus did not have student questionnaire data, in most of the predictors we used in our models: MTP-S versus control group status, teacher gender, teacher experience, class size, proportion of African American and Hispanic students, traditional versus block course schedule, and employment in high school versus middle school. Teachers with student questionnaires at baseline had a lower proportion of male students, $F(1, 86) = 6.21$, $p = .02$, than did teachers without student questionnaire data, but this was not true for teachers who did versus did not have observation data. At post-test, teachers who did versus did not have observation data, as well as teachers who did versus did not have questionnaire data, did not differ on any demographic predictor, whether they had been in the MTP-S versus control group, and crucially, on baseline indicators of positive peer interactions. Thus, to the best of our knowledge, data were missing at random and not connected to intervention group status or to baseline peer interactions. Full information maximum likelihood methods were used to address missing data (Enders, 2001). Although MTP-S teachers varied in the number of cycles completed (whereby the teacher videotapes and consultant reviews; $M = 9$, $SD = 3$, range = 0–16), an indication of the extent to which the teachers participated in the treatment, we adopted an intent-to-treat strategy.

Our main hypothesis was that MTP-S would lead to improvements in students' observed and self-reported positive peer interactions. We speculated that the self-report measure best assessed students' affective feelings towards classroom peers and the observational measure best assessed students' cooperative and respectful behaviors with these peers. We considered both to be distinct constructs and important, so we looked at them individually.

We used analysis of covariance procedures to test intervention effects on the outcome measure of observed peer interactions at post-test, which was a classroom average. We covaried the baseline measure of observed positive peer interactions and the demographic measures of traditional versus block course structure, high school versus middle school, teacher gender, teacher years of experience, class size, percent male students, and percent African American or Hispanic students. Our approach of predicting the future level of a variable while accounting for the initial level allows estimation of relative change over the course of the school year in that variable. The demographic covariates were selected because we wished to ascertain whether the intervention effect existed after teacher and classroom characteristics were considered. Crucially, we entered teachers' intervention status (MTP-S = 1; control = −1) as a predictor of observed positive peer interactions. If participation in

MTP-S significantly predicted the outcome variable, with a positive beta weight, then this would support out hypothesis.

We used hierarchical linear modeling to test the hypotheses that teacher participation in MTP-S would contribute to improvements in student self-report of positive peer interactions. The logic behind this hierarchical linear model was the same as the logic behind the previous analysis of covariance model testing MTP-S effects on observed peer relationships: MTP-S, demographic covariates, and the interactions between MTP-S and these demographic covariates were entered as predictors of the criterion variable of peer relationships. The difference is that in the previous analysis of covariance analysis, both the criterion variable of observed peer relationships and the intervention were at the classroom level. Because the criterion variable of student self-reported peer interactions was at the student level, while the intervention continued to be at the classroom level, we needed to control for the possibility that students in the same classroom might be influenced to be similar in their self-reports of peer relationships (for other reasons not pertaining to the MTP-S intervention) when estimating MTP-S intervention effects.

An unconditional model with post-test peer interactions as the outcome and no predictors revealed that the ICC—the measure of the variability at the classroom level—was .11. This ICC suggests that classrooms do differ in self-reported peer interactions at post-test, justifying the examination of classroom-level predictors (such as MTP-S participation) that explain this variability (Raudenbush & Bryk, 2002). At Level 1, students' self-reported peer interactions at post-test was the criterion (Y_{ij}) and baseline disruptive behavior as well as baseline peer interactions were covariates. At Level 2, we entered the demographic covariates of traditional versus block course structure, high school versus middle school, teacher gender, teacher experience, class size, percent male students, and percent African American or Hispanic students. Then we tested the predictor of intervention status (MTP-S = 1; control = −1).

$$Y_{ij}=\beta_{0j}+\beta_{1j}\,(\text{baseline disruptive behavior})+\beta_{2j}\,(\text{baseline peer interactions})+e_{ij} \quad \text{Level 1}$$

$$\beta_{0j}=\gamma_{000}+\gamma_{001}\,(\text{intervention status})+\gamma_{002}\,(\text{covariates})\ldots+u_{0j}$$
$$\beta_{1j}=\gamma_{100}+\gamma_{101}\,(\text{intervention status})+\gamma_{102}\,(\text{covariates})\ldots+u_{1j} \quad \text{Level 2}$$
$$\beta 2j=\gamma 200$$

If γ_{001} was significant and positive, this would provide initial support for our hypothesis that teacher participation in MTP-S was associated with gains in this outcome. The significance of γ_{101} tests our next hypothesis that MTP-S participation would be most effective for assisting the peer relationships of students with disruptive behavior. We expected β_{1j} to be negative, suggesting that students high in disruptive behavior at baseline decline in the quality of their peer interactions over the study period. If γ_{101} was positive, this would provide initial support for our hypothesis that in classrooms where teachers had participated in MTP-S, the relationship between disruptive behavior and poorer peer interactions was weaker (e.g., the positive γ_{101} coefficient operates in the opposite direction of the negative β_{1j}). See Chang (2004) for a similar interpretation of cross-level interactions. Results were interpreted using robust standard errors.

In both models predicting the outcome variables of positive peer interactions (both observed and self-report), we centered all variables by converting them to *z* scores across the full sample in order to facilitate interpretation of coefficients. We also included, as a final step,

all two-way interaction terms between treatment group assignment (MTP-S vs. control) and the demographic covariates (block vs. traditional course structure, high school vs. middle school, teacher gender, teacher years of experience, class size, percent male students, and percent African American or Hispanic students). Given that we had no theoretical hypotheses regarding interaction effects, we adopted the following decision rule: In the event that the addition of the interaction terms (as a block) predicted significant incremental variance in the outcome, and one or more interactions were significant at the $p < .05$ level, we probed those interactions in the manner recommended by Holmbeck (2002). In addition, although classrooms were nested in 12 schools, we did not have hypotheses about school-level effects. Because the ICCs to ascertain the amount of between-school variance on our key dependent variables of peer relationships were minimal (ranging from 0.1% to 3.1%), we did not include the school level.

Results

Descriptive Statistics

Table 2 displays descriptive statistics on the key predictors and outcome measures at the classroom level. Observed and self-reported positive peer interactions were modestly correlated at post-test, but not at baseline. However, given that the average correlation between two informants on the same questionnaire about the same child is about .30 (Achenbach, McConaughy, & Howell, 1987), our lower correlations across both informant and measure are not surprising. Observed peer interactions had modest stability between baseline and post-test, and self-reported peer interactions had greater stability over this time period. All key predictors and outcome measures were normally distributed, with skewness values between 1 and −1. There were no outliers that met or exceeded 3.5 *SD* beyond the mean on any measure.

MTP-S Effects on Observed Positive Peer Interactions

Table 3 presents the analysis of covariance analyses testing MTP-S effects on observed positive peer interactions. The only significant demographic covariate was the racial makeup of students; in classrooms with a higher percentage of African American and Hispanic students, ratings of observed positive peer interactions were lower. Crucially, after statistical control of all covariates, teacher participation in MTP-S was associated with increases in observed positive peer relationships at post-test. The effect size associated with MTP-S, partial $\eta^2 = .052$, approaches the medium range (small = .01, medium = .06, large = .14; Stevens, 2002). Inspection of group means (see Table 1) suggests that at baseline, both MTP-S and control group classrooms demonstrated similar, relatively low levels of positive peer interactions (means close to 3 on the 1–7 scale). By post-test, positive peer interactions in MTP-S classrooms had increased, while they had remained roughly the same in control classrooms. The addition of the interaction terms (as a block) did not predict increased variance (difference between model fit: $\chi^2[df = 7] = 9.26$; $p > .10$), nor was any interaction between treatment condition and demographic covariates significant.

MTP-S Effects on Self-Reported Positive Peer Interactions

Table 4 presents the hierarchical linear modeling analyses testing MTP-S effects on student self-report of positive peer interactions. Student self-report of peer interaction quality at baseline positively predicted self-report at post-test. In addition, high school (vs. middle school) classrooms, classrooms with a larger percentage of male students, and classrooms with male teachers, had lower average levels of student self-reported positive peer interactions. After statistical control of these covariates, teacher participation in MTP-S did not significantly predict changes in this outcome variable. Inspection of group means (see Table 1) suggests that both at baseline and at post-test, students tended to self-report getting

along with about 75% of classroom peers. The addition of the interaction effects (as a block) was not associated with a significant increase in explained variance (difference between model fit: $\chi^2[df = 7] = 10.12$; $p > .10$). Therefore, although one interaction (of $n = 7$ possible) was significant, we did not probe further.

Data also presented in Table 4 suggested support for our second hypothesis. Students who began the course high in disruptive behavior showed significant declines in the quality of their self-reported peer relationships over the course period. In addition, in classrooms with a higher proportion of male students, the association between disruptive behavior and declining peer relationship quality was accentuated. Nonetheless, if the classroom teacher had participated in MTP-S, this trend was mitigated. The addition of the Level 2 predictors in the model explained nearly all the variance (see Table 4), which can be considered an indicator of effect size. The magnitude of results suggests that, for students in control classrooms, the average coefficient between baseline disruptive behavior and post-test positive peer interactions was $B_{1j} = -0.19$ ($p < .01$); however, this association was reduced to $B_{1j} = -0.01$ ($p > .10$) for students in MTP-S classrooms.

The addition of the interaction effects (as a block) was associated with a significant increase in explained variance (difference between model fit: $\chi^2[df = 7] = 16.56$; $p = .02$). Therefore, we probed the two interactions that were significant: treatment group by teacher experience, and treatment group by class size. For teachers 1 *SD* above the mean in years of experience, the estimated effect of participation in MTP-S relative to participation in the control group ($\gamma_{101} = 0.20$; $p < .01$) was significant in mitigating the trajectory between student disruptive behavior and poor peer interactions. However, for teachers 1 *SD* below the mean in experience, intervention condition did not appear to matter ($\gamma_{101} = -0.01$; $p > .10$). Probing of the second interaction suggested that for teachers 1 *SD* below the mean in class size, participation in MTP-S mitigated the trajectory between student disruptive behavior and poor peer interactions ($\gamma_{101} = 0.18$; $p < .01$). However, for teachers 1 *SD* above the mean class size, there was no effect of intervention condition ($\gamma_{101} = 0.01$; $p > .10$).

Discussion

We found evidence that teachers' participation in MTP-S, a professional development intervention, was associated with increases in observations of students' positive peer interactions in that classroom. No change was found in student self-reports of peer interactions. However, although there was a typical trajectory for students with high disruptive behavior to decrease in self-reported positive peer interactions over time, this association was mitigated for teachers who took part in MTP-S. There were few interaction effects between intervention condition and demographic variables, with two exceptions. Teachers who had more years of experience and smaller class sizes may have benefited more from participating in MTP-S in terms of reducing the association between student disruptive behavior and peer problems.

It is notable that somewhat discrepant findings were obtained for the outcome measures of observed versus student self-reported positive peer interactions. These results underscore the importance of using multiple informants in studies about classroom peer relationships (Cornell et al., 2006). It is possible that MTP-S led to stronger changes on observations and not student self-report because prosocial, respectful peer interactions are easier to shift than are students' true feelings about one another. Nonetheless, it is difficult to argue that observable change in student behavior is irrelevant, and the way peers treat one another behaviorally may even be most important for healthy adjustment. For instance, research suggests that the relationship between peers' affective liking about a target child and that child's subsequent academic failure is mediated by the target child's experiences of being

behaviorally mistreated and victimized by classroom peers (Buhs, Ladd, & Herald, 2006). Thus, MTP-S-related effects on observations of students' positive behavioral interactions with one another (regardless of changes in students' affective perceptions about one other) may still hold value.

Another possibility is that the improvements in observers' codes of the average level of positive peer interactions in the classroom may be most influenced by the improvement for those students high in disruptive behavior. Indeed, this interpretation may make sense given our other findings that students with high disruptive behaviors appear to reap the greatest benefit, in terms of their peer outcomes, from teachers' participation in MTP-S. Youth with disruptive behavior may have a disproportionate effect on the classroom environment that exceeds their statistical prevalence in the classroom. Therefore, substantial changes to the peer interactions of disruptive students may have a smaller effect size when investigating the mean of the student measures (where disruptive students comprise only a proportion of the class roster), but can have significant effects on the overall class climate (assessed by the independent observers).

Collectively, these results support the relevance of systems theory (Bronfenbrenner, 1979; Seidman, 1988) to the classroom environment, suggesting that the ecology of teachers' behaviors towards students may relate to the ecology of students behaviors towards each other in that classroom. Teachers' warm interactions with students and choice of instructional practices that engage and challenge all students may have a positive effect on students' interactions with one another. Crucially, MTP-S is not a peer relationship intervention, nor does the model directly attempt to teach students social skills. Rather, MTP-S focuses exclusively on changing teacher–student interactions. That effects carried over to student–student interactions provides empirical support from a randomized design for the theoretical model that interpersonal relationships are interconnected within the classroom setting (Pianta, 1999; Seidman & Tseng, 2011).

The data from the current study also underscore the relevance of teacher–student interactions to student–student interactions in secondary school. Previous research on this topic has predominantly, and nearly exclusively, been conducted among elementary school youth. We speculate that at both elementary and secondary levels, teachers who have warm, positive relationships with all students will encourage peers to similarly see the strengths in their classmates. By contrast, teachers who show favoritism or differential treatment to students by having a "pet" will communicate that it is acceptable for peers to have a social status hierarchy among themselves. However, while we speculate that youth of all ages are encouraged to develop social status hierarchies when teachers display favoritism, elementary children are more likely to place the students that the teacher values most at the top of the peer group hierarchy, whereas secondary youth may react by placing the students that the teacher values most at the bottom of the peer group hierarchy. Future research might directly compare these processes and the relative effect sizes in primary versus secondary school samples.

There are implications of these findings for students with disruptive behavior problems. First, data suggest that students with such behavior problems are in fact at risk for *declining* social relationships in their regular classroom setting. These results are demonstrated even during the brief time of one course (e.g., one academic year or one semester), and underscore the need for school psychologists' attention to this population of youth. School psychologists may need to consider the social ecology of a referred student's classroom early in the school year to help thwart increasingly negative social interactions as the year progresses. Nonetheless, MTP-S was suggested to be more effective for this at-risk population in regard to the outcome measure of positive peer interactions. We speculate that

disruptive students are typically the hardest for teachers to personally like (Mikami et al., 2004). Unfortunately, when teachers display frustration towards students who have disruptive behavior problems, this may accentuate peers' feelings of disliking and exclusion of these students (McAuliffe, Hubbard, & Romano, 2009; Mikami et al., 2011). MTP-S aims to help teachers to maintain more positive, sensitive relationships with all students, but this task may be most challenging (yet most needed) for the students with disruptive problems. We hypothesize, however, that when teachers can be sensitive to the needs of this student population, it sets a model for peers to follow.

Intriguing associations were found between demographic covariates and peer outcomes. Classrooms with more minority students displayed poorer observed peer interactions, and classrooms at the high school level, with more boys and with male teachers, displayed poorer self-reported peer interactions. Classrooms with more boys displayed a stronger association between disruptive behavior and declining peer relationships over the course period. In addition, for teachers with more experience and smaller class sizes, there was an accentuated effect of MTP-S on mitigating the typical trajectory between students' disruptive behavior and poor peer relationships.

Given that we had no a priori hypotheses as to why certain demographic characteristics would be significant because no demographic covariate consistently emerged as significant for *both* self-report and observational measures, these findings may not be reliable. If we assume that findings are genuine, one possibility is that classes with more minority students tend to be lower achieving, and lower achieving youth have more difficulty cooperating in classroom settings. Another possibility is that our observational coders, who were undergraduates at a selective university and largely white, were not sensitive to the nuances of positive peer interactions among populations different from themselves. It is not clear to us why students of male teachers would have poorer self-reported peer relationships. However, it may be that male students are more willing to tease one another during class and to show accentuated disruptive behavior, and these results were picked up on questionnaires. High school teachers may be more focused on content than are middle school teachers and thus less likely to encourage students to have positive peer interactions. In regard to the interaction effects, teachers with more experience and smaller class sizes may have the ability to focus on students' peer relationships, instead of needing to attend to other classroom management demands first. However, an important direction for future research will be to determine if findings can be consistently replicated.

Strengths of this study included the use of both observations and student self-report data to reduce shared method variance. In addition, there were few demand characteristics because teachers were not reporters of any of the key outcome measures. Rather, observers and students (who provided the outcome data) were kept unaware of teachers' assignment to MTP-S versus control conditions. Finally, the fact that we used an experimentally manipulated design by randomly assigning teachers to MTP-S versus control conditions confers a stronger empirical test of intervention effectiveness and of the theoretical proposition that the social ecology of teacher–student interactions has an effect on (and is not just correlated with) the social ecology of student–student interactions.

Limitations of this study pertain to the teachers randomly assigned to the control condition. These teachers did not receive aid from the study team. They simply engaged in their typical professional development activities offered by their schools, which largely consisted of workshops and not videotape review and mentorship. However, the professional development received in the control group varied across teachers. Further, it is unknown to what extent that mere interaction with the study team in an attention-control treatment may have improved teacher practices. However, the fact that none of the peer relationship

outcome measures were provided by the teachers, who may have been most sensitive to a general attention-control condition, strengthens confidence in our intervention effects. Another limitation pertains to the research design whereby teachers were stratified within school to MTP-S versus control condition. We chose this random assignment procedure in order to control for potential influences at the school level, and undertook procedures to minimize contamination between study conditions within a school, but it is unknown to what degree contamination between study conditions within a school may have occurred anyway. However, any contamination would weaken our ability to detect a treatment effect, given our use of intent-to-treat analyses.

It is important to note that the effect sizes for the MTP-S intervention were relatively small, suggesting that substantially changing students' peer interactions may require greater efforts devoted to this specific outcome. In addition, while we obtained positive evidence for MTP-S-related improvements in peer interactions during that classroom period, it is unknown whether effects generalized to these same students' relationships outside of the particular teacher's classroom. More sustained positive peer interactions are likely required in order for students to reap adjustment benefits in the long-term.

A final limitation of this study pertains to the inability to disentangle the potential effects of the emotional versus cognitive components of the intervention. It was hypothesized that both components work to improve cooperative peer relationships. The emotional component is important because the teacher is communicating that she sincerely likes the students, and the cognitive components because the teacher is communicating acceptance of different learning styles. Students model both behaviors by increasing their own awareness of positive aspects of peers and acceptance of peers who are different from themselves. However, a good direction for future research would be to test the relative effectiveness of each component separately.

These findings have potential implications for practitioners of school psychology. Typically, school psychologists focus on improving the social skills of individual students who are having difficult social interactions with peers (Bramlett, Murphy, Johnson, & Wallingsford, 2002), but an exclusive focus on the individual student may miss alternative entry points for intervention. The current data suggest consultation targeting changes in teachers' regular day-to-day practices (interactions with students, instructional choices) can improve students' peer relationships. Changing teachers' day-to-day practice is in contrast to other examples of social-emotional learning curricula that directly attempt to instruct students in positive ways of interacting. Although social-emotional learning curricula may be useful (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), they also predominantly exist for primary grades. Secondary school teachers may be less willing or less able to devote time to direct instruction in social skills given pressures to teach academic content. The model supported by the current data provides teachers with alternate options to improve students' peer relationships that interface with their regular academic instruction and daily interactions with students. Crucially, given links between students' peer relationships and learning (Buhs et al., 2006), attention to improving positive peer interactions in the classroom may be an additional way to promote academic success.

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Table 1

Teacher and Classroom Demographics

	MTP-S (*n* = 43)	**Control (*n* = 45)**
Years teaching experience	10.49 (11.16)	7.38 (6.61)
Teacher gender	Female: 30	Female: 26
	Male: 13	Male: 19
Middle or high school level	Middle: 28	Middle: 25
	High: 15	High: 20
Course structure	Traditional: 35	Traditional: 32
	Block: 8	Block: 13
Class size	22.64 (5.42)	21.33 (5.01)
% Male students	51% (12%)	52% (13%)
% African American and Hispanic students	37% (14%)	34% (13%)
Observed peer interactions (baseline)	3.33 (0.74)	3.40 (0.79)
Observed peer interactions (post-test)	3.72 (0.81)	3.29 (0.72)
Self-report peer interactions (baseline)	3.97 (0.26)	4.05 (0.28)
Self-report peer interactions (post-test)	4.00 (0.45)	4.00 (0.30)
Self-report disruptive behavior (baseline)	1.82 (0.34)	1.66 (0.20)

Note. MTP-S = My Teaching Partner—Secondary. Means are listed in table with standard deviations in parentheses. No significant differences between MTP-S versus control groups were found on any demographic variable (those above the line in the table), nor on baseline levels of either observed or self-reported positive peer interactions. Differences were tested using independent sample *t* tests for continuous variables and chi-squared for categorical variables.

Table 2

Correlations Among Study Variables

	1	2	3	4	5
1. Observed peer baseline	—	.24*	.02	.12	.02
2. Observed peer post-test		—	.21	.21	−.22
3. Self-report peer baseline			—	.54**	−.29*
4. Self-report peer post-test				—	−.15
5. Self-report disruptive baseline					—

* $p < .05$.

** $p < .01$.

Table 3

MTP-S Effects on Observed Positive Peer Interactions

Predictors	*B* (SE)	*t* (74)	*p*
Intercept	2.93 (0.42)	6.91	.00
1. Intervention (MTP-S = 1; control = −1)	0.19 (0.08)	2.34	.02
2. Course structure (block = 1; traditional = −1)	−0.14 (0.09)	1.56	.12
3. Teacher gender (female = 1; male = −1)	−0.02 (0.09)	0.20	.84
4. Level (high school = 1; middle school = −1)	0.05 (0.09)	0.58	.56
5. Teacher years experience	−0.03 (0.09)	0.33	.74
6. Class size	−0.02 (0.09)	0.22	.82
7. % African American and Hispanic students	−0.21 (0.09)	2.28	.03
8. % Male students	−0.14 (0.09)	1.49	.14
9. Baseline observed peer interactions	0.18 (0.13)	1.44	.15
10. Predictor 1 × 2	−0.08 (0.09)	0.89	.38
11. Predictor 1 × 3	−0.12 (0.09)	1.29	.20
12. Predictor 1 × 4	0.01 (0.10)	0.08	.94
13. Predictor 1 × 5	0.13 (0.10)	1.36	.18
14. Predictor 1 × 6	0.12 (0.09)	1.38	.17
15. Predictor 1 × 7	−0.03 (0.09)	0.28	.78
16. Predictor 1 × 8	−0.06 (0.09)	0.63	.53

Note. MTP-S = My Teaching Partner—Secondary.

Table 4

MTP-S Effects on Self-Reported Positive Peer Interactions

		Post-Test Peer Interactions		
Fixed Effects	**Parameter**	**Coefficient (SE)**	***t*(55)**	***p***
Intercept β_{0j}	γ_{000}	4.016 (0.030)	134.90	<.01
1. Intervention (MTP-S = 1; control = −1)	γ_{001}	0.023 (0.032)	0.72	.47
2. Course structure (block = 1; traditional = −1)	γ_{002}	−0.035 (0.027)	1.28	.21
3. Teacher gender (female = 1; male = −1)	γ_{003}	0.058 (0.029)	2.00	.05
4. Level (high school = 1; middle school = −1)	γ_{004}	−0.075 (0.029)	2.63	.01
5. Teacher years experience	γ_{005}	−0.059 (0.038)	1.55	.13
6. Class size	γ_{006}	−0.002 (0.032)	0.07	.95
7. % African American and Hispanic students	γ_{007}	0.007 (0.037)	0.20	.84
8. % Male students	γ_{008}	−0.070 (0.031)	2.27	.03
9. Predictor 1 × 2	γ_{009}	0.002 (0.027)	0.07	.95
10. Predictor 1 × 3	γ_{010}	0.098 (0.030)	3.30	<.01
11. Predictor 1 × 4	γ_{011}	0.027 (0.029)	0.94	.35
12. Predictor 1 × 5	γ_{012}	−0.004 (0.039)	0.11	.91
13. Predictor 1 × 6	γ_{013}	−0.019 (0.032)	0.58	.56
14. Predictor 1 × 7	γ_{014}	0.001 (0.037)	0.03	.98
15. Predictor 1 × 8	γ_{015}	0.001 (0.031)	0.02	.98
Slope of disruptive behavior β_{1j}	γ_{100}	0.103 (0.035)	2.93	<.01
1. Intervention (MTP-S = 1; control = −1)	γ_{101}	0.090 (0.033)	2.62	.01
2. Course structure (block = 1; traditional = −1)	γ_{102}	0.065 (0.039)	1.66	.10
3. Teacher gender (female = 1; male = −1)	γ_{103}	0.042 (0.030)	1.39	.17
4. Level (high school = 1; middle school = −1)	γ_{104}	−0.046 (0.033)	1.38	.17
5. Teacher years experience	γ_{105}	−0.013 (0.031)	0.43	.66
6. Class size	γ_{106}	0.025 (0.037)	0.70	.49
7. % African American and Hispanic students	γ_{107}	0.029 (0.032)	0.90	.37
8. % Male students	γ_{108}	−0.090 (0.033)	2.72	.01
9. Predictor 1 × 2	γ_{109}	−0.052 (0.039)	1.33	.19
10. Predictor 1 × 3	γ_{110}	−0.039 (0.030)	1.30	.20
11. Predictor 1 × 4	γ_{111}	0.026 (0.033)	0.80	.43
12. Predictor 1 × 5	γ_{112}	0.120 (0.031)	3.86	<.01
13. Predictor 1 × 6	γ_{113}	−0.082 (0.037)	2.23	.03
14. Predictor 1 × 7	γ_{114}	0.058 (0.042)	1.79	.08
15. Predictor 1 × 8	γ_{115}	0.032 (0.033)	0.98	.33
Slope of baseline peer interactions β_{2j}	γ_{200}	0.547 (0.036)	15.25	<.01

Random Effects	**Level 1 Predictors Only**	**Final Model**
σ^2	.386	.379

Random Effects	Level 1 Predictors Only	Final Model
τ for intercept β_{0j}	.033, $\chi^2(69) = 133.89$, $p < .01$	.013, $\chi^2(54) = 107.00$, $p < .01$
τ for slope β_{1j}	.020, $\chi^2(69) = 95.68$, $p < .02$	.001, $\chi^2(54) = 65.57$, $p > .10$

Note. MTP-S = My Teaching Partner—Secondary.