Effects of a Seating Chart Intervention for Target and Non-Target Students

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Abstract

Teachers' efforts to manage classroom social dynamics can have positive effects on students' social relationships. One way that teachers may seek to manage these relationships is through seating arrangements. In a randomized control trial, van den Berg, Segers, and Cillessen (2012) found that closer proximity in the classroom can reduce disliking between two students who dislike each other (target students). However, the effect of this intervention on the larger class is unknown. The present study implemented a short version of this seating chart intervention, investigated effects on both target and non-target students, and explored whether teachers' efficacy to manage social dynamics moderated the effects of the intervention. Data came from 1573 students in 59 Grade 5 classrooms in the Netherlands. Results indicated that students in intervention classes exhibited more overt aggression, and perceived less cooperation among classmates than students in the control condition. These effects were consistent across target and non-target students, and were not moderated by teachers' efficacy for managing social dynamics. It may be that the intervention initially causes tension between target students that is resolved first at the dyad level, and is only later noticed by other classmates. Whether these initial negative effects for target and non-target students become positive after a longer period of adjustment and reorganization of relationships is to be determined in further research.

Highlights

- RCT of a seating chart intervention that brought students who reported disliking each other closer together
- Students in intervention classes reported their peers were more overtly aggressive than control students
- Students in intervention classes reported lower cooperation among peers than control students
- Results were consistent across target and non-target students
- Results were not moderated by teachers' efficacy for managing social dynamics

Effects of a Seating Chart Intervention on Target and Non-Target Students

Recent theoretical models suggest several ways in which teachers, as the social leaders of the classroom, can intervene with the peer system to benefit the development of social relationships in the classroom (Farmer, 2000; Farmer et al., 2006; Farmer, McAuliffe Lines, & Hamm, 2011; Gest & Rodkin, 2011; Hughes, 2012). Indeed, correlational and intervention studies have shown that teachers' management of classroom social dynamics can have a positive impact on classroom peer relations (Gest, Madill, Zadzora, Miller, & Rodkin, 2014; van den Berg, Segers, & Cillessen, 2012) as well as academic engagement (Hamm, Farmer, Lambert, & Gravelle, 2014). The current study focused on teachers' strategic use of seating arrangements as a practice that may influence the development of peer relationships. The current study contributes to the growing body of literature on teachers' efforts to manage peer relationships by examining the effects of a specific seating intervention on all students in the class, which to date has remained unexplored.

Classroom Arrangements and Social Relationships

Teachers have autonomy over how to arrange the physical desks in their classroom. Most teachers cluster desks together to create small groups or arrange desks in rows facing the front of the classroom (Gremmen, van den Berg, Segers, & Cillessen, 2016). The majority of research on teachers' use of seating has investigated the effects of various seating arrangements on students' *academic* development. For example, teachers' use of rows has been shown to facilitate students' on-task behavior, and students produce more high quality work when seated in rows versus groups (Wannarka & Ruhl, 2008). More recent studies have also focused on how seating arrangements may affect *social* development. Theory and empirical evidence support the notion that social interaction is encouraged when students are able to establish face-to-face contact

(Marx, Fuhrer, & Hartig, 2000). Indeed, students exhibit more social behaviors when desks are arranged in groups than when they are arranged in rows, and more task-oriented behavior when they are arranged in rows, which is considered desirable behavior in traditional classrooms (Wheldall, Morris, Vaughan, & Ng, 1981).

In addition to establishing the physical configuration of desks, teachers also have autonomy over where to seat specific students and whom to place next to one another. Researchers have suggested that this is an exceptionally important decision as "it is clearly children's experience of the context rather than any more direct physical features of the setting" that influence their academic and social experiences (Croll & Hastings, 2012, p. 38). In the case of seating, students' experiences in a particular seat and next to specific seatmates may be more influential than the arrangement of the physical structure of desks in the classroom. In fact, teachers report a range of reasons for seating students in specific places in the classroom, including physical, social, and academic considerations (Gremmen et al., 2016). However, compared to the arrangement of the physical structure of the class, little research has investigated the effect of teachers' use of specific seating strategies (i.e., whom they place where) on students' social development. The present study contributes to the current literature base by focusing on the social effects of a specific seating strategy for students in the class.

There are various reasons why seating may impact students' social relationships. Allport's intergroup contact theory posits that bringing students together under conditions of equal status, common goals, and support of the teacher, all conditions which are met in the elementary classroom, results in the development of positive social relationships among students (Allport, 1954, in Pettigrew, 1998). Pettigrew's (1998) reformulation of intergroup contact theory articulates the theory of change behind the positive social effects of close proximity. First, sitting

in close proximity to a classmate allows students to learn about one another and the groups to which they belong. Second, students' behavior towards each other is expected to change based on what they have learned about each other. Third, students develop affective ties, or a positive relationship with the other person. A naturalistic study of 5th and 6th grade students for whom teachers assigned their seats supported the hypothesis that proximity in seating is related to positive affective ties among nearby students. Students reported liking peers who were seated closer in proximity to themselves more than those who were seated further away (van den Berg & Cillessen, 2015).

In the first randomized control trial to test a seating chart intervention based on this guiding theory, van den Berg and colleagues (2012) rearranged classroom seating charts so that pairs of students with a negative relationship (e.g., marked by disliking) were placed in closer proximity for 12 to 14 weeks. At the end of the intervention, they found that rejected children became better liked, supporting Pettigrew's (1998) theory of change. A study of similar design placed students with externalizing problems next to a random classmate or a prosocial buddy of high status (van den Berg & Stoltz, 2018). Students were better liked by classmates sitting next to them and teachers reported fewer externalizing problems when these students were seated next to a prosocial buddy. Together, these studies indicate that where students sit and whom they sit close to can positively influence their social and behavioral adjustment. We were particularly interested in students' prosocial and aggressive behavior, and peer acceptance and rejection due to the large body of literature demonstrating the importance of these behaviors and experiences for students' current well-being and later development (e.g., Coie, Lochman, Terry, & Hyman, 1992). We also explored students' perceptions of the peer context because these perceptions contribute to students' social experiences and influence their academic and social development

(Boor-Klip, Segers, Hendrickx, & Cillessen, 2016).

Beyond Target Students

Although the initial studies on seating arrangements focused on intervention effects for target students (van den Berg et al., 2012; van den Berg & Stoltz, 2018), theoretical frameworks indicate that these types of interventions can also affect other students in the class. Pettigrew (1998) articulated a fourth step in the intergroup contact theory of change. In this step, the positive relationships formed by those in close proximity are cultivated and, over time, generalized to other students and contexts. Applied to the seating chart intervention in which pairs of students with a negative relationship were placed in closer proximity, we expected that students in these pairs would have more than one acrimonious relationship. After experiencing improvements in the relationship with the disliked peer, target students may also experience improvements in their relationships with other classmates, and other classmates may also perceive improvements in target students' behavior and relationships. In addition, social learning theory (Bandura, 1971) states that students learn by observing others. We expected that after a period of time observing improvement in their peers' relationships, classmates who were not in an intervention pair may also begin to have more positive relationships with their peers (van Schaik & Hunnius, 2016), and positive perceptions of the classroom peer context. Specifically, we hypothesized that target and non-target students would experience increases in prosocial behavior and acceptance, and decreases in aggression and rejection. However, to date, no studies have investigated the effects of this seating chart intervention beyond the target dyads.

Teachers' Efficacy for Managing Social Dynamics

The ecological systems framework and theoretical models of teacher influence on classroom social dynamics (Bronfenbrenner, 1977; Farmer, McAuliffe Lines, & Hamm, 2011;

Gest & Rodkin, 2011) posit that teacher characteristics such as demographics and beliefs also affect the development of students' social relationships. Teachers' general sense of efficacy is strongly related to their beliefs, practices, and student outcomes (Tschannen-Moran & Hoy, 2001). For example, teachers who disapprove of aggression have classes with weaker aggressive norms (Gest & Rodkin, 2011). More specifically, recent work has focused on one type of efficacy, teachers' efficacy for managing classroom social dynamics, which refers to teachers' sense of competence for positively managing students' interpersonal relationships (Ryan, Kuusinen, & Bedoya-Skoog, 2015). Evidence suggests that teachers' efficacy for managing social dynamics is related to aspects of observed classroom quality, likely through their self-perceived competence and behavioral adeptness for managing the social challenges that arise in the complex classroom environment (Ryan, Kuusinen, & Bedoya-Skoog, 2015). As we anticipated that social challenges would likely arise when students' seats in intervention classes were rearranged, we explored whether the effects of the intervention were moderated by teachers' efficacy for managing social dynamics, such that more positive outcomes were experienced in classes where teachers felt efficacious at managing students' relationships.

Present Study

The present study employed a randomized control trial design to test the effects of a seating chart intervention that brought students who reported disliking each other closer together on students' levels of prosocial and aggressive behavior, acceptance and rejection, and perceptions of the classroom peer context. The research questions were:

RQ1: What is the effect of the seating chart intervention on students in the class?

RQ2: Is the effect of the intervention moderated by students' status as a member of a target pair?

RQ3: Is the effect of the intervention moderated by teachers' efficacy to manage social dynamics?

We hypothesized that students in intervention classes would have more favorable outcomes (higher prosocial behavior and acceptance, and lower aggressive behavior and rejection) than students in control classrooms. Further, we explored whether these effects were experienced by target and non-target students. Finally, we hypothesized that the intervention would be most beneficial in intervention classes where teachers reported a high efficacy for managing social dynamics.

Method

Recruitment and Procedure

Schools across the Netherlands were contacted by telephone or letter soliciting their participation. A call for participation was also placed in a teacher magazine. Of the 211 schools that were contacted, 41 schools (19.4%) agreed to participate. Schools were classified as small (one Grade 5 classroom, 26 schools), medium (two Grade 5 classrooms, 12 schools), or large (three Grade 5 classrooms, 3 schools). All Grade 5 teachers in these schools agreed to participate in the study. To prevent teachers within the same school from receiving and discussing the differing intervention/control group procedures, randomization took place at the school level, and with school size equally distributed between the intervention and control conditions. This resulted in 33 classrooms with 879 students in the control condition and 26 classrooms with 694 students in the intervention condition. One teacher in the intervention condition, and one teacher in the control condition dropped out after pre-test; thus, the data from these classes are not included in analyses. Parents of Grade 5 students in these schools received a letter with information about the study and returned informed consent forms (99% participation). See Boor-

Klip (2017) for additional information.

Data were collected at two time points in the 2012-2013 school year. Pre-test data were collected from September to November. Approximately 13 weeks after the pre-test, post-intervention data were collected from December to March. Demographic information and teacher efficacy for managing social dynamics were collected at pre-test. At both times, students in all classes completed a survey in Dutch about their classmates and their perceptions of the classroom peer context.

Participants

The 1573 students were on average 10.61 years (*SD* = 0.50) and 47% were female. All students spoke Dutch as their native language, 83% of students had both parents born in the Netherlands and 88% were from families with medium-high socioeconomic status. Sixty-four percent of participating teachers were female. Teachers had an average of 15 years of classroom experience (*SD* = 11 years). Class size was consistent across intervention and control conditions, with an average class size of 26 students (*SD* = 4). The characteristics of participating classrooms, teachers, and students did not differ by condition.

Intervention Procedure

To rearrange the classroom seats, we used the procedure described in Boor-Klip (2017) and van den Berg and et al. (2012). Based on the pre-test, pairs of students were selected where at least one member reported disliking the other (were nominated as “like least” and received a likability rating of 1 or 2 on a scale of 1 to 7; 1 = *Not at all nice,* 7 = *Very nice*); these students were identified as a target pair. Students could be a member of multiple target pairs. In the intervention condition, selected modifications were made to teachers’ original seating charts such that target pairs were moved closer together, ideally reducing distance by 50%, as displayed in

Figure 1. Target students were never seated directly next to one another. Within four weeks of the pre-test, researchers met with the teachers to explain the rationale behind the new arrangement (without identifying specific pairs or students) and to give them the opportunity to request necessary adjustments, such as moving a student with a visual impairment closer to the front. The new seating arrangement was implemented in the intervention condition within a week of this meeting, and students remained in these seats for approximately nine weeks. Teachers in the control condition were interviewed about their classroom arrangement and managed their seating charts as usual. Both intervention and control teachers recorded any changes they made to the arrangement throughout the study.

Measures

Student-level outcomes (sociometric and classroom peer context) and covariates were collected. Descriptive statistics are provided in Table 1.

Sociometric measures. Students nominated an unlimited number of classmates for a selection of descriptors. Each student received a score for the proportion of classmates who nominated him or her for each item. For example, a student with a value of .35 for prosocial behavior indicated that 35% of their peers nominated them as behaving in this way. *Prosocial behavior* was calculated by averaging scores for "helps others" and "works well with others." *Overt aggression* was calculated by averaging "scolds others" and "kicks, hits, or pushes others." *Acceptance* was the proportion score for "like most." *Rejection* was the classroom proportion score for "like least."

Classroom peer context. Students responded to 15 items from the Classroom Peer Context Questionnaire (CPCQ) about four dimensions of their classroom peer context (1 = *Not at all true;* 5 = *Totally true*; Boor-Klip, Segers, Hendrickx, & Cillessen; 2016): cooperation,

conflict, cohesion, and isolation. *Cooperation* was measured by averaging four items, including "children help each other in this class" (α = .81). The *conflict* subscale consisted of four items, including "children argue with each other in this class (α = .83). The *cohesion* subscale consisted of three items, including "everyone likes each other in this class" (α = .73). *Isolation* was measured using four items, including "in this class, there are children who are often alone" (α = .76).

Covariates. Students' status as a *target of the intervention* (1 = *target student*) was noted. Student could be part of multiple target dyads. Students' *gender* (1 = *female*) was noted. Each student's *sociometric status* (SES) was coded on a scale of 1 to 3 based on the highest level of education earned by a parent. SES of children whose most highly educated parent received no education, only finished primary school, or pre-vocational secondary education was coded as 1. SES of children whose most highly educated parent received a vocational school degree, senior general or pre-university secondary education was coded as 2. The SES of children whose most highly educated parent received a higher professional (e.g., undergraduate / bachelor) or university degree was coded as 3.

Classroom-level

Whether the class was part of the *intervention* or control group (1 = *intervention*), and the *number of target pairs* in the class were recorded. The *proportion of students who were female* was calculated, and *SES* of students was aggregated at the classroom level with higher scores indicating classes with more educated and affluent parents. *Class size* was also recorded.

Efficacy for social dynamics management was measured at pre-test using six items regarding teachers' ability to manage classroom social dynamics. Teachers responded to each item on a 1-7 scale, such as "How much trust do you have in helping a student with no friends

make friends?" (1 = *No trust*; 7 = *Very confident*; α = .72).

Analytic Strategy

Descriptive statistics. Analyses were completed in R. First, intraclass correlations (ICCs) were calculated to determine the proportion of variance attributed to between-class and between-student differences in baseline measures. Independent samples *t*-tests were also run to determine whether students differed in pre-test assessments according to condition. Statistical assumptions of skewness and kurtosis were also assessed.

RQ1: Intervention effects. To determine the extent to which the intervention influenced the development of students' sociometric ratings of prosocial and aggressive behavior, acceptance, and rejection, and their perceptions of the classroom peer context over the course of the intervention, a series of multilevel models in R Studio were run predicting each outcome at the end of the intervention. Models controlled for several student- and classroom-level covariates, including: pre-test assessment, students' gender, and SES, the gender composition of the class (proportion female), class SES, and class size, as is typical for outcomes which may be influenced by these factors (e.g., Gest et al., 2014; Pianta & Stuhlman, 2004). The number of target pairs in the class was also included as a covariate, as it fluctuated by class but was not a focus of the present study. To address RQ1, whether the intervention condition affected student outcomes, a main effects model was tested that included intervention condition and teachers' efficacy for managing social dynamics. With the exception of student gender (0 = *male*; 1 = *female*) and condition (0 = *control*; 1 = *intervention*), all variables were grand mean centered, such that the intercept represents a non-target, male student, with average SES, within a control class with an average number of target pairs; gender distribution; SES; class size; and a teacher with an average level of efficacy for managing social dynamics. Effect sizes were calculated

using Morris' (2008) guidelines for a study of this design where *d* = $C_P[\frac{(M_{Post,T}-M_{Pre,T})-(M_{Post,C}-M_{Pre,C})}{SD_{Pre}}]$, where $C_P = 1 - \frac{3}{4(N_T+N_C-2)-1}$ which accounts for the differing starting values and sizes of each group. In accordance with traditional interpretations, effect sizes were interpreted as *d* = 0.2 *small*, *d* = 0.5 *medium*, and *d* = 0.8 *large* (Sawilowsky, 2009).

RQ2: Moderation by target student status. To address RQ2, whether these effects were experienced by both target and non-target students, the interaction of intervention*target student was added to each outcome model.

RQ3: Moderation by teachers' efficacy for social dynamics management. Finally, to address RQ3, whether teachers' efficacy for managing social dynamics moderated the effects of the intervention, the interaction of intervention*efficacy for SDM was added to the initial main effects model. Thus, three models were tested for each outcome.

Results

Descriptive Statistics

Descriptive statistics are provided in Table 1; correlations are provided in Table 2. In sum, between 2%-17% of the variance in the baseline measures was attributed to between-class differences, warranting further investigation of whether this classroom-level intervention could influence these measures (Aguinis, Gottfredson, & Culpepper, 2013). Students' prosocial behavior, and perceptions of cooperation, conflict, and cohesion did differ significantly by condition at pre-test. To control for these baseline differences, pre-test measures were included in the outcome models. Pre-test measures were in the normal range for skewness (< 2) and kurtosis (< 7; West, Finch, & Curran, 1995), except for overt aggression and rejection, which were positively skewed. Applying the square root transformation brought these into the normal

range. Subsequent models were run with the transformed and untransformed variables, and effects were consistent across both versions. For ease of interpretation, the models tabled include the untransformed version of these variables (Table 3).

RQ1: Intervention Effects

Sociometric measures

First, we examined the degree to which students' prosocial behavior, aggression, acceptance, and rejection were influenced by intervention condition. Unstandardized regression coefficients from the multilevel models are displayed in Table 3.

Prosocial behavior. The effect of the intervention was nonsignificant (b = -0.03, SE = .02, p = *ns*), such that students in intervention classes did not differ significantly in peer reports of prosocial behavior at the end of the intervention from students in control cases. This effect was equivalent to a small effect size of d = -0.10 (Figure 2). In addition, students' prosocial behavior at pre-test predicted their behavior at post-intervention (b = 0.53, SE = 0.03, p < .05), and girls (b = 0.02, SE = 0.01, p < .05) were nominated as more prosocial than boys. No other effects were significant.

Overt aggression. The effect of the intervention was significant (b = 0.03, SE = 0.01, p < .05), such that students in intervention classes had higher levels of peer-nominated aggression at post-intervention than students in control classes. This effect was equivalent to a small effect size, d = 0.10.

Acceptance. The effect of intervention was nonsignificant (b = 0.01, SE = .01, p = *ns*), such that students in intervention classes did not differ significantly in peer reports of acceptance at post-intervention than students in control classes. This effect was equivalent to a small effect size, d = 0.13.

Rejection. The effect of intervention was nonsignificant (b = 0.01, SE = .01, p = *ns*), such that students in intervention classes did not differ significantly in peer reports of rejection at post-intervention than students in control classes. This effect was equivalent to a small effect size, d = 0.06. Teachers' efficacy for SDM was a significant predictor of rejection (b = -0.01, SE = .01, $p < .05$), with students whose teachers report higher efficacy for SDM reporting lower levels of rejection than students whose teachers report low efficacy for SDM.

Classroom peer context

***Cooperation*.** The effect of the intervention was significant (b = -0.14, SE = 0.05, $p < .05$; Table 4), such that students in intervention classes reported lower levels of cooperation among classmates than students in control classes. This effect was equivalent to a small effect size, d = -0.20 (Figure 2). Target students reported lower levels of cooperation at post-intervention than students who were not identified as targets (b = -0.09, SE = 0.03, $p < .05$).

Conflict. The effect of the intervention was nonsignificant (b = 0.14, SE = 0.09, p = *ns*), such that students in intervention classes did not differ significantly in perceptions of conflict than students in control classes. This effect was equivalent to a small effect size, d = 0.18. Target students reported higher levels of conflict at post-intervention than students who were not identified as targets (b = 0.11, SE = 0.05, $p < .05$).

***Cohesion*.** The effect of the intervention was nonsignificant (b = -0.12, SE = 0.07, p = *ns*), such that students in intervention classes did not differ significantly in perceptions of cohesion than students in control classes. This effect was equivalent to a small effect size, d = -0.16.

***Isolation*.** The effect of the intervention was nonsignificant (b = 0.05, SE = 0.06, p = *ns*), such that students in intervention classes did not differ significantly in perceptions of isolation

than students in control classes. This effect was equivalent to a small effect size, $d = 0.14$.

RQ2: Moderation by target student status

Next, the interaction of intervention*target student was added to each outcome model to test whether the effect of the intervention was moderated by students' status as a target student. For all outcomes, the interaction was nonsignificant; as such, the effects of the intervention, as reported above, were consistent for both target students and non-target students alike. For ease of presentation, these results are not tabled.

RQ3: Moderation by teachers' efficacy for social dynamics management

Finally, the interaction of intervention*efficacy for social dynamics management was added to the initial models to test whether the effect of the intervention was moderated by teachers' efficacy in this domain. For all outcomes, the interaction was nonsignificant; the effects of the intervention, as reported above, were consistent regardless of teachers' efficacy for managing social dynamics. For ease of presentation, these results are not tabled.

Discussion

Initial findings from this seating chart intervention focused on its effects on liking between target students. Those results indicated that intervening to move students who dislike each other closer together improves dyadic liking (van den Berg et al., 2012). The present study expanded the scope of possible intervention effects one more step to determine the effect of this intervention for both target and non-target students, and on a wider array of peer-nominated and self-reported outcomes that have been linked to students' concurrent experiences and later adjustment. Results demonstrated two iatrogenic effects: students in intervention classes reported higher aggression and lower levels of cooperation among classmates than students in control classes. A further assessment of effect sizes demonstrated small effects of the intervention in the

unhypothesized direction for all outcomes except for peer-reported acceptance, which was higher in the intervention condition. Effects of the intervention were similar for both target and non-target students. Finally, teachers' level of efficacy for managing social dynamics did not affect these intervention effects. In sum, our hypotheses that the intervention would have positive effects for students, particularly target students, and for students whose teachers have high levels of efficacy for managing social dynamics, were not supported.

Managing Classroom Dynamics Through Seating Arrangements

The present results support overarching theories that posit that teachers can influence classroom peer relationships through their everyday teaching practices, such as the use of seating charts (Farmer et al., 2011; Gest & Rodkin, 2011; White & Jones, 2000). Seating charts may be used, as in the present study, to strategically bring together students who are currently in a relationship marked by animosity. While intervening in this way for a period of 12-14 weeks has been found to improve these students' dyadic relationship (van den Berg et al., 2012), the current study suggests that this method of intervention may not have the same positive effects on target students' outcomes as reported by their classmates (e.g., overt aggression), nor on students in the larger class (e.g., non-target students).

It is important to note here that the initial study found improvements in liking among target students over the course of the intervention, yet no changes in target students' peer nominated prosocial behavior nor rejection. While the initial study also controlled for pre-test measures, it did not control for the additional covariates included in the present analyses. Results of the present study are then consistent with the initial study with regards to null effects of the intervention on these outcomes, with the analytic approach in the current study as an even more stringent test of the intervention than the original approach. An examination and comparison of

the effect sizes suggests that although the effects were nonsignificant in the present study, they were more robust than those in the initial study, again primarily in the unhypothesized direction. Taken together, these findings suggest that target students' dyadic relationship is a distinct outcome from classmates' perceptions of target students.

The present study examined several outcomes outside of the scope of the initial study. Most notably, the intervention was associated greater peer-nominated aggressive behavior and less positive perceptions of cooperation in the peer group. These effects were consistent for both target and non-target students. We may imagine improvements in dyadic liking and increases in aggression as possibly concordant phenomenon: two students may come to like each other through their shared proclivity for aggression, or through negative peer influence, whereby setting an example for other classmates to also act in this way. Students' perceptions of cooperation in the classroom were similarly outside of the scope of the initial paper yet were found to decrease for both target and non-target students in the present study. We may also envision students improving in their individual relationship with a specific peer, yet still feeling negatively about the larger peer group.

The present study also differs from the initial study in the length of time of the intervention. In the initial study, the intervention took place over 12-14 weeks; in the current study, the intervention took place over 8 weeks. We suspect that moving students with heightened animosity together initially leads to some classroom challenges and disruptions that take time to disappear. Placed in closer proximity, the initial interactions between target students likely involve disagreements and disruptions. Over the course of time, as they have no choice but to cooperate, their dyadic relationship improves, consistent with Pettigrew's (1998) theory of change and the findings by van den Berg et al. (2012). It may be that at the 8-week assessment in

the current study students were still in the throes of disruption, whereas sufficient time had elapsed over the course of the 12-14 weeks of the initial study for positive effects to be found at the dyad level. We posit that in the present study, both target and non-target students were still adjusting to the initial perturbations. We suspect that improved dyadic relationships are the intermediate outcome of the intervention, while the generalization of these effects to other students' perceptions of target students, and for other students themselves are more distal and slower to manifest. It is possible that in our study not enough time had passed for the positive effects at the dyad level found in the initial study to have occurred, and relatedly, to have been disseminated to students in the larger class. This difference in timing may therefore explain why more robust effects in the unhypothesized direction were found in the present study than in the initial study.

Managing Classroom Social Dynamics Via Efficacy

Aside from the intervention effects, teachers' efficacy for social dynamics management was associated with greater reductions in peer rejection. This finding suggests that teachers who feel more efficacious in managing social dynamics may indeed manage situations of social unrest more adeptly than teachers who feel less efficacious in this domain. Efficacy for social dynamics management has been associated with effective teaching practices such as observed classroom quality (Ryan, Kuusinen, & Bedoya-Skoog, 2015); the present study contributes to our emerging understanding of the role of efficacy for managing social dynamics by suggesting that it may also be related to teachers' management of social relations, as suggested by the decreases in peer rejection in classes of efficacious teachers.

While it is plausible that teachers who apply a strategic and careful rearrangement of seats, and who are efficacious in managing social dynamics may have students with the most

positive outcomes, results of the present study indicate that the effect of the intervention was not moderated by teachers' efficacy in this domain, suggesting that high efficacy for managing social dynamics does not seem to be a necessary ingredient for achieving results from this method of intervention. Future studies could examine if alternative teacher-level factors, such as occupational stress or burnout, may influence the outcomes of this intervention method.

Limitations and Future Directions

While this seating chart intervention demonstrated positive effects at the dyad level when implemented over the course of 12-14 weeks (van den Berg et al., 2012), the present study did not find positive effects for target and non-target students' sociometric nominations and perceptions of the classroom peer context in this 8-week intervention. The design of the present study enabled only an examination of immediate post-intervention results. It is possible that the intervention seating arrangements were implemented on too short of a time scale to replicate the positive dyadic effects found in the initial study, and for these effects to generalize to non-target students. Whether the initial negative effects become positive after a longer period of adjustment and reorganization of relationships is to be determined by future longitudinal research. A multi-method and multi-informant design will also allow for a more thorough investigation of the processes through which these effects may unfold.

The present study was an in foray into the examination of intervention effects for both target and non-target students. However, as Farmer et al. (2018) emphasized, understanding social dynamics is a complicated goal involving a plethora of important variables operating as a dynamic, interrelated, bidirectional system. With reference to understanding the effects of the current intervention, we expect that many additional student- and dyad-level factors are likely at play, such as the popularity and characteristics of each member of the target pair (Cillessen,

Schwartz, & Mayeux, 2011). For example, the intervention may be most effective when one unpopular, highly disruptive peer is paired with a highly popular, accepted, and prosocial peer, who can politely navigate being seating next to this undesirable seatmate. Classmates may look up to the highly popular and prosocial peer as a model for interacting with those they did not initially like, which may improve prosocial behavior and acceptance across the larger class. In contrast, pairing one unpopular, highly disruptive peer with a highly popular, aggressive peer may set the stage for the modeling of inappropriate responses to potentially challenging social situations. Alternatively, the strength of the disliking by each member of the target pair may also influence results; it may be that students in classes whose target pairs experience strong, reciprocal disliking are less likely to experience positive intervention effects than students in classes whose target pairs experience more mild or one-sided animosity.

The initial study of this intervention found several significant interactions between condition and pre-test assessment, indicating that target students who were the lowest at pre-test improved more in intervention classes than control classes. It may be that the null effects found in the present study are masking more complex findings. While the present study did embrace a student-level approach to examining intervention effects, these more nuanced approaches were outside of the current scope of study. Future studies focusing on the specific characteristics of each member of the target pair, or additional student-level information, will help to elucidate whether these potentially important characteristics do indeed impact the effects of the intervention. Similarly, additional attention to broader peer dynamics within these classrooms, such as classroom norms and peer groups, may also be at play.

Methodologically, the correlation between pre-test assessments and target student status may have contributed to the null effects of the moderation of the intervention by target student

status in the present study. Additional methodological care should be taken with future studies, as issues of multicollinearity (e.g., students' pre-test scores are correlated with their status as a target student) and non-normal distributions (e.g., zero hurdle distributions) may be present with these data. More complex analytical approaches may better take into account these data, resulting in models that are more sensitive to intervention effects. We look forward to these more nuanced and methodologically rigorous studies.

The seating intervention used in this study focused on the consequences of moving students who expressed disliking closer together. However, this is only one of many strategies that teachers may employ in designing their seating arrangements (Gremmen et al., 2016). Future studies that investigate the effects of alternative seating considerations on students' social development at school would contribute to this literature base. For example, studies could focus on the consequences of separating friends, or seating a rejected child next to a prosocial, popular peer.

Practical Application and Conclusion

Audley-Piotrowski, Singer, and Patterson (2015) warned that "classroom management strategies may not foster … intended norms and instead may strain, rather than promote, positive peer relations" (p. 194). The current study is an example of this warning, and emphasizes the need to examine the effects of teachers' efforts to manage classroom social dynamics at multiple levels and on various timescales. Seemingly contradictory to prior work on this intervention, which demonstrated its positive short-term effects at the dyad level, the present study found the intervention to be associated with less positive changes on a shorter-term scale. As such, teachers should be aware that while dyadic relationships may improve, initial effects of the intervention on students' aggression and perceptions of the peer context may be negative. Before strategies

for managing social dynamics are disseminated to teachers as viable interventions, they must be fully investigated to ensure that the consequences are in line with teachers' goals.

The present study provides a more in-depth understanding of the consequences of a seating chart intervention for students in the class. Over the 8-week period, the intervention was associated with increases in aggressive behavior and decreases in perceptions of cooperation for both target and non-target students. We look forward to future longitudinal studies that can test whether these initial negative effects become positive after a longer period of time that allows for a positive relationship to be formed by target pairs, and for this relationship to generalize to the larger class.

Compliance with Ethical Standards

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Table 1

Descriptive Statistics for Main Study Variables at Pre-Test

	ICC		Control		Intervention		*t*-test
	Between-Class	Between-Student	Mean	*SD*	Mean	*SD*	
Student-Level Pre-Test Assessment							
Sociometrics							
Prosocial Behavior	0.17	0.72	0.25	0.14	0.25	0.14	*ns*
Overt Aggression	0.02	0.87	0.10	0.16	0.12	0.18	$p = .05$
Acceptance	0.17	0.72	0.13	0.09	0.13	0.09	*ns*
Rejection	0.02	0.86	0.09	0.12	0.09	0.12	*ns*
Classroom Peer Context							
Cooperation	0.09	0.80	3.89	0.62	3.78	0.64	$p < .01$
Conflict	0.17	0.72	2.67	0.80	2.87	0.77	$p < .01$
Cohesion	0.11	0.77	2.84	0.80	2.70	0.80	$p < .01$
Isolation	0.08	0.80	3.27	0.64	3.30	0.62	*ns*
Covariates							
Student-Level							
Student SES			2.39	0.70	2.40	0.69	*ns*
Classroom-Level							
Number of Target Pairs			37	18	38	17	*ns*
Proportion Female			0.49	0.07	0.46	0.09	*ns*
Class SES			2.36	0.32	2.36	0.38	*ns*
Class Size			26	3	26	5	*ns*
Efficacy for SDM			5.71	0.64	5.31	0.72	$p = .03$

Note. SES = Socioeconomic status. SDM = Social dynamics management.

Table 2

Correlations Among Main Study Variables at Pre-Test

	Student-Level											Classroom-Level					
	Sociometrics				Classroom Peer Context				Covariates								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Prosocial	Overt Aggression	Acceptance	Rejection	Cooperation	Conflict	Cohesion	Isolation	Target Pair	Female	SES	Intervention	Number Target Pairs	Proportion Female	SES	Class Size	Efficacy for SDM
1	-																
2	-0.42	-															
3	0.61	-0.25	-														
4	-0.44	0.63	-0.34	-													
5	0.15	-0.09	0.14	-0.15	-												
6	-0.14	0.20	-0.16	0.16	-0.48	-											
7	0.10	-0.09	0.08	-0.09	0.57	-0.48	-										
8	-0.08	0.06	-0.04	-0.01	-0.23	0.47	-0.35	-									
9	-0.21	0.17	-0.20	0.28	-0.17	0.15	-0.16	0.15	-								
10	0.34	-0.42	0.16	-0.18	0.04	-0.08	0.07	-0.03	0.02	-							
11	-0.02	-0.04	-0.04	0.01	0.00	0.00	-0.01	0.03	0.02	0.01	-						
12	-0.11	0.07	-0.07	0.00	-0.10	0.15	-0.11	0.08	0.06	0.00	0.02	-					
13	-0.06	0.04	0.05	0.09	-0.17	0.18	-0.16	0.13	0.16	-0.03	0.00	0.02	-				
14	0.09	-0.01	0.05	0.00	0.02	-0.03	0.04	-0.06	-0.05	0.16	-0.11	-0.08	-0.20	-			
15	-0.07	0.01	-0.04	0.03	0.02	-0.08	-0.05	0.04	0.00	-0.02	0.44	0.03	0.00	-0.24	-		
16	-0.20	-0.09	-0.10	-0.10	-0.04	0.08	-0.07	0.11	0.05	-0.07	0.00	0.07	0.52	-0.33	-0.01	-	
17	0.05	-0.06	0.05	0.01	0.07	-0.08	0.08	-0.04	-0.05	-0.01	-0.01	-0.30	0.03	-0.05	-0.04	0.18	-

Note. SES = Socioeconomic status. SDM = Social dynamics management. Correlations $|r| > .09$ are significant at $p < .05$.

Table 3

Predicting Changes in Student-Level Sociometric Outcomes

	Prosocial			Overt Aggression			Acceptance			Rejection		
	Beta		SE	Beta		SE	Beta		SE	Beta		SE
Intercept	0.32	*	0.01	0.12	*	0.01	0.18	*	0.01	0.11	*	0.01
Student-Level												
Outcome at Pre-Test	0.53	*	0.03	0.46	*	0.03	0.40	*	0.04	0.43	*	0.03
Target Student	-0.01		0.01	0.01		0.01	-0.01		0.01	0.01		0.01
Female	0.02	*	0.01	-0.02		0.01	0.01		0.01	-0.01		0.01
SES	-0.01		0.01	0.00		0.01	0.00		0.00	0.00		0.01
Classroom-Level												
Intervention	-0.03		0.02	0.03	*	0.01	0.01		0.01	0.01		0.01
Number Target Pairs	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
Proportion Female	0.06		0.12	0.03		0.08	-0.12		0.08	0.09		0.05
SES	-0.05		0.03	-0.03		0.02	-0.02		0.02	-0.01		0.01
Class Size	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
Efficacy for SDM	-0.01		0.01	0.00		0.01	0.00		0.01	-0.01	*	0.01

Note. * $p < .05$. *SE* = Standard error. SES = Socioeconomic status. SDM = Social dynamics management.

Table 4

Predicting Changes in Students' Perceptions of the Classroom Peer Context

	Cooperation			Conflict			Cohesion			Isolation		
	Beta		SE	Beta		SE	Beta		SE	Beta		SE
Intercept	3.94	*	0.05	2.61	*	0.07	2.80	*	0.07	3.29	*	0.06
Student-Level												
Outcome at Pre-Test	0.54	*	0.03	0.59	*	0.03	0.56	*	0.03	0.42	*	0.03
Target Student	-0.09	*	0.04	0.11	*	0.05	-0.02		0.06	-0.01		0.05
Female	0.09	*	0.03	-0.11	*	0.04	0.04		0.04	-0.03		0.03
SES	0.00		0.03	-0.03		0.03	0.03		0.04	-0.02		0.03
Classroom-Level												
Intervention	-0.14	*	0.05	0.14		0.09	-0.12		0.07	0.05		0.06
Number Target Pairs	0.00		0.00	0.00		0.00	0.00		0.00	0.00		0.00
Proportion Female	0.62		0.32	-0.44		0.60	0.80		0.48	-0.15		0.41
SES	0.21	*	0.08	-0.22		0.14	0.27	*	0.11	-0.08		0.09
Class Size	0.01		0.01	-0.01		0.01	0.01		0.01	0.00		0.01
Efficacy for SDM	0.02		0.04	-0.04		0.07	0.01		0.06	-0.08		0.05

Note. * $p < .05$. *SE* = Standard error. SES = Socioeconomic status. SDM = Social dynamics management.

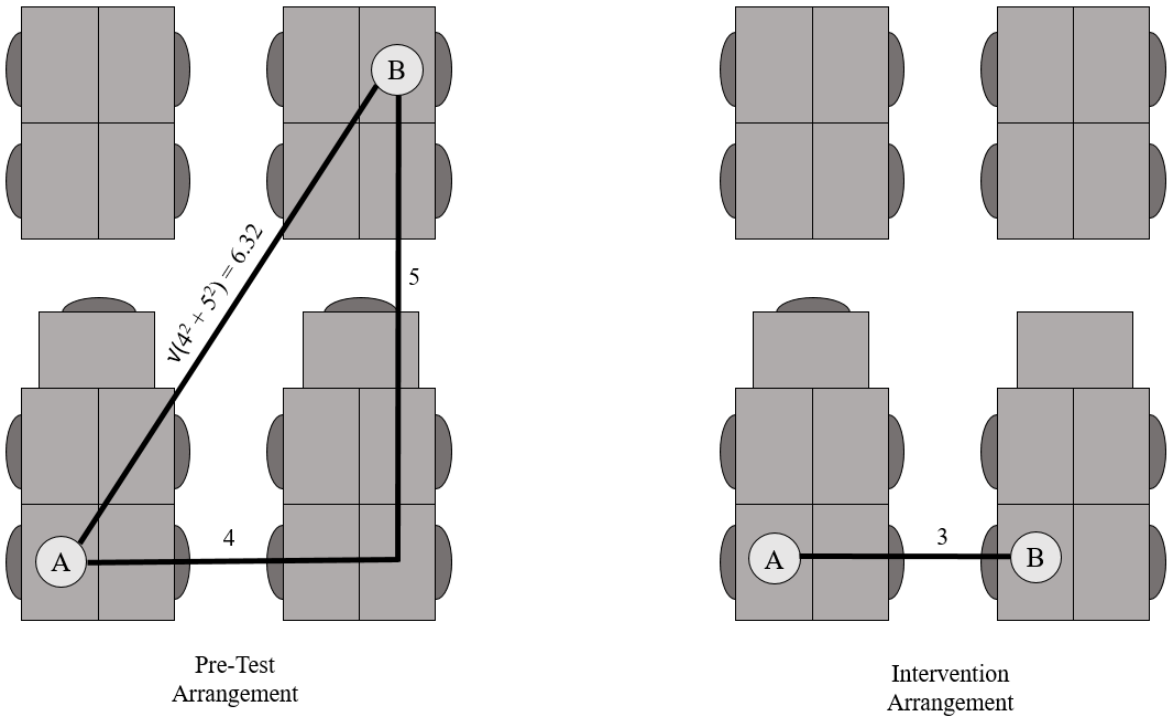

Figure 1. Example of distance calculation. The Euclidean distance between Student A and Student B was reduced from 6.32 units in the pre-test arrangement to 3 units in the intervention arrangement, such that the distance change (intervention assignment - pre-test assignment) was -3.32.

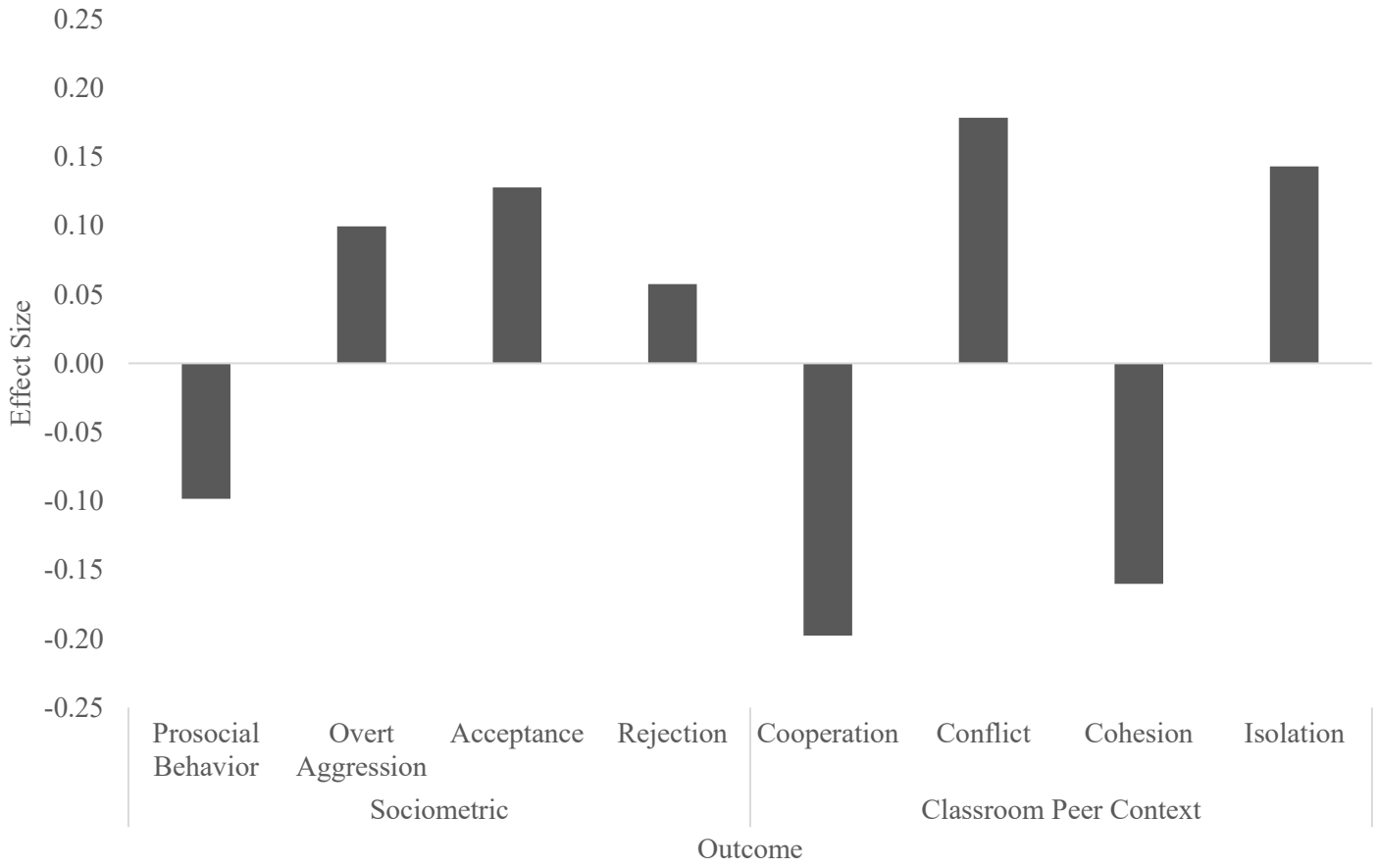

Figure 2. Effect sizes of the intervention on peer-reported sociometric outcomes and students' self-reported perceptions of the classroom peer context; $d = C_P[\frac{(M_{Post,T} - M_{Pre,T}) - (M_{Post,C} - M_{Pre,C})}{SD_{Pre}}]$, where $C_P = 1 - \frac{3}{4(N_T + N_C - 2) - 1}$. Effect sizes were all small, ranging from – 0.20 to 0.18.