Using Social Network Analysis to Examine the Impact of a Teacher-Implemented Social Inclusion Intervention

A thesis presented to

the faculty of

the College of Arts and Sciences of Ohio University

In partial fulfillment

of the requirements for the degree

Master of Science

Hannah D. Kassab

December 2020

This thesis titled

Using Social Network Analysis to Examine the Impact of a Teacher-Implemented Social Inclusion Intervention

by

HANNAH D. KASSAB

has been approved for

the Department of Psychology

and the College of Arts and Sciences by

Julie S. Owens

Professor of Psychology

Florenz Plassmann

Dean, College of Arts and Sciences

Abstract

KASSAB, HANNAH D., M.S., December 2020, Clinical Psychology

Using Social Network Analysis to Examine the Impact of a Teacher-Implemented Social Inclusion Intervention

Director of Thesis: Julie S. Owens

Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common disorders among school-aged children, and has been shown to be strongly associated with marked academic and social impairment. Although interventions have been developed to improve social deficits in children with ADHD, few successfully change peer perceptions of these children, even when ADHD behaviors and symptoms improve. The **M**aking **So**cially **A**ccepting **I**nclusive **C**lassrooms (MOSAIC) program, a teacher-implemented classroom intervention, was developed to specifically target peer perceptions of students with ADHD and social impairment. This pilot study aimed to explore whether teachers (N=12) who implemented the MOSAIC intervention over the course of a school year experienced change in the classroom social network, especially with regard to target students (N=43) with elevated ADHD symptoms and social impairment. In-degree centrality, out-degree centrality, alter-based centrality, and classroom density were calculated using Social Network Analysis (SNA). T-tests were conducted to evaluate whether social outcomes for target students differed from their typically-developing peers and to assess whether change occurred in classroom social networks from fall to spring. Results indicated that change in social outcomes for targets students did not differ significantly from change experienced by peers. Results for change in classroom networks were mixed. Correlational analyses that examined the relationship between

teacher integrity to the MOSAIC strategies and change in SNA metrics were also mixed. Implications and future directions are discussed.

Dedication

I would like to dedicate this work to my family and friends. To my best friend for loving me through it all, my siblings for giving me so many reasons to laugh, my grandparents for supporting me unconditionally, my father for keeping me humble, and my mother for always being my soft place to fall—I love you all dearly.

Acknowledgments

I would like to acknowledge the wonderful mentorship through this thesis process by my amazing advisor, Dr. Julie Owens, my brilliant statistics consultant, Dr. Zachary Neal, and my committee members, Dr. Steve Evans and Dr. Elise Cappella. I very much appreciate your patience and guidance. Additionally, I would like to acknowledge our fantastic research assistant, Abigail Stratton, for her crucial help with data entry for this project.

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Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a chronic mental health condition present in over 9% of school-aged children (Danielson et al., 2018). Children with ADHD encounter more peer difficulties and social rejection compared to typically-developing peers (Loe & Feldman, 2007). This is significant given that early experience of social rejection increases risk of rejection in adolescence (Pederson et al., 2007) and is associated with long-term negative outcomes (Canu & Carlson, 2003; Kuriyan et al., 2013). Thus, treatment of social impairment associated with ADHD is warranted, especially in classroom settings wherein children interact with peers. However, interventions for improving peer acceptance in children with ADHD have yet to be established (Evans et al., 2018; Hoza, 2007). Indeed, even when children with ADHD improve their behavior, peer ratings remain unaffected (Hoza et al., 2005). Thus, addressing problem behavior alone, may not be sufficient for shifting peer acceptance.

The pattern of relationships that constitutes the social structure of a classroom represents the social network. Researchers suggest that peer processes (e.g. social norms) that occur in the context of a classroom social network may be a powerful determinant of healthy development in middle childhood; yet there is limited research investigating the potential association between intervention and change in peer processes (Cappella & Hwang, 2015). Interventions targeting peer group influences, like inclusivity and norms for social acceptance, may be necessary to see improvement in peer perceptions of socially rejected children (Buhs et al., 2006; Mikami et al., 2013a). Based on these principles, Mikami & colleagues, developed the **M**aking **So**cially **A**ccepting **I**nclusive **C**lassrooms (MOSAIC) Program (Mikami et al., 2013a; Mikami et al., 2013b), a teacher-

implemented classroom intervention to improve peer acceptance of students with ADHD. MOSAIC is innovative because it leverages teacher-implemented strategies that simultaneously address behavior of the impaired students (i.e. target students) and peer group influences.

This study is an exploratory analysis of the school-based MOSAIC intervention and its relation to social change in the classroom over the course of one school year. Social network analysis (SNA) was selected to investigate change in relational ties of students in the classroom networks. Specifically, the goal of this study was to evaluate change in the pattern of peer connectedness (based on peer-nominations) in the classroom network, with regard to target students and the classroom network as a whole. Additionally, in conceptualizing the teacher as the "invisible hand" in classrooms implementing the MOSAIC strategies designed to reduce the impact of negative peer group influences on peer relations in the classroom (Farmer et al., 2011), teacher implementation integrity is investigated as a potential mechanism of social change in the classroom. Overall, this study seeks to enhance our understanding of how MOSAIC can impact social functioning in children with elevated ADHD symptoms and peer relationship problems and their social context.

Peer Status in Children with ADHD

Many children with ADHD experience social rejection. One nationally representative study of school-aged children found that 52% of children with ADHD were socially rejected based on peer ratings, 56% of children with ADHD had no reciprocal friendships, and less than 1% were considered popular by peers (Hoza et al., 2005). Other peer relationship studies of school-aged children have revealed that most

(60%) of children with ADHD receive peer rejection scores that fall two standard deviations above average (Hoza, 2007; Pelham & Bender, 1982). Such negative peer status is associated with poor academic functioning and greater disengagement from school, concurrently (Buhs et al., 2006), and lower grade point averages in high school and college, greater employment instability, and greater difficulties in romantic relationships, longitudinally (Canu & Carlson, 2003; Kent et al., 2011; Kuriyan et al., 2013).

Research indicates that social rejection of children may stem from perceptions that children with disruptive behavior violate peer group norms (Mikami & Normand, 2015). Namely, children do not like children who act differently. Peers *socially devalue* these children and may be especially unforgiving of those with ADHD because they perceive problem behaviors to be within the child's control (Hinshaw, 2005). Negative peer perceptions of children with ADHD symptoms form quickly (Erhard & Hinshaw, 1994), persist over time, and are difficult to change (de Boo & Prins, 2007; Taylor, 1994). Further, peer perceptions of a child's reputation can remain stable for over a year (Taylor, 1994). Thus, even if a child with ADHD improves their behavior, peers may not change their negative perceptions of that child, suggesting peers are continuing to hold a *reputational bias* (Mikami & Normand, 2015). Peer victimization and *exclusionary behavior* towards a child communicates a lower social value and discourages others from developing relational ties with the child (Mikami & Normand, 2015). Although it is important to reduce disruptive behavior to achieve healthy classroom functioning, the factors of *social devaluation, reputational bias, and exclusionary behavior* by a child's peers likely contribute to the lower social status of

children with ADHD. These peer group influences should be taken into consideration to address the limitations of previous social interventions for children with ADHD that have largely been ineffective (Evans et al., 2018).

Interventions Addressing Peer Status in ADHD

To date, there are no evidence-based psychosocial interventions that successfully change peer-rated peer status in children with ADHD (Evans et al., 2018). Traditional interventions designed to address social impairment have most commonly taken the format of a weekly social skills training (SST; Frankel et al., 1997; Tutty et al., 2003; Tynan et al., 1999). This approach fails to address the needs of students with ADHD for several reasons. First, SST conceptualizes social skill development as the mechanism producing change in social functioning. Achieving such skill development requires extensive practice and repetition with performance feedback. Most traditional, weekly SSTs lack extensive practice of social skills, and are thus reliant on the "train-and-hope" approach (Stokes & Baer, 1977). Among young children, little behavior change is likely to occur without consistent contingent reinforcement of skills use over time (de Boo & Prins, 2007). Second, children with ADHD need guidance and reinforcement to apply the skills in settings like the classroom, where they interact with peers. Most SSTs do not provide reinforcement for skill use and development outside the clinic- or camp where the intervention is delivered; and research shows that effects are not maintained following intervention cessation (Evans et al., 2018). Even with extensive practice of skill development in settings where it matters most, efforts to change behavior based on this model are likely insufficient to shift peer perceptions, given that negative peer perceptions can persist for over a year (Taylor, 1994). Thus, intervention on peers' social

devaluation, exclusionary behavior, and reputational biases may be needed.

Many of the issues with traditional SSTs could be addressed by developing school-based interventions that include strategies to improve both student behavior *and* peer group influences (Farmer et al., 2011). First, teachers interact with students for several hours over an extended period of time, and their position of influence in the classroom allows them to both model and reinforce positive behaviors frequently and in real time. Second, interventions that focus on improving peer relations by discouraging exclusionary behavior and social devaluation could be more effective in the classroom settings where children have the most opportunities to show positive social behavior towards their peers. Third, teachers could work to model and develop more positive attitudes towards marginalized members of the class at a global level in the classroom, thus reducing reputational bias. A comprehensive teacher-implemented intervention designed to improve how a child with ADHD interacts with and is perceived by their peers in a school setting could be critical to successful socialization in early elementary school years.

Current Innovations: The MOSAIC Program

In response to limitations in addressing social impairment in children with ADHD, Mikami & colleagues (2013) developed and pilot-tested the MOSAIC program in the context of a short summer camp. Developers created a set of strategies that draw from multiple theories, including group socialization theory, attachment theory, behavior theory, and social learning theory to innovatively address peer group influences (i.e. social devaluation, reputational bias, and exclusionary behavior) that are hypothesized to affect social functioning, *in addition* to addressing the deficient behavioral and social

skills of children with ADHD. Pilot testing of MOSAIC relative to a traditional behavior modification intervention yielded promising results for improving social impairment for students with ADHD (Mikami et al., 2013). Results indicated that participants with ADHD received fewer negative nominations, greater liking ratings, and more nominations for reciprocal friendships (for boys only) when receiving the MOSAIC intervention. Preliminary findings also suggest that the benefits of MOSAIC on peer functioning generalize to other typically-developing students at risk for social rejection (Mikami et al., 2013a, 2013b). Given this proof of concept, a school-based version of MOSAIC was developed and was evaluated (Mikami et al., 2020), thus providing the opportunity to examine the association between MOSAIC strategy use and change in the social network.

Strategies to Increase Social Value

The MOSAIC program includes several strategies to address social devaluation (see Appendix for Description of MOSAIC Strategies). *Facilitating Connections between Children* is hypothesized to reduce social devaluation by intentionally highlighting similarities between students. Leveraging group socialization theory (Harris, 1998), highlighting similarities between students can reduce ingroup-outgroup development, increase the social value of individuals who deviate behaviorally from the group, and may encourage development of new relational ties by helping them find common ground. *CARE Time* is hypothesized to shift peer perceptions of a student's value (and thus the ties in the classroom network) via more indirect methods. As an "invisible hand" (Farmer et al., 2011), the teacher communicates to the social network that the child has value and is worthy of attention. CARE Time is a 3 to 5 minute individual student teacher

interaction that is **C**hild-directed (C), **A**ffirming (A), **R**eflecting (R) the child's words and behavior, and a time to **E**njoy (E) getting to know the child better. CARE Time is rooted in principles of attachment theory (Bretherton, 1992) and the authoritative parenting approach (Baumrind, 1978). Theoretically, CARE time communicates the social value of a child to their peers (and gives teachers the time and structure to use strategic attention to build a relationship with the student).

Strategies to Reduce Exclusionary Behavior

A number of MOSAIC strategies were designed to address exclusionary behavior in the classroom. First, teachers are encouraged to establish norms for inclusivity. Then, teachers are encouraged to provide a *Review of Expectations for Inclusiveness* and make it a norm in the classroom. Based on group socialization theory (Harris, 1998), this strategy helps to establish group norms regarding inclusive behavior and acceptance in the classroom, which may indirectly impact the development of relational ties. In addition, teacher are encouraged to *Reinforce Inclusiveness*, or praise students who use inclusive behavior. According to behavior theory, this strategy leverages adult attention to directly reinforce connections made between students; this will increase the likelihood of student engagement in prosocial behaviors towards peers and reduce exclusionary behavior (Skinner, 1988). Lastly, the MOSAIC program also includes a strategy called *Handling Exclusionary Behavior*. When using this strategy, teachers label the behavior and intervene to stop it, thereby directly denouncing exclusionary behavior. In doing so, the teacher confirms group norms about inclusivity and models tolerance towards all members of a classroom, which may encourage development of relational ties based on social learning theory (Bandura & Walters, 1977).

Strategies to Reduce Reputational Bias

Other MOSAIC strategies were designed to enhance the reputation of children with elevated problem behaviors and peer difficulties by limiting the damage done to a child's reputation by reprimands and corrective feedback. *Reviewing Behavioral Expectations* and *Discreet Corrective Feedback* are two indirect strategies for reducing off-putting behavior. First, using principles of group socialization theory, teachers establish group norms for behavioral expectations in the classroom and communicate them to students prior to an activity as a prompt for engaging in prosocial behaviors. When correcting student behavior, teachers are encouraged to do so in a discreet manner; via a more private interaction between the teacher and the student rather than publicly in front of the rest of the class. This should reduce the amount of negative evidence that contributes to the previously formed reputation (Mikami et al., 2010).

In sum, MOSAIC was created to address peer group influences by building positive teacher-student relationships, encouraging inclusivity, highlighting positive qualities, and facilitating connections between peers. MOSAIC was designed so that strategies can be applied universally or in a targeted manner to benefit students with ADHD symptoms and peer problems.

Assessment of Peer Status

The gold standard approach for assessing peer relations and change in peer status is peer-to-peer sociometric ratings (Mikami et al., 2013a; Torrente et al., 2014). There is documented advantage of this method over parent and teacher ratings, as peers have insight into the social world of a student that teachers and parents do not (Hoza et al., 2005; Yugar & Shapiro, 2001). In addition, there are metrics that can be used to

maximize understanding of the social network and an individual's status or location in that network. Experts suggest that contextualizing peer relations within the social structure of the classroom may provide a clearer picture of the students' status and highlight the impact of the social structure on student and classroom functioning (Cairns et al., 1995; Gershman & Hayes, 1983).

Social Network Analysis (SNA) is a methodology used to characterize social relations, based on theories about relational processes, structure, techniques, and tools. SNA assesses a relational tie between actors (in this case, students) in a network (i.e., a classroom) as the unit of analysis rather than the individual actor. Approaching measurement of social relationships from the SNA perspective requires conceptualization of individuals and their actions as interdependent, which deviates from a more traditional approach to statistics that typically assumes independence of observations (Wasserman & Faust, 1994). Among the most common measures utilized to examine networks are density and centrality (Robins, 2015; Valente, 2015; see Table D1 in Appendix for relevant formulas). *Density* represents the number of links in a social network expressed as a proportion of all links possible. Thus, if MOSAIC strategies reduce exclusionary behavior, theoretically the classroom would become more dense over the course of the year. *Centrality* represents how much a student nominates or is nominated by their peers and can indicate how connected or isolated the student is to other peers. There are multiple metrics of centrality. First, *in-degree centrality* is a measure of how many nominations an actor receives from the other actors in the network, which depending on the nature of the sociometric nomination can indicate how popular someone is based on the number of "like" nominations, or how unpopular that individual is if based on the

number of "dislike" nominations. In-degree centrality can help sort out who may be a leader in the classroom, and who may be more isolated, which may differentially affect each student's outcomes. *Out-degree centrality* is a measure of how many times an actor nominates other actors in the network, thus providing a measure of network activity; thus, even if a student is not very well-liked by their classmates, out-degree centrality may reveal that the student of interest still nominates several friends and may still feel connected to the network in that manner. *Alter-based centrality*, is particularly relevant in this case as it allows the researcher to quantify "the connectedness of an individual and the connectedness of each peer to whom s/he is connected to" (Jackson et al., 2015, p. 297), by calculating a weighted count of an individual's relational ties based on the popularity, or nominations received from peers, of each tie. This contextualizes the social standing of the student of interest within the classroom social structure. These metrics have valuable implications for student adjustment and intervention development (Cappella et al., 2013; Grunspan et al., 2014; Neal et al., 2011).

In one of the few studies that evaluated the association between teacher attitudes and practices and classroom social networks, Gest and Rodkin (2011) assessed teacher empathy, observed teacher practices in the classroom, and measured student social outcomes using SNA (i.e. density). Results indicated that greater teacher empathy for shy-withdrawn students was associated with and lower disliking density in their classroom networks ($r = -0.38$, $p<0.05$), and greater teacher disapproval of aggression was associated with lower density of peer nominations of aggression ($r = -0.43$, $p<0.05$). In addition, an evaluation of a teacher consultation and coaching program over the course of a school year in five urban elementary schools revealed that children identified as peer

victims were less isolated in social networks of classrooms with higher levels of teacher emotional support (Cappella et al., 2012). Lastly, another study found a positive association between greater teacher emotional support (i.e. warmth and responsiveness for all students), and preference for nominating cross-ethnic friends in fifth-grade boys (Serdiouk et al., 2019). These studies offer support for the connection between teacher attitudes and practices, and peer social networks, and suggests that further exploration of the influence of the teacher as "the invisible hand" on the classroom social structure is warranted.

Implementation Integrity as a Predictor of Social Change

Implementation integrity represents the extent to which an intervention is delivered as intended or designed. Integrity is a multidimensional construct and the dimension of implementation that is most often measured is adherence, or the extent to which the implementer successfully utilizes the essential components of an intervention as planned (Dane & Schneider, 1998; Sanetti & Kratochwill, 2009). This dimension of integrity has been associated with positive student outcomes, including increased engagement and reduced student behavior problems (Conroy et al., 2015; Owens et al., 2018). MOSAIC is a multicomponent program that provides flexibility for teachers in the number of strategies used and frequency of use. Thus, it stands to reason that higher levels of teacher integrity to strategy use would confer greater behavioral and/or social outcomes. If changes in the social network are detected, it is important to determine if such changes are related to teacher implementation of the program.

Current Study

This study uses data from first evaluation of the school-based version of the

MOSAIC program. The study aims were to use SNA to (1) determine the extent to which the change in social outcomes (i.e. in-degree, out-degree, and alter-based centrality) for target students differs from change among typically-developing students, (2) assess the extent to which there is change in the class-wide social network over the course of the year (i.e. in-degree centrality, out-degree centrality, alter-based centrality, and density), and (3) assess the relationship between teachers' implementation integrity and change in the aforementioned social network metrics. Other metrics of centrality were considered, but the metrics most relevant to determining change in development of direct peer relationships and connectedness in the classroom over the course of the school year were selected for the purposes of this study. Based on preliminary findings from the pilot test of the MOSAIC intervention (Mikami et al., 2013a, 2013b), I expected to see a differential response in SNA metrics for target students relative to their typically-developing peers in MOSAIC classrooms over the course of the year. I hypothesized that changes within structure of each classroom social network as a whole (e.g. developing more positive relational ties and fewer negative relational ties) will also occur in MOSAIC classrooms in this time frame. Finally, I expected that greater teacher use of the MOSAIC strategies would be associated with positive change in social network metrics.

Method

Participants

For this study, I used a pre-post within-subjects design. With the support of a consultant, teachers delivered the MOSAIC intervention during the 2017-2018 school year as part of an intervention development project funded by the Institute of Education Sciences (R324A160053). Investigators recruited for early elementary-aged students for similarity in developmental social skills. Participants were 12 elementary school teachers (grades K-4) and 194 students for whom parent consent and child assent were obtained. The teacher sample was 100% Non-Hispanic female, 83% White; 83% had earned a Master's degree. On average, the teachers had 11.2 years of teaching experience (SD = 8.9). The student sample represents a 75.3% consent rate (43% to 84% across classrooms). For this study, only students who were present for both data collection time points (fall and spring) were included (n =172); 22 students who moved or did not assent to the child interview process were not included. These students did not differ from the remaining 172 students on demographic variables, ADHD symptom severity, or positive and negative nominations receive in the fall (see Tables A2 & A3 in the Appendix). For classroom demographics overall, see Table D 4 in the Appendix.

Teachers and students were recruited from three schools in Southeastern Ohio and three schools in Southwestern British Columbia, Canada. In each class, three to five students were identified as target students based on elevated teacher-rated ADHD symptoms and social problems (see measures below). Namely, those with the highest ratings in the class were considered as target students; a total of 51 target students were identified, of which 43 students had both fall and spring data and were included in this

study. The target students were designated so they could receive a higher dose of intervention strategies (i.e., targeted components), as compared to their typically-developing peers who received the universal aspects of the intervention. Student demographic information is provided in Table 1. Consultants were trained project staff (100% female) with a Bachelor's degree in psychology, most of whom were pursuing or earned a Master's or doctoral degree in school counseling or clinical psychology.

Table 1

Characteristics of Student Sample

Characteristic	Full Sample (n = 172) N (%)	Target Sample (n = 43) N (%)
Gender		
Female	77 (*44.8*)	9 (*20.9*)
Male	94 (*54.7*)	34 (*79.1*)
Transgender	1 (*0.6*)	0 (0.0)
Grade		
Kindergarten	18 (*10.5*)	5 (*11.6*)
First Grade	93 (*54.1*)	23 (*53.5*)
Second Grade	24 (*14.0*)	9 (20.9)
Third Grade	17 (*9.9*)	3 (*7.0*)
Fourth Grade	20 (*11.6*)	3 (*7.0*)
Race		
White/Caucasian	113 (*65.7*)	27 (62.*8*)
Asian/Asian American/Asian Canadian	23 (*13.4*)	3 (*7.0*)
Black/African American/Afro Canadian/Black Canadian	3 (*1.7*)	1 (*2.3*)
American Indian/Alaska Native	1 (*0.6*)	0 (*0.0*)
Multiracial	31 (*18.0*)	12 (*27.9*)
Missing/Did Not Report	1 (*0.6*)	0 (*0.0*)
Ethnicity		
Hispanic	5 (*2.9*)	2 (*4.7*)
Non-Hispanic	147 (*85.5*)	40 (*93.0*)
Missing/Did Not Report	1 (*0.6*)	1 (*2.3*)
Characteristic	Full Sample (n = 172) M (*SD*)	Target Sample (n = 43) M (*SD*)
Age	6.59 (*1.4*)	6.43 (*1.36*)
ADHD Symptoms		
Inattention Symptoms	7.91 (*7.08*)	11.74 (*8.79*)
Hyperactive/Impulsive Symptoms	4.61 (*5.91*)	6.47 (*7.15*)
Dishion Social Acceptance Ratings		
Teacher-Rated Percent Liked	75.88 (*21.72*)	63.72 (*23.33*)
Teacher-Rated Percent Disliked	6.42 (*11.71*)	16.40 (*16.95*)
Teacher-Rated Percent Ignored	17.70 (*16.92*)	19.88 (*15.94*)
Sociometric Nominations		
Proportion of Positive Nominations Received (F)	0.31 (*0.16*)	0.21 (*0.13*)
Proportion of Negative Nominations Received (F)	0.12 (*0.14*)	0.24 (*0.19*)
Proportion of Positive Nominations Received (S)	0.32 (*0.14*)	0.26 (*0.14*)
Proportion of Negative Nominations Received (S)	0.14 (*0.15*)	0.23 (*0.17*)

Note. F = fall; S = spring.

Procedures

All procedures were approved by the research boards at both universities and by administrators in all school districts. Investigators distributed project information to teachers via email and at staff meetings. Teachers who consented to the project attended a 2-hour training in May or June of 2016, during which they received the intervention manual and were oriented to intervention strategies and project procedures. There was no control group.

Students were recruited in August and September of the 2017 school year via flyers sent to all parents in participating teachers' classroom. To incentivize return of consent forms, each classroom could earn a pizza or cookie party if 75% of consent forms were returned (regardless of participation decision). When providing parent consent, parents also completed the child demographic questionnaire. After parent consent was received, child assent was sought.

Approximately 6 weeks after the start of the school year, teachers were asked to complete the *Dishion Social Acceptance Scale* (Dishion, 1990) and *Attention Deficit Hyperactivity Disorder Rating Scale-5* (DuPaul et al., 2016) for all consented students in the class. All teacher surveys about students were completed online using the Research Electronic Data Capture (REDCap) system (Harris et al., 2009). Once teacher and parent rating scales were completed, students were ranked in each class based on highest teacher-rated ADHD scores and/or the highest social impairment scores. When scores were similar between two closely-ranked students, teacher impairment ratings from the ARS-5 were used to select the more severe student. Rankings were discussed with each teacher and used to identify three to five target students.

In the fall and spring, all students who assented were individually interviewed in a private location by research assistants about perceptions of their peers using the sociometric procedure. Students were asked to keep their responses confidential following the interview.

Intervention

The MOSAIC program was implemented over the entire school year by teachers for the whole class (universal application) and for target students (targeted application). MOSAIC strategies were designed to address peer group factors of social devaluation, exclusionary behavior, and reputational bias, and to reduce disliked children's behavior. A total of 25 strategies were progressively introduced to the teachers (8 at the beginning of the school year; 11 in December; 6 in March) (see Appendix for Descriptions of MOSAIC Strategies). Teachers' use of the strategies was observed weekly and teachers received consultation twice per month to support implementation. During consultation sessions, teachers received feedback on what they implemented well and options for improving use of MOSAIC strategies.

Consultant Training

Consultants for the project were oriented to MOSAIC strategies in a two-day training, wherein consultants reviewed strategies and participated in role plays to achieve mastery in presenting the MOSAIC strategies. Consultation sessions were audio-recorded and reviewed by a supervisor, who provided consultants with feedback on adherence to the intervention and feedback for improvement, as needed.

Measures

Demographics

Parents were asked to report on the student's gender, age, grade, race, and ethnicity. Teachers were asked to report their own gender, age, race, ethnicity, highest degree earned, current grade, and years in the profession.

ADHD Rating Scale-5

The ADHD Rating Scale-5 (DuPaul et al., 2016) assesses teacher perceptions of student Inattention (9 items) and Hyperactivity/Impulsivity (9 items), as described in the fifth edition of the *Diagnostic Statistical Manual* (DSM-5; APA, 2013), as well as impairment associated with each symptom domain. It has strong internal reliability and predictive validity for identifying students with ADHD (DuPaul et al., 1997; DuPaul et al., 2016). In the fall, teachers completed 18 symptom items and 3 impairment items for all consented students in the classroom. Internal consistency estimates were .95 for the Inattention and .94 for Hyperactive/Impulsive dimensions. Fall ratings were used to identify target students.

Dishion Social Acceptance Scale (DSAS)

In the fall, teachers were asked to estimate the percentage of classmates who *like and accept*, *dislike and reject*, and *ignore or are neutral about* the child (Dishion, 1990) to identify the most disliked, least liked and/or most ignored students as potential target students. Teachers were reminded that the three percentages must add to 100%. This is a commonly used measure to obtain teacher perceptions of student peer status; the ratings have moderate correlations with peer sociometrics, the gold standard measure for peer status (Dishion, 1990). Percentages were completed for all consented students in the

classroom.

Peer-to-Peer Sociometric Ratings

To assess peer status, students participated in a standard sociometric procedure in the fall and spring (Coie, Dodge & Coppotelli, 1982). Students were asked to nominate the peers in their classroom (with parent consent and child assent) whom they like and whom they dislike. During an individual session, students were shown pictures of their consented classmates in alphabetized order were permitted to make unlimited nominations for these categories. The roster was utilized for its demonstrated validity and reliability; use of this method maximizes the likelihood of reporting relational ties (Ferligoj & Hlebec, 1999).

Positive and negative nomination data from this measure was used to construct matrices for SNA (see Table D 5 in Appendix). Self-nominations and nominations of siblings (if they were in the same class), were removed from the data. The presence or absence of a relational tie between peers, as denoted by a nomination, was denoted as a 1 or 0, respectively (Wasserman & Faust, 1994). A matrix was then constructed for each classroom, wherein each student represented a row and a column, and nominations were recorded in the matrix as 1's or 0's using the nomination data. In negative nomination networks, a 1 indicated that a peer identified an individual that they disliked, whereas in positive nomination networks, a 1 represented a nomination of an individual that a peer liked.

Implementation Integrity of MOSAIC Strategies

Project staff conducted weekly observations using the MOSAIC Integrity Observation System to record the frequency of times teachers used each MOSAIC

strategy. In the context of the team's development work, 25 practices were explored for feasibility of teacher use, feasibility of measurement, teacher acceptability, and inter-rater reliability. Strategies were separated into three phases and teachers were encouraged to progressively implement them over the course of the school year. At the beginning of each phase, teachers worked with consultants to create a plan for strategies that they intended to implement. Observers tracked teacher use of MOSAIC strategies for the duration of a 40-minute time period (broken into 5, 8-minute intervals) on a weekly basis. Each teacher was observed an average of 29.3 times (*SD* = 6.8, *range* = 19 to 37) across the academic year.

Observers achieved high reliability with the coding system (ICC's >.80 for all strategies; for details see Reliability of MOSAIC Observation System in Appendix). Frequency counts of strategy use were compiled for each teacher and strategy. Proportions for observed use of each strategy were calculated by summing the total number of times that strategy was observed per 8-minute observation period and dividing the sum by the number of observation periods conducted. Probe surveys were also sent to teachers after most consultation sessions throughout the year to solicit self-reports of strategy use (see Table D 6 in Appendix for Probes Distribution Schedule). Proportions of these scores were calculated for analysis by adding together teacher-reported use of each strategy and dividing it by the number of probe surveys sent for that phase.

In the current study, we focus on nine key practices based on theoretical and empirical rationale. First, strategies that were theoretically relevant to the aims and methodology for this study (i.e. considerations for developing positive relational ties or reducing negative relational ties) were prioritized. Then, strategies within this subset that

had adequate frequency and inter-observer reliability were retained. Bivariate correlations were conducted to evaluate whether observed use was associated with teacher self-report (see Table D 7 in Appendix). For strategies that had moderate to high correlation between observed and self-reported use and were reliably observed, *z*-scores were calculated for self-report and observed use, and then averaged to create a composite value to represent integrity for each strategy. Composite scores were utilized for all but two strategies; for *Discreet Corrective Feedback* and *Handling Exclusionary Behavior*, the correlation between observed and self-reported use was very low (r's < 0.30). Consequently, observed and self-reported use were considered separately for these strategies. Frequency counts indicated that *Handling Exclusionary Behavior* was not observed often across classrooms due to low occurrence of this behavior amongst students during observation times; thus self-reported use was selected as the representative integrity value for this strategy. Observation frequencies of *Discreet Corrective Feedback* were more variable, so observation data were selected as the representative value of integrity.

Analytic Strategy

When conducting the social network analyses, I used data from the sociometric nominations process (see Tables A7 & 8 for descriptive statistics). I used the statistical programming software R (Version 3.2.4) to analyze social network measures including density of the network, in-degree centrality, out-degree centrality, and alter-based centrality. Given the large number of statistical analyses conducted, only outcomes at $p <$ 0.01 are interpreted and all are interpreted with caution. Parametric tests assume that each of the observations is independent. In contrast, the analyses used for SNA assumes interdependence. Given that the data violate the assumptions of parametric t-tests, thus

increasing the risk of having a standard error that is too small and Type 1 errors, non-parametric *p*-values were used to assess the statistical significance.

Aim 1: Comparing Change in Network Metrics between Target and Non-Target Students

To determine whether or not target students experienced social change in each classroom social network relative to non-target students as a result of the MOSAIC intervention, multiple network indices of centrality were calculated. Liking and disliking nominations from the peer sociometrics data survey collected in fall and spring were used to assess the degree of centrality of the target and non-target students within classroom networks.

Specifically, in-degree centrality was calculated by totaling the number of nominations received from peers, and out-degree centrality was calculated by totaling the number of nominations given. For positive nomination networks, higher in-degree centrality indicates that an individual was nominated by their peers more frequently; this is analogous to the sociometric measure of popularity in the classroom. For negative networks, higher in-degree centrality indicates more negative peer perceptions of that individual, such that the individual is nominated as a disliked member of the classroom more often. High out-degree centrality is indicative of an individual's higher regard for their peers in positive networks, and higher levels of perceived connections or friendships in the classroom. In negative networks, out-degree centrality may indicate that an individual does not think very highly of their peers in the classroom, and thus nominate a higher number of peers who they dislike. Alter-based centrality was calculated to assess the degree to which targets may have developed ties to well-connected peers in their

classroom network over the course of the school year by totaling the number of nominations received by a given individual's peers, and adding it to the number of in-degree nominations of that same individual. This metric was only calculated for positive nomination networks; higher scores are indicative of an individual being connected to more well-connected peers.

For target students and non-target students, change scores were calculated for all metrics by subtracting the fall score from the spring score. Positive scores indicate an increase in the number of positive and negative relational ties in networks over the course of the year, whereas negative numbers show a reduction in the number of ties. Two-sample t-tests were conducted on the difference scores to assess whether change in these metrics were different for target students relative to non-target students.

Aim 2: Evaluating Change in Whole Class Network Metrics

To evaluate change in the structure of the social network at the level of the whole class, dependent samples t-tests were conducted to determine whether change occurred from fall to spring in classroom centrality and density. A class average was derived for in-degree centrality, out-degree centrality, and alter-based centrality at each time point by averaging the individual scores for each centrality metric (see Aim 1 for more details) across members of each classroom. Density was calculated for each network by creating a proportion of the number of in-degree and out-degree nominations in each classroom and dividing it by the number of possible nominations for that classroom. Dependent samples t-tests were conducted for all centrality metrics and density for positive networks, as well as for in-degree centrality, out-degree centrality, and density for negative networks.

Aim 3: The Relationship between Teacher Integrity and Change in Social Network Metrics

Correlational analyses were conducted to examine the relationship between implementation integrity and change in relational ties in the classroom network over the course of the year. Differences were calculated for centrality metrics by subtracting the fall class average from the spring class average (see Aim 2 for more details) to represent change for each teacher. For density, the proportion in the fall for each classroom was subtracted from the proportion in the spring. Then, difference scores for SNA metrics were correlated with representative integrity values for each strategy.

Results

Aim 1: Comparing Change in Network Metrics between Target and Non-Target Students

Two-sample t-tests were conducted to compare change scores for target students to change scores for non-target students in each classroom. These t-tests were conducted for five social network metric change scores (positive in-degree nominations, negative in-degree nominations, positive out-degree nominations, negative out-degree nominations, and positive alter-based centrality). Results indicated that target students' change scores did not differ significantly from non-target students' change scores on any of the metrics. Trends for out-degree centrality that aligned with hypotheses were found for 8 of 12 classroom for positive nominations (see Table 2) and for 7 of 12 classrooms for alter-based centrality (see Table 3).

Table 2

Two-Sample T-Tests to Compare In-Degree Centrality Change Scores and Out-Degree Centrality Change Scores for Target versus Non-Target Students

	In-Degree Positive Networks					In-Degree Negative Networks				
Class	*t*	*df*	Target Mean	Non-Target Mean	*p*-value	*t*	*df*	Target Mean	Non-Target Mean	*p*-value
A	0.76	16	**1.20**	0.31	0.46	-1.00	16	**-0.80**	-0.54	0.37
B	-0.20	8	-1.00	-0.88	1.00	0.49	8	1.50	1.13	0.69
C	1.06	13	**0.80**	-0.20	0.36	-0.76	13	**-0.60**	0.40	0.55
D	-0.38	12	-1.00	-0.80	0.76	-2.25	12	**-2.00**	0.90	0.06
E	-0.26	15	-0.25	0.08	0.90	-0.07	15	0.50	0.54	0.97
F	1.91	15	**2.20**	0.25	0.09	0.22	15	0.80	0.58	0.89
G	0.22	18	-0.33	-0.59	0.86	0.22	18	**-0.33**	-0.59	0.86
H	2.03	8	**2.00**	0.63	0.11	1.43	8	1.00	-0.38	0.31
I	1.91	13	**3.00**	1.00	0.10	-1.95	13	**-0.75**	1.00	0.08
J	1.15	7	**1.00**	-0.40	0.29	0.00	7	0.00	0.00	1.00
K	--	--	0.00	-1.00	--	--	--	0.00	0.14	--
L	0.14	17	-0.25	-0.40	1.00	1.44	17	1.25	0.00	0.23
	Out-Degree Positive Networks					Out-Degree Negative Networks				
Class	*t*	*df*	Target Mean	Non-Target Mean	*p*-value	*t*	*df*	Target Mean	Non-Target Mean	*p*-value
A	1.46	16	**2.60**	-0.23	0.18	-0.20	16	0.00	0.23	0.91
B	-1.18	8	-3.00	-0.38	0.29	0.25	8	1.50	1.13	0.80
C	0.28	13	**0.40**	0.00	0.84	-0.30	13	0.00	0.10	1.00

Table 2 continued

D	-0.38	12	-1.25	-0.70	0.71	-0.85	12	**-1.00**	0.50	0.48
E	0.16	15	**0.25**	-0.08	0.93	-0.34	15	0.25	0.62	0.69
F	0.15	15	**1.00**	0.75	0.94	-0.65	15	0.20	0.83	0.57
G	-1.04	18	-2.00	-0.29	0.35	-1.15	18	**-1.00**	0.59	0.30
H	1.42	8	**3.00**	0.38	0.22	-0.84	8	**-0.50**	0.00	0.64
I	0.53	13	**2.50**	1.18	0.64	0.03	13	0.50	0.55	0.98
J	0.04	7	**0.25**	0.20	1	-0.67	7	**-0.50**	0.40	0.96
K	--	--	-2.00	-0.71	--	--	--	1.00	0.00	--
L	0.68	17	**0.75**	-0.67	0.36	-1.95	17	**-1.25**	0.67	0.09

Note. Non-parametric p-values are reported. For positive nomination networks, positive change scores indicate an increase in positive nominations from fall to spring. For negative nomination networks, change scores indicate an increase in negative nominations from fall to spring. Bolded values indicate trends that align with study hypotheses. For Classroom K, there were not enough degrees of freedom to run the statistical test.

Table 3

Two-Sample T-Tests to Compare Alter-Based Centrality Change Scores for Target versus Non-Target Students

Class	*t*	*df*	Target Mean	Non-Target Mean	*p*-value
A	0.85	16	**11.80**	6.23	0.41
B	1.14	8	-2.50	-6.13	0.31
C	0.86	13	**3.20**	-0.30	0.47
D	-0.75	12	-7.00	-5.20	0.49
E	-1.13	15	-3.25	3.38	0.28
F	1.25	15	**10.40**	3.00	0.23
G	0.03	18	-3.67	-3.82	1.00
H	0.10	8	**5.50**	5.38	1.00
I	2.05	13	**19.75**	8.73	0.06
J	-0.10	7	**1.50**	1.80	0.97
K	--	--	**2.00**	-5.00	--
L	0.51	17	-4.00	-6.93	0.62

Note. Non-parametric p-values are reported for these statistical tests. Two-sample t-tests were conducted using the average change in out-degree centrality from fall to spring for each group of students in each classroom. For Classroom K, there were not enough degrees of freedom to run the statistical test. Bolded values indicate trends that align with study hypotheses.

Aim 2: Evaluating Change in Whole Class Network Metrics

Dependent samples t-tests were conducted to assess change in average in-degree per child for each classroom network over the course of the school year, as metric representations of nominations received and given, respectively. There were no classrooms in which statistically significant change occurred for in-degree centrality (p's > 0.01; see Table 4). Where trends were found, changes indicate change in approximately 1-2 relational ties per child, on average, in each classroom.

Table 4

Paired Samples T-Tests to Compare In-Degree Centrality and Out-Degree Centrality in Fall and Spring Semesters

	In-Degree Positive Networks					In-Degree Negative Networks				
Class	*t*	*df*	Fall Mean	Spring Mean	*p*-value	*t*	*df*	Fall Mean	Spring Mean	*p*-value
A	-1.07	17	4.83	5.39	0.34	-0.28	17	2.50	2.67	0.86
B	3.86	9	4.20	3.30	0.02*	-4.13	9	0.90	2.10	0.01*
C	-0.30	14	4.73	4.87	0.88	-0.11	14	1.60	1.67	1.00
D	3.71	13	4.29	3.43	0.01*	-0.11	13	2.21	2.29	1.00
E	0	16	4.94	4.94	1.00	-2.17	16	1.53	2.06	0.07
F	-1.64	16	4.29	5.12	0.15	-1.45	16	1.82	2.47	0.21
G	1.33	19	4.45	3.90	0.24	1.33	19	4.45	3.90	0.53
H	-2.86	9	2.00	2.90	0.03*	0.25	9	1.00	0.90	1.00
I	-3.03	14	4.07	5.60	0.01*	-1.23	14	2.67	3.20	0.31
J	-0.36	8	2.67	2.89	0.86	0.00	8	1.11	1.11	1.00
K	2.50	7	3.25	2.38	0.09	-1.00	7	0.13	0.25	1.00
L	0.86	18	6.05	5.68	0.47	-0.72	18	1.79	2.05	0.62

	Out-Degree Positive Networks					Out-Degree Negative Networks				
Class	*t*	*df*	Fall Mean	Spring Mean	*p*-value	*t*	*df*	Fall Mean	Spring Mean	*p*-value
A	-0.56	17	4.83	5.39	0.65	-0.44	17	2.50	2.67	0.75
B	0.99	9	4.20	3.30	0.41	-2.09	9	0.90	2.10	0.09
C	-0.21	14	4.73	4.87	0.92	-0.43	14	1.60	1.67	1.00
D	1.37	13	4.29	3.43	0.24	-0.09	13	2.21	2.29	1.00

Table 3 continued

E	0	16	4.94	4.94	1.00	-1.21	16	1.53	2.06	0.30
F	-1.12	16	4.29	5.12	0.30	-1.48	16	1.82	2.47	0.20
G	0.86	19	4.45	3.90	0.45	-0.70	19	1.60	1.95	0.55
H	-1.15	9	2.00	2.90	0.40	0.43	9	1.00	0.90	1.00
I	-1.44	14	4.07	5.60	0.20	-0.91	14	2.67	3.20	0.44
J	-0.41	8	2.67	2.89	0.91	0.00	8	1.11	1.11	1.00
K	1.51	7	3.25	2.38	0.25	-0.55	7	0.13	0.25	1.00
L	0.36	18	6.05	5.68	0.77	-0.61	18	1.79	2.05	0.64

Note. Non-parametric p-values are reported for these statistical tests.
*$p<0.05$.

Tests of change in average out-degree centrality per child from fall to spring also indicated that there was no statistically significant change in any classroom networks over the course of the school year (see Table 4). Results do not reveal a clear pattern of change in in-degree or out-degree centrality for positive nomination networks, given that half of classrooms saw an increase in nominations and half did not; for negative nomination networks, it appears that most classrooms (n = 9) saw a trend toward an increase in negative nominations received.

Dependent samples t-tests to compare average change in alter-based centrality per child in each classroom network yielded significant positive change for two classrooms and significant negative change for two classrooms (see Table 5). More specifically, there was a statistically significant change in alter-based centrality for Classroom H, $t(9) = -10.82$, $p < 0.01$, such that students and their connected peers were connected to more peers and/or more highly connected peers in the spring semester compared to the fall semester ($M_{Fall} = 4.20$, $M_{Spring} = 9.60$). Classroom I also experienced statistically significant change over the course of the school year, $t(14) = -4.42$, $p < 0.01$, in that students and their connected peers became more well-connected by the end of the spring semester ($M_{Fall} = 15.73$, $M_{Spring} = 27.40$). See Figures 1 and 2 for sociograms that represent the relational ties between members of Classrooms H and I.

Table 5

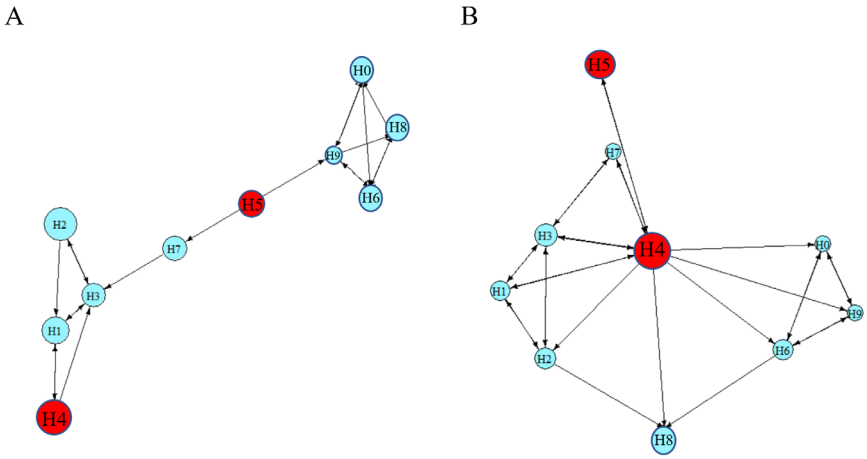
Paired Samples T-Tests to Compare Alter-Based Centrality in Fall and Spring Semesters for Positive Classroom Networks

Class	*t*	*df*	Fall Mean	Spring Mean	*p*-value
A	-2.68	17	22.28	30.06	0.02*
B	4.18	9	16.20	10.80	0.004**
C	-0.45	14	21.53	22.40	0.67
D	5.33	13	18.00	12.29	0.001**
E	-0.72	16	23.29	25.12	0.49
F	-1.89	16	19.00	24.18	0.08
G	2.34	19	20.10	16.30	0.03*
H	-10.82	9	4.20	9.60	0.002**
I	-4.42	14	15.73	27.40	<0.001**
J	-1.15	8	7.56	9.22	0.34
K	3.04	7	10.88	6.75	0.03*
L	2.73	18	31.68	25.37	0.02*

Note. Non-parametric p-values are reported for these statistical tests.
*$p<0.05$, **$p<0.01$.

Figure 1

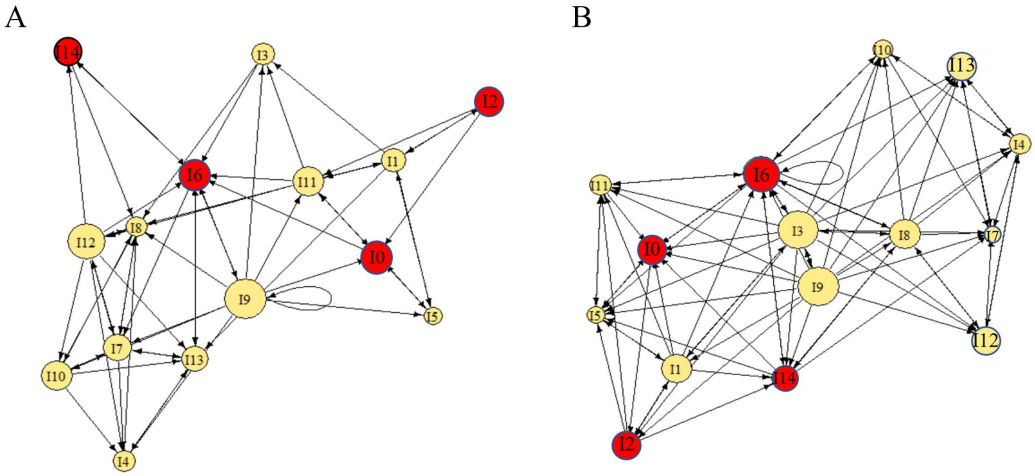
Classroom H Sociograms for Fall and Spring Positive Networks



Note. Panel A represents the positive nominations network in the fall for Classroom H, and Panel B represents the positive nominations network for Classroom H in the spring. Target students are denoted in red.

Figure 2

Classroom I Sociograms for Fall and Spring Positive Networks

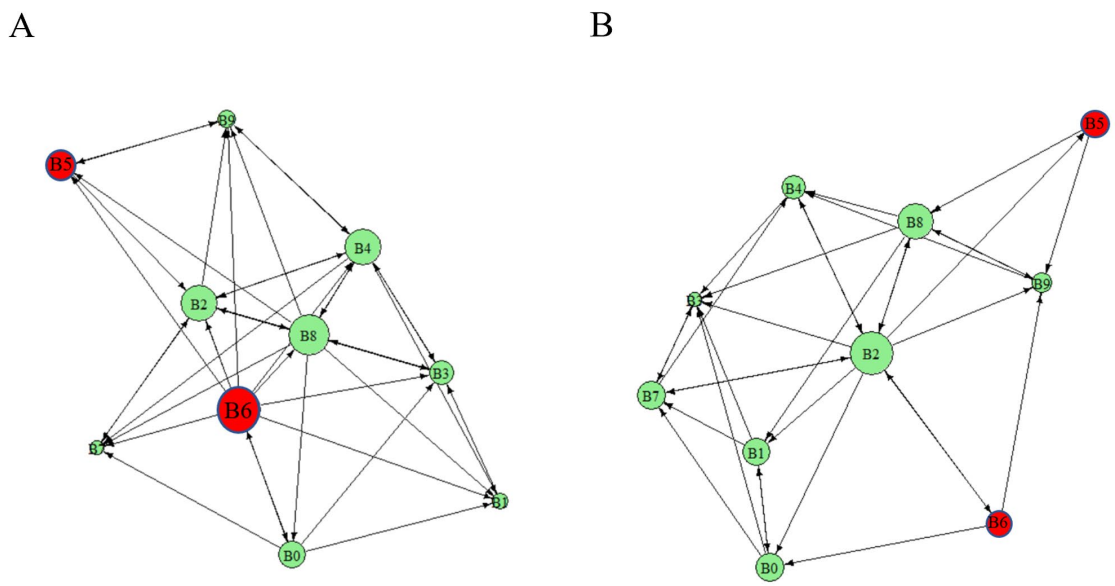


Note. Panel A represents the positive nominations network in the fall for Classroom I, and Panel B represents the positive nominations network for Classroom I in the spring. Target students are denoted in red.

In contrast, Classrooms B and D experienced a decrease in the number of relational ties of students and their connected peers. Students and their connected peers were connected to fewer peers and/or less well-connected peers in the spring semester compared to the fall semester ($M_{Fall} = 16.20$, $M_{Spring} = 10.80$) for Classroom B, $t(9) = 4.18$, $p < 0.01$. There was also a decrease in alter-based centrality for students in Classroom D ($M_{Fall} = 18.00$, $M_{Spring} = 12.29$), $t(13) = 5.33$, $p < 0.01$. See Figures 3 and 4 for sociograms that represent the relational ties between members of Classrooms B and D.

Figure 3

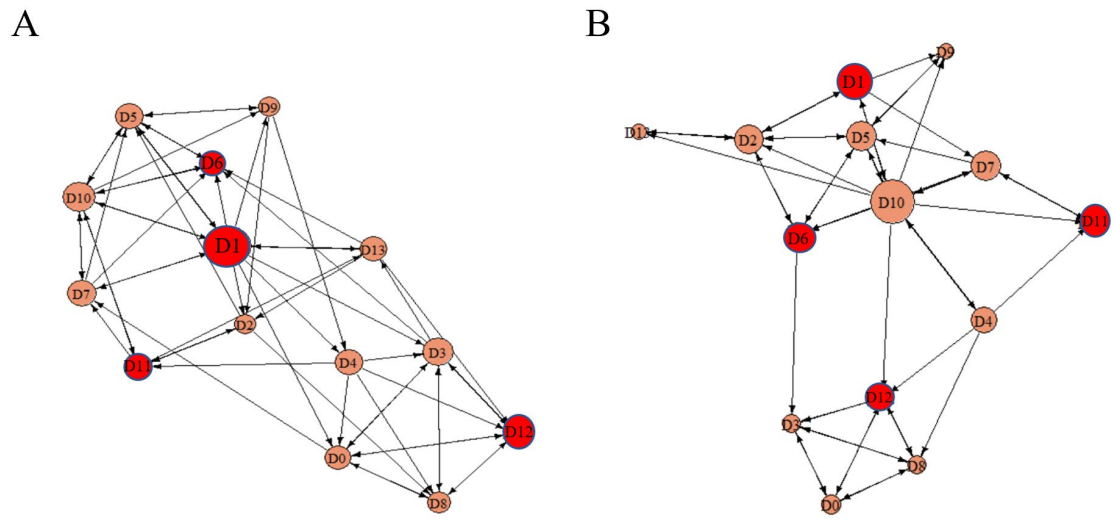
Classroom B Sociograms for Fall and Spring Positive Networks



Note. Panel A represents the positive nominations network in the fall for Classroom B, and Panel B represents the positive nominations network for Classroom B in the spring. Target students are denoted in red.

Figure 4

Classroom D Sociograms for Fall and Spring Positive Networks



Note. Panel A represents the positive nominations network in the fall for Classroom D, and Panel B represents the positive nominations network for Classroom D in the spring. Target students are denoted in red.

Dependent samples t-tests were conducted for positive and negative nominations networks to assess change in network density across classroom networks (see Table 6). This represents the proportion of both in-degree and out-degree nominations relative to the number of possible connections in the classroom network. Findings indicated that, on average for all classrooms included in the study, there was no statistically significant change in density over the course of the school year. There was a marginally significant increase in the proportion of negative nominations in classroom networks, $t(11) = -2.38$, $p < 0.05$. On average, classrooms saw a 2% increase in negative nominations from fall to spring ($M_{Fall} = 0.12$, $M_{Spring} = 0.14$).

Table 6

Paired Samples T-Tests to Compare Classroom Density in Fall and Spring Semesters

Network Type	*t*	*df*	Fall Mean	Spring Mean	*p*-value
Negative Networks	-2.38	11	0.12	0.14	0.04*
Positive Networks	0.01	11	0.32	0.32	0.99

Note. Non-parametric p-values are reported for these statistical tests.
*$p<0.05$.

Aim 3: The Relationship between Teacher Integrity and Change in SNA Metrics

Correlations were conducted to assess the association between teacher integrity and change in peer nominations (see Tables 7 & 8). Contrary to hypotheses, greater teacher use of *Reviewing Behavioral Expectations* was associated with decreases in in-degree centrality ($r = -0.63$) and density ($r = -0.66$) for positive nominations. Similarly, there was a moderate negative association between teacher use *of Reviewing Behavioral Expectations* and decreases in alter-based centrality ($r = -0.51$) for positive nominations

Table 7

Bivariate Correlations to Test the Association of Teacher Integrity with Changes in Social Network Metrics of Positive Nomination Networks

Strategy	In-Degree Centrality	Alter-Based Centrality	Density
Reviewing Behavioral Expectations	-0.63*	-0.51	-0.66*
Reviewing Expectations for Inclusiveness	-0.18	-0.10	-0.33
Reinforcing Behavioral Expectations	-0.25	-0.20	-0.27
Reinforcing Expectations for Inclusiveness	-0.17	0.06	-0.35
CARE Time Minutes	-0.01	-0.03	-0.11
Facilitating Connections Between Children	0.26	0.26	0.24
Highlighting Personal Attributes	**0.40**	**0.44**	**0.42**
Discreet Corrective Feedback (Observed Use)	0.06	0.07	0.07
Handling Exclusionary Behavior (Self-Reported Use)	0.17	0.21	0.07

Note. The correlational analyses for integrity utilize parametric *p*-values, all other tests in this study utilized non-parametric *p*-values.
*$p<0.05$.
in MOSAIC classrooms from fall to spring.

Table 8

Bivariate Correlations to Test the Association of Teacher Integrity with Changes in Social Network Metrics of Negative Nomination Networks

Strategy	In-Degree Centrality	Density
Reviewing Behavioral Expectations	-0.14	-0.13
Reviewing Expectations for Inclusiveness	0.58*	0.40
Reinforcing Behavioral Expectations	0.32	0.10
Reinforcing Expectations for Inclusiveness	0.12	0.11
CARE Time Minutes	-0.28	**-0.44**
Facilitating Connections Between Children	**-0.46**	**-0.41**
Personal Attributes	-0.07	-0.04
Discreet Corrective Feedback (Observed Use)	0.26	-0.01
Handling Exclusionary Behavior (Self-Reported Use)	0.38	0.22

Note. The correlational analyses for integrity utilize parametric *p*-values, all other tests in this study utilized non-parametric *p*-values.
*$p<0.05$.

Consistent with hypotheses, teacher use of *Highlighting Personal Attributes* was positively associated with increases in in-degree centrality ($r = 0.40$), alter-based centrality ($r = 0.44$), and density ($r = 0.42$) of positive nominations networks. This pattern was also found for the strategy of *Facilitating Connections Between Children*, but the relationship was weaker (r's < 0.30).

Correlations also revealed some moderate associations between teacher integrity and SNA metrics for negative nominations networks. Contrary to hypotheses, greater use of the strategy *Reviewing Expectations for Inclusiveness* was moderately associated with

an increase in in-degree centrality ($r = 0.58$) and density ($r = 0.40$) of negative nominations. Consistent with hypotheses, greater minutes in *CARE Time* was associated with a decrease in density of negative networks, or fewer negative nominations in their classroom networks overall ($r = -0.44$). Teacher use of *Facilitating Connections Between Children* had a moderate, negative association with in-degree centrality and density in negative nominations networks, suggesting that these strategies were associated with fewer negative nominations in classroom networks ($0.40 < r\text{'s} < 0.50$).

For the strategies of *Discreet Corrective Feedback* and *Handling Exclusionary Behavior*, measurement of integrity was analyzed separately due to the low correlation between self-reported and observed use of the strategy. There was a moderate positive association between *Handling Exclusionary Behavior* and in-degree centrality for negative networks ($r = 0.38$); all other SNA metrics were weakly related to this strategy. Results revealed only weak associations between observed use of *Discreet Corrective Feedback* and changes in SNA metrics ($r\text{'s} < 0.30$).

Secondary Exploratory Analysis

Exploratory analyses were conducted to generate possible explanations for significant results (i.e., in Aim 2; positive change in classroom networks for Classrooms H and I and negative change in Classrooms C and D). The profile of MOSAIC strategy use was explored to see if teachers in Classrooms H and I were high on multiple strategies or on similar strategies (See Figure 2 in Appendix). However, no clear pattern emerged that may account for what facilitated more connectedness in their classrooms. Notably, Teachers B and D also saw significant, negative change in classroom networks over the course of the school year in alter-based centrality. Both Teacher B and Teacher

D were the two lowest implementers of the strategy *Facilitating Connections Between Children* relative to their peers.

Because use of *Reviewing Behavioral Expectations* was unexpected negatively correlated with in-degree and alter-based centrality scores across teachers included in the study, secondary analyses were conducted to explore possible explanations for this pattern. One explanation of this phenomenon was that teachers who were using this strategy more than their peers may have also had classrooms that contained students with higher severity of ADHD symptoms, a characteristic that was likely also associated with negative social outcomes over the course of the year. Thus, ADHD symptoms were correlated with use of *Reviewing Behavioral Expectations*. Results yielded a moderate, positive association between use of this strategy and a higher number of average hyperactive/impulsive symptoms in the classroom, as rated by the teacher ($r = 0.33$). Additionally, secondary exploratory analyses revealed that one teacher who was in the bottom tier of implementers for this strategy started out with very low value of positive relational ties in her classroom relative to other teachers, which may be contributing to this association.

Discussion

The goal of this study was to evaluate potential changes in the social networks of classrooms participating in a pilot investigation of the MOSAIC program, a teacher-implemented intervention designed to address social impairment of children with elevated ADHD symptoms. Results indicated that target students' change scores did not differ significantly from non-target students' change scores on any of the SNA metrics, but that the target sample across classrooms did see a marginally significant increase in in-degree and alter-based centrality over the course of the school year. With regard to evaluating change in classroom networks overall, there were no classrooms in which statistically significant change occurred for in-degree or out-degree centrality. For alter-based centrality, significant effects were found for 4 classrooms, 2 of which suggested improvement aligned with hypotheses and 2 that suggested deterioration. Lastly, correlational analyses with integrity revealed several relationships in the expected direction, with the exception of *Reviewing Behavioral Expectations*, which yielded results that indicated higher use of this strategy was negatively associated with change in network metrics. Overall results suggest that the first iteration of the school-based MOSAIC program, may not be sufficient to significantly shift social networks. However, given the pilot nature of the study, several trends may be worthy of exploration as a way to generate hypotheses for future program modification.

Target Student Effects

At the individual child level, no statistically significant difference between target and non-target students was found for any SNA metric. However, trends in support of hypotheses emerged for over 40% of classrooms for in-degree centrality, and over 50%

of classrooms for out-degree and alter-based centrality. Thus, potential factors that may have accounted for these patterns, such as classroom levels of ADHD symptom severity and use of MOSAIC practices (see Figure 2 in Appendix) were explored. Unfortunately, the patterns did not identify any such explanatory factors. Of note, exploratory analyses indicated that males included in the study in 11 of 12 classrooms were slightly overrepresented compared to the whole sample. Although MOSAIC classrooms did not see positive, significant change in peer relationships for target students, there was also very little negative change. It is possible that MOSAIC may have helped maintain the stability of peer relations, which is typical of interventions for elementary-aged students (e.g. Brendgen et al., 2001; Parke et al., 1997), but it is difficult to know without a control group comparison. Findings from this study suggest that there may be a protective effect for keeping target students at risk for social problems from worsening in social status, which studies have shown can occur on a longitudinal basis (Brendgen et al., 2001). Additionally, results of this study highlight that peer status and reputation may be difficult to shift in the span of one school year (Taylor et al., 1994). It is possible that the analytic strategy used in Aim 1 and a limitation in study methodology rendered it difficult to detect group differences. Namely, a dyadic tie between actors in a network serves as the unit of the analysis and these observations are not independent of each other (Wasserman & Faust, 1994; Van Duijn & Vermunt, 2006). Consequently, the development of a relational tie between a target student and a non-target student would increase the centrality of both actors, thus washing out any differential effect between groups.

With regard to study methodology, although teachers were instructed to deliver

higher doses of MOSAIC strategies to target students, differential dosage was not measured, so it may be that targets did not receive a higher dose of the intervention relative to their peers. Of note, this study methodology was recently rectified in the context of a randomized clinical trial, and still there was a lack of a significant main effect of the MOSAIC program as compared to typical practice on peer sociometrics (Mikami et al., under review). Results also revealed that target students in MOSAIC classrooms may have experienced negative effects in terms of peer sociometrics relative to target students in control classrooms. Collectively, this suggests that MOSAIC strategies may be insufficient to positively impact the peer reputation of students at risk for ADHD who also experience social impairment. Perhaps strategies that more directly impact peer relationships (rather than indirectly via an 'invisible hand') are warranted.

Whole Class Effects

Results indicated that there were no significant changes over the course of the year for average in-degree centrality and average out-degree centrality in each classroom. However, results for average alter-based centrality scores were mixed. In two classrooms, there was significant positive change in positive nomination networks by the end of the year, suggesting that students in these classrooms and their connected peers became more well-connected either by developing more relational ties or by becoming connected to more highly-connected peers. Patterns in teacher strategy use were explored to attempt to identify strategies that may have been associated with positive change in these two classrooms. For example, in support of study hypotheses, the teacher in Classroom H had the highest use of *Highlighting Positive Attributes*; however, her scores for most other strategies were lower than other teachers. Similarly, the teacher in Classroom I had the

highest use of *CARE Time* relative to her peers included in the study but was in the lowest tier of implementers for several other MOSAIC strategies.

I also examined strategy use patterns for the teachers in the two classrooms that experienced significant negative change. Both teachers with negative change were the lowest implementers of *Facilitating Connections Between Children*. In support of the theory behind these strategies, limited use of directly pointing out connections between students may also have contributed to loss of relational ties over the course of the school year. However, Teachers H and I were also in the lower 50% of implementers for this strategy. Taken together, findings indicate that while alter-based centrality may change in classrooms over the course of the year, no MOSAIC strategy can explain what facilitates greater or lesser connectedness in classroom networks. It may be that more direct teacher strategies are needed to shift social dynamics. For instance, one study that evaluated teachers' physical room arrangement of their students yielded promising results for ability to improve social dynamics in the classroom, such that seating students that disliked each other together at the beginning of the year increased likeability ratings and decreased peer-reported victimization compared to control classrooms over the course of the school year (van den Berg et al,. 2011). Encouraging social change in the classroom through direct strategies such as manipulating seating arrangements may be more effective than using indirect strategies that leverage teacher's position as the "invisible hand" in the classroom.

Finally, the density analyses (see Table 6) revealed a marginally significant 2% increase in relational ties in negative nominations networks over the course of the year. This is contradictory to study hypotheses. Examination of the fall (baseline status) of the

classrooms in this study may help to explain this finding. Namely, the average density for positive networks in classrooms tended to be higher on average than several other studies of classroom density (e.g. Ahn et al., 2010; Ahn & Rodkin, 2014; Gest &Rodkin, 2011; Jackson et al., 2015). This may have resulted in a ceiling effect that prevented detection of any incremental benefit that MOSAIC may have had on social outcomes of the whole class over the course of the school year. There are fewer studies that examine measures of disliking, but Gest & Rodkin (2011) found that the average density for negative nominations networks in their study that was also notably higher ($M = 0.22$) than that of classrooms included in this study. The low number of negative nominations in MOSAIC classrooms in the fall may have created a floor effect, making change harder to detect.

Teacher Integrity Associated with SNA Metrics

There were several moderate associations between teacher integrity to use of strategies and social outcomes that align with study hypotheses. First, greater use of *Highlighting Positive Attributes* was moderately associated with increases in average in-degree centrality and density in positive networks (r's > 0.40). In addition, greater use of *Facilitating Connections Between Children* was associated with decreases in in-degree centrality in negative nominations networks, suggesting that pointing out commonalities may be important to protecting against the development of negative relational ties in the classroom ($r = -0.46$). Minutes spent in *CARE Time* with students was associated with a decrease density of ties in negative nomination networks, as was higher use of *Facilitating Connections Between Children* ($-0.50 < r$'s < -0.40). Findings with regard to teacher integrity indicate that strategies to increase the social value of students who struggle with social impairment may be the most useful for shifting social change in a

positive direction in a classroom context, as it reduces the impact of a stigmatizing reputation that contributes to lower social value by communicating the opposite to peers. This supports the notion that addressing peer perceptions may be necessary, given that change in children's behaviors is insufficient to shift social stigma (Milich & McAninch, 1992).

For strategies intended to establish group norms, like *Reviewing Expectations for Behavior* and *Reviewing Expectations for Inclusiveness*, results of integrity analyses revealed findings that contradict study hypotheses. Specifically, *Reviewing Expectations for Inclusiveness* was moderately associated with greater in-degree centrality and density in negative nominations networks. Greater use of *Reviewing Behavioral Expectations* was associated with decreases in average in-degree centrality (*r*'s = -0.63), density (*r*'s > -0.66), and alter-based centrality (*r* = -0.51). Results with regard to reviewing expectations in general suggest that establishing those expectations may be helpful for shaping behavior, in accordance with behavior theory (Skinner, 1988), but reviewing them too often may be harmful to peer relations in the classroom. It may be that children are apt to figure out that reviewing expectations may be intended for children who exhibit deviant behavior, or that reminders of expectations increases the salience of group norms that children with problem behaviors are more likely to violate. It may be important for teachers to use reminder prompts for behavioral expectations in a more discreet, or targeted manner for the students who need it most, however, these findings should be interpreted with caution, as it is possible that classrooms with more disruptive behavior overall may lead to more review of rules; it is difficult to determine in this study, given the sample size.

Limitations

Given the small sample (N = 12) of teachers and the lack of control group, results from this study should be interpreted with caution. These limitations inhibit the ability to derive causal relationships between variables of interest, and the lack of control condition does not allow for determining whether MOSAIC practices differ meaningfully from typical teacher practices. With regard to delivery of the intervention to target students, study developers did not measure whether target students received a higher dose of the intervention relative to non-target students. Additionally, target students in this study were selected based on elevated teacher ratings of ADHD symptoms and perceived peer rejections; however, other exclusionary criteria were not applied. Thus, target students may have meet criteria for other disorders (e.g. autism) that are characterized by social difficulties, and their social impairment may be even more difficult to shift using strategies from this intervention. Further, the findings may have been impacted in unknown ways by characteristics of the consented sample relative to characteristics of the actual classroom (e.g., boys are slightly overrepresented in the consented sample) or by other factors not assessed (e.g., duration of friendships in each classroom; classroom consent rates, teacher attitudes, school district differences across sites). Finally, although observations were conducted weekly and there was a reasonable correlation with self-report, 45 minutes on a weekly basis may not have been an adequate amount of time to adequately capture integrity in the class for all strategies, thus weakening the ability to detect relationships between use and social outcomes.

Future Directions and Implications

This pilot study of the MOSAIC intervention revealed that classrooms in the

study saw some improvement in social outcomes for target students from fall to spring and some degree of maintenance. Additionally, there were many trends in support of study hypotheses that provide support for further evaluating the effects of this intervention. Future analyses of the effects of MOSAIC on classroom social functioning, especially analyses of the results from the RCT in which MOSAIC was compared to teacher-as-usual condition (Mikami et al, under review), should include evaluation outcomes at the level of the social network. It is possible that analyzing the social structure of the classroom may provide context for the emerging results.

Results yielded moderate associations between teacher integrity and social outcomes. In this study, findings indicated that use of strategies specifically focused on increasing the social value of an individual may be most promising for assisting students. However, outcomes of the first RCT of MOSAIC indicate that leveraging the teacher as the invisible hand may not be enough to shift peer perceptions of students who deviate from the norm behaviorally and who are already disliked by their peers (Mikami et al., under review). Thus, exploring intervention strategies in the classroom to facilitate a positive classroom community that more directly addresses peer group influences may be necessary.

Findings for alter-based centrality were mixed, but indicated some statistically significant change in networks over the course of the school year; this metric, however, does not account for the fact that a connection to one person may not be “equal” to another connection (Jackson et al., 2015). Thus, conducting further analyses wherein relational ties are weighted by a particular value based on peer ratings of individuals may provide further insight into the enhancing development of new connections or leveraging

established connections in the classroom to reduce perceived social impairment. Other SNA metrics (i.e. reciprocity) may provide alternative information about the social structure of the classroom but were not best suited to answer the research questions asked in this particular study.

Conclusions

Findings of this pilot study revealed that, contrary to hypotheses, there were no differences between target students with elevated ADHD symptoms and risk for social impairment and their typically-developing peers. Additionally, no clear pattern emerged with regard to change in social functioning within classroom networks over the course of year-long implementation of the MOSAIC program, and exploratory analyses did not reveal any particular strategies that emerged as explanation for mixed results. These findings confirm that social impairment is very difficult to shift, and that leveraging the teacher as an "invisible hand" to facilitate positive change in social functioning may be insufficient; this may inform future program development, in that more direct strategies that target peer relationships may be necessary to impact social impairment associated with ADHD symptoms. There may be some utility in using a teacher-implemented social intervention to improve or maintain social functioning for children at risk for ADHD, and specifically in evaluating their social functioning through a contextual lens using social network analysis. Further evaluation is needed to develop effective social interventions and further understand what intervention mechanisms or components are key to facilitating positive social outcomes for children at risk for ADHD.

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Appendix A: MOSAIC Intervention Description

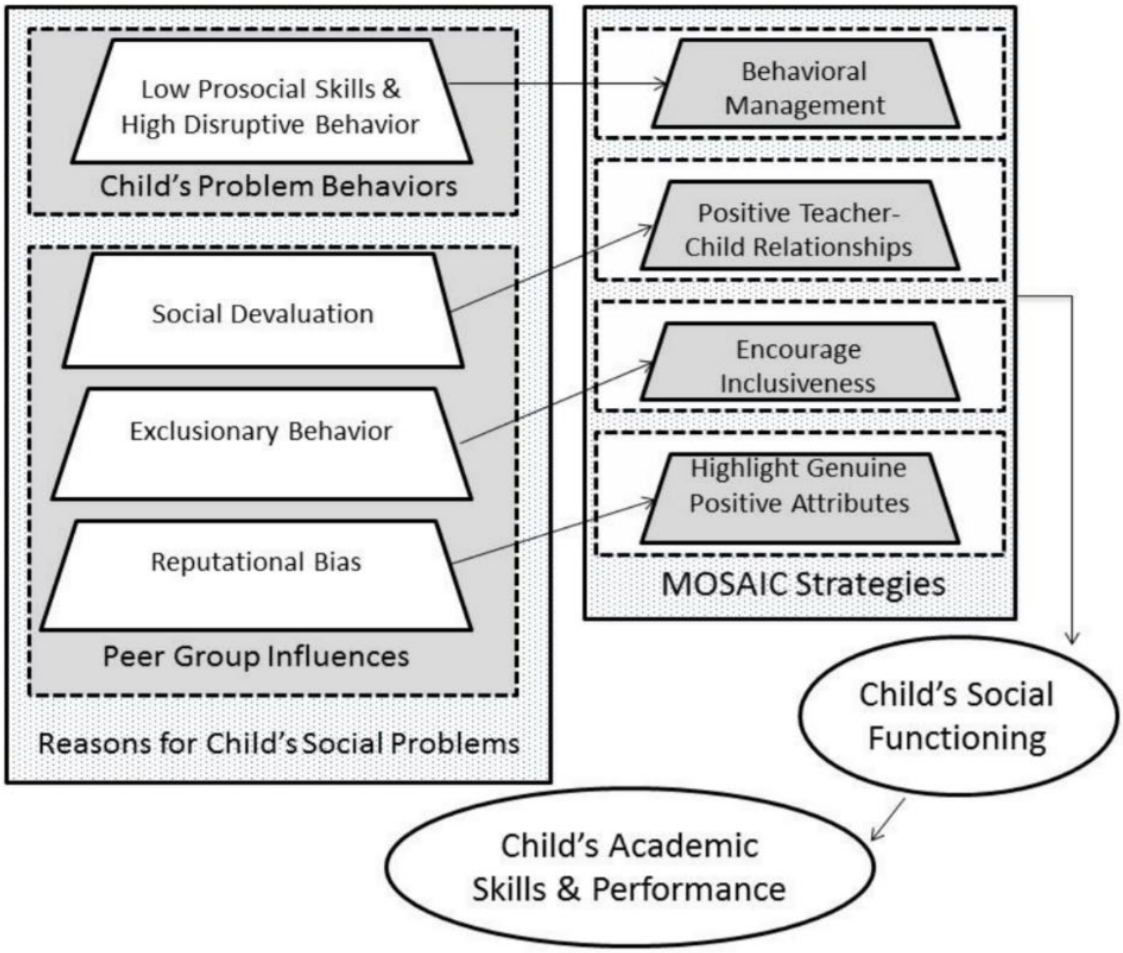
(From MOSAIC Teacher Manual and MOSAIC Integrity Manual for Teacher Consultants,

2017-2018 Versions)

The model below is a pictorial representation of the various components of the MOSAIC intervention. Most social skills interventions for children with behavioral problems attempt to improve social skill and disruptive behaviors via behavioral management strategies. However, the authors of MOSAIC propose that the difficulty in improving peer relationships occurs because behavior change in the disliked child is *a necessary, but not sufficient*, condition to result in peers' acceptance. The authors hypothesize that there are three peer group influences that, if addressed along with child behavior deficiencies, may improve children's social and academic functioning (see Figure 1). Thus, the innovation of MOSAIC is that addressing other social factors *in addition to* behavior management will improve social functioning. More specifically, the fostering of a positive teacher-child relationship to improve social devaluation, encouragement of inclusiveness by the teacher to reduce exclusionary behavior among students, and the emphasis of a child's strengths to reduce reputation bias against the child are three major components of MOSAIC that are hypothesized to positively impact social functioning, and by extension, improve academic functioning. Strategies to address each of the components of the theoretical model for MOSAIC are introduced to teachers for implementation over the course of the school year in three phases: **A**chieving a Welcoming Foundation, **R**einforcing Relationships, and **T**aking it Further.

Figure A 1

Theoretical Model of the MOSAIC Intervention



Appendix B: Description of MOSAIC Strategies

(From MOSAIC Teacher Manual, 2017-2018 Version)

Phase A: Achieving a Welcoming Foundation (first 4 to 6 weeks of school)

Greetings

The teacher individually greets a child, displaying warmth and/or indicating that the teacher personally likes that child and wants to make a connection with that child.

Personal Check-Ins

An interaction lasting less than 1 minute where the teacher shows interest in the child as a person in an individualized manner, to help the child feel special.

Classroom Charter with Expectations for Inclusiveness

A shared code of conduct among students and the teacher that describes how students should act (e.g., put away materials in the morning; work quietly during silent reading time) that includes the classroom values for inclusiveness.

Reviewing and Reinforcing Behavioral Expectations to Increase Positive Behavior

Prior to an activity, the teacher reviews the specific behaviors that the teacher wants to see during the activity (e.g., paying attention, following directions, being respectful and inclusive of peers). During the activity, the teacher reinforces the behaviors by pointing out children who are displaying the positive behaviors.

Question of the Day

Teacher poses a question with multiple choice responses and uses children's responses to point out commonalities between peers.

Community Circle

A formalized, regular routine in your classroom that provides a place for children to build

community.

Physical Room Arrangement Supporting Positive Relationships

A physical room arrangement that provides a framework for positive and inclusive relationships to build.

Phase R: Reinforcing Relationships (next 2 to 3 months of school)

CARE Time

A one-on-one teacher-student interaction that is separate from academics and lasts for about 5 minutes. The interaction is Child centered, Affirming, Reflecting the child's words and behavior, and a time to Enjoy getting to know the child better (CARE).

Highlighting Positive Personal Attributes in Children

Genuinely calling attention to a child's positive personal qualities that are unrelated to behavioral compliance or academic ability.

Addressing Negative Student Behavior

When a student is misbehaving, the teacher first determines if the behavior is minor enough to be ignored. If not, the teacher corrects it by stating the behavior the teacher wants to see instead, while maintaining a positive teacher-student relationship, and if possible doing so in a discreet interaction with the student (e.g., lowered tone of voice, pulling child aside, using a secret signal).

Handling Exclusionary Behavior

Teacher makes a point to notice exclusionary behavior and then intervenes to stop it when it happens.

Teacher Empathy for Children

Expressing genuine feelings of empathy when children are having difficulty by labelling

the emotion and communicating understanding and compassion, before correcting behavior.

Teacher as Human

Sharing age-appropriate examples with children about the teacher's personal life (e.g., hobbies, food, family, friends, or pets) or experiences (including negative emotions or mistakes).

Student Choice about Activities

Teacher gives students a meaningful choice about where or how they wish to work, or lets students personalize an assignment by choosing a topic of interest.

Recognition Round-up

The teacher can find a formal time to give recognitions to designated children that highlight personal, well-chosen, genuine positive qualities in each child. This could include, for example, an awards ceremony or public acknowledgement during circle time.

Ignoring Minor Misbehavior

The point of the current strategy is to help the teacher decide which of these behaviors can be ignored or addressed through other means, versus which need to be corrected. The idea is that if the teacher can ignore some minor misbehaviors, this will also reduce teacher time/stress and preserve relationships because the teacher does not need to issue a correction.

Discreet Corrective Feedback

In order to reduce the likelihood that peers will develop a negative impression of the child as a result (while continuing to correct the child's behavior), when possible, the teacher should try to correct behavior in a discreet manner that is more of a private

interaction between the teacher and the student, and less of a reprimand in front of the rest of the class.

Maintaining a Positive Teacher-Student Relationship when Correcting Behavior

Regardless of whether behavioral corrections are delivered discreetly or publically, it is essential for the teacher to manage his or her own frustration and irritation when delivering the correction, and to stay positively connected with the child.

Phase T: Taking it Further (second half of the school year)

Connections between Children

Pointing out commonalities between children that ideally are heard by all children involved.

Facilitating Peer Compliments

Helping children to identify positive personal qualities in classmates and to communicate what they have noticed to each other.

Taking a Break

Giving a student a few minutes of time to sit in a designated, comfortable space when the student needs time away from the group to calm down.

Encouraging Collaboration

Setting up activities including a structure where everyone has a job, where teachers set behavioral expectations for and reinforce inclusionary behavior, so children are encouraged to collaborate successfully.

Addressing Fights between Children

When children have interpersonal disagreements, the teacher makes active efforts to help them repair the relationship.

Teaching Social Skills

Teacher provides explicit instruction and practice on particular social skills needed by the class.

Appendix C: Reliability of MOSAIC Observation System

Each observation period lasted for 40 minutes, divided into five, 8-minute blocks within this time. This time period was chosen to render the data comparable to that obtained in the summer program pilot of MOSAIC (Mikami et al., 2013a), and to align with the duration of elementary class periods in several of our buildings (which allowed us to observe instruction, as well as transitions to and from an activity, which is important because many MOSAIC strategies can occur during transitions).

An average of 39.8% of observation periods were completed by the consultant assigned to the teacher whereas the remaining periods were completed by independent observers (e.g., other study staff members who were not the consultants). We found no significant differences in the rates of practices observed by the consultant relative to independent observers. In addition, 30.2% of observation periods were conducted by two observers (60.4% of these were by the consultant and an independent observer, while the remaining 39.6% were by two independent observers). We calculated inter-rater reliability during the double-coded observations using inter-class correlation (ICC) coefficients. Conventions for interpreting ICC for inter-rater reliability are: < .40 = poor, .40-.59 = fair, .60-.74 = good, > .75 = excellent (Cicchetti, 1994).

Reference from:

Mikami, A. Y., Owens, J. S., Hudec, K., Kassab, H., & Evans, S. W. (in press). Classroom Strategies Designed to Reduce Child Problem Behavior and Increase Peer Inclusiveness: Does Teacher Use Predict Students' Sociometric Ratings? *School Mental Health.*

Appendix D: Auxiliary Tables and Figures for Reference

Table D 1

Formulas for Social Network Analysis

Metric	Purpose	Formula or Notation	Variables
Alter-based Centrality[1]	Connectedness of Node or Actor (Student) *and* Relevant Ties (Peer)	$\frac{\sum(\mathrm{R}ij \text{ x } \mathrm{DC}j)}{maxAC}$	R*ij* represents the presence of a relational tie between node *i* and node *j*; DC*j* represents the degree centrality of node *j*; the denominator refers to the maximum alter-based centrality score in the classroom
Degree Centrality[2]	Node or Activity Activity (Out-degree) and Popularity (In-degree)	$\frac{\sum_{\ j} x_{ij}}{(n-1)}$	X_{ij} represents a relational tie between actor node *i* and node *j*; (n-1) represents the number of alters, or nodes connected to the focal node of the network; Degree of node *i* (focal student) relative to *j* (peer) is

			represented in two ways:
			For out-degree, the number of ties directed away from node *i*
			For in-degree, the number of ties directed towards node *i*
Density[2]	Network Activity	$\frac{L}{n(n-1)}$	*L* represents the number of edges or ties present; *n* represents the number of nodes or actors in the network, so *n*(*n*-1) represents the total number of possible ties

Note. The terms "node" and "actor" can be used interchangeably as can the terms "edge" and "tie." Graph theory is the origin for "node" and "edge," while "actor" and "tie" are more commonly used in social network terminology (Robins, 2015).
[1]Jackson, Cappella, & Neal, 2015
[2]Robins, 2015

Table D 2

Chi Square Tests of Categorical Variables for Comparison of Included versus Excluded Student Participants

Variable of Interest	χ^2	*df*	*p*-value
Gender	0.72	2	0.70
Grade	5.49	4	0.24
Race	1.43	5	0.92
Ethnicity	0.89	3	0.83

Table D 3

Independent Samples T-Tests of Quantitative Variables for Comparison of Included versus Excluded Student Participants

Variable of Interest	Included M (*SD*)	Excluded M (*SD*)	*t*	*df*	*p*-value
Age	6.56 (*1.49*)	6.91 (*1.44*)	-1.08	190	0.30
ADHD Symptoms					
Inattention Symptoms	7.95 (*7.10*)	8.74 (*6.95*)	-0.50	190	0.62
Hyperactive/Impulsive Symptoms	4.64 (*5.95*)	6.57 (*8.33*)	-1.38	190	0.17
Dishion Social Acceptance Ratings					
Teacher-Rated Percent Liked	75.88 (*21,72*)	69.26 (*25.93*)	1.34	190	0.18
Teacher-Rated Percent Disliked	6.42 (*11.72*)	8.26 (*11.74*)	-0.71	190	0.48
Teacher-Rated Percent Ignored	17.70 (*16.92*)	22.48 (*19.95*)	-1.24	190	0.22
Sociometric Nominations					
Proportion of Positive Nominations Received (Fall)	0.32 (*0.21*)	0.31 (*0.16*)	0.23	182	0.82
Proportion of Negative Nominations Received (Fall)	0.16 (*0.16*)	0.12 (*0.14*)	1.08	182	0.28

Table D 4

Class Demographics

Teacher	Grade	Total Students	Total Study Participants	% Male (Total Students)	% Male (Study Participants)	Age	Teacher-Rated Inattention	Teacher-Rated Hyperactivity
A	K/1	20	17	40.0	35.3	5.1	5.2	5.0
B	K/1	20	11	30.0	54.5	5.1	5.7	3.6
C	2/3	22	15	45.5	66.7	7.2	7.8	4.1
D	1	18	13	55.6	61.5	5.8	7.0	4.9
E	1	20	17	55.0	64.7	5.8	7.1	10.0
F	1/2	20	17	40.0	47.1	6.3	8.5	5.0
G	4	28	20	32.1	40.0	9.5	3.3	2.3
H	3	23	10	30.4	50.0	7.4	8.5	3.4
I	1	27	15	33.3	60.0	6.4	7.0	6.0
J	2	16	9	56.3	88.9	7.1	6.7	4.5
K	1	20	8	20.0	25.0	6.3	6.8	3.7
L	1	22	19	54.5	57.9	6.2	8.2	8.9

Table D 5

Descriptive Statistics for Target Student Sociometrics

Class	Target Student Sample			
	Fall Positive Nominations M (*SD*)	Fall Negative Nominations M (*SD*)	Spring Positive Nominations M (*SD*)	Spring Negative Nominations M (*SD*)
A	0.27 (*0.08*)	0.28 (*0.12*)	0.37 (*0.07*)	0.21 (*0.10*)
B	0.29 (*0.17*)	0.28 (*0.31*)	0.12 (*0.05*)	0.40 (*0.20*)
C	0.18 (*0.17*)	0.26 (*0.33*)	0.25 (*0.08*)	0.20 (*0.18*)
D	0.23 (*0.09*)	0.35 (*0.14*)	0.19 (*0.10*)	0.21 (*0.18*)
E	0.22 (*0.23*)	0.17 (*0.13*)	0.20 (*0.13*)	0.20 (*0.13*)
F	0.14 (*0.08*)	0.20 (*0.16*)	0.28 (*0.13*)	0.25 (*0.28*)
G	0.25 (*0.10*)	0.15 (*0.10*)	0.25 (*0.06*)	0.14 (*0.13*)
H	0.05 (*0.07*)	0.20 (*0.14*)	0.28 (*0.24*)	0.28 (*0.24*)
I	0.25 (*0.19*)	0.29 (*0.15*)	0.46 (*0.15*)	0.23 (*0.15*)
J	0.21 (*0.07*)	0.08 (*0.07*)	0.33 (*0.14*)	0.17 (*0.07*)
K	0.40 (*0.40*)	0 (*0.00*)	0.33 (*0.33*)	0 (*0.00*)
L	0.18 (*0.03*)	0.25 (*0.11*)	0.14 (*0.12*)	0.32 (*0.21*)

Table D 6

Descriptive Statistics for Whole Class Student Sociometrics

Class	Whole Class Sample			
	Fall Positive Nominations M (*SD*)	Fall Negative Nominations M (*SD*)	Spring Positive Nominations M (*SD*)	Spring Negative Nominations M (*SD*)
A	0.28 (*0.09*)	0.17 (*0.13*)	0.32 (*0.10*)	0.17 (*0.12*)
B	0.45 (*0.16*)	0.10 (*0.18*)	0.36 (*0.18*)	0.25 (*0.16*)
C	0.33 (*0.16*)	0.10 (*0.20*)	0.34 (*0.13*)	0.11 (*0.14*)
D	0.31 (*0.11*)	0.18 (*0.16*)	0.26 (*0.10*)	0.18 (*0.13*)
E	0.32 (*0.16*)	0.10 (*0.13*)	0.31 (*0.16*)	0.13 (*0.15*)
F	0.27 (*0.17*)	0.11 (*0.12*)	0.32 (*0.14*)	0.15 (*0.19*)
G	0.23 (*0.06*)	0.09 (*0.07*)	0.21 (*0.09*)	0.10 (*0.12*)
H	0.21 (*0.14*)	0.12 (*0.14*)	0.32 (*0.10*)	0.10 (*0.14*)
I	0.29 (*0.14*)	0.19 (*0.13*)	0.40 (*0.14*)	0.23 (*0.18*)
J	0.35 (*0.21*)	0.14 (*0.20*)	0.36 (*0.16*)	0.14 (*0.13*)
K	0.50 (*0.11*)	0.01 (*0.04*)	0.37 (*0.17*)	0.03 (*0.05*)
L	0.36 (*0.17*)	0.10 (*0.13*)	0.31 (*0.15*)	0.11 (*0.18*)

Table D 7

Probes (Self-Report of MOSAIC Strategy Use) Distribution Schedule for the 2017-2018 School Year

Probe	Consultation Session						
	A2-A5	R1	R2-R4	R5	T1	T2-T4	T5
A Tracker	**X**	**X**		**X**			
R Tracker			**X**		**X**		**X**
T Tracker						**X**	

Note. The Strategy Tracker column delineates which phase of strategies (i.e. **A**chieving a Welcoming Foundation, **R**einforcing Relationships, and **T**aking it Further) were administered to teachers following each consultation session.

Table D 8

Teacher Integrity by MOSAIC Strategy of Interest

Strategy	Teacher Self-Reported Use M (*SD*)	Minimum Reported Use	Maximum Reported Use	Observed Use M (*SD*)	Minimum Observed Use	Maximum Observed Use	Inter-Observer Reliability	Correlation between Observation and Self-Report
Reviewing Expectations Inclusiveness	0.88 (*0.20*)	0.50	1	0.12 (*0.10*)	0.02	0.30	0.96	0.55
Reinforcing Expectations Inclusiveness	0.88 (*0.20*)	0.50	1	0.14 (*0.10*)	0.02	0.36	0.97	0.63*
Reviewing Behavioral Expectations	0.90 (*0.20*)	0.50	1	0.3 (*0.20*)	0.07	0.72	0.99	0.35
CARE Time Minutes	2.35 (*1.91*)	0	5	0.12 (*0.10*)	0	0.34	0.99	0.38
Highlighting Personal Attributes	--	0.50	1	0.08 (*0.10*)	0.01	0.30	0.86	0.74*
Discreet Feedback	0.90 (*0.22*)	0.25	1	0.49 (*0.39*)	0.04	1.49	0.99	0.22
Handling Exclusionary Behavior	0.66 (*0.29*)	0	1	0.01 (*0.01*)	0	0.03	0.96	0.11
Connections between Children	0.95 (*0.11*)	0.67	1	0.05 (*0.04*)	0.01	0.11	0.97	0.30

Table D 8 continued

Note: For Discreet Corrective Feedback and Handling Exclusionary Behavior, the correlation between observed use and teacher self-reported use was low (r's < 0.3). Consequently, the composite value was not utilized for correlational analyses. Instead, observed use of Discreet Corrective Feedback was utilized, as coders were able to capture a wide variability of use across classrooms for this strategy, and teacher self-reported use of Handling Exclusionary Behavior was utilized, as frequency of observed use of this strategy was very low.

Table D 9

Means of SNA Metrics for Target and Non-Target Students in Positive Classroom Networks

Class	Target Students					
	In-Degree Fall	In-Degree Spring	Out-Degree Fall	Out-Degree Spring	Alter-Based Fall	Alter-Based Spring
A	4.40	5.60	2.60	5.20	19.80	31.60
B	2.00	1.00	5.50	2.50	6.50	4.00
C	2.80	3.60	5.80	6.20	11.20	14.40
D	3.50	2.50	6.00	4.75	15.75	8.75
E	3.50	3.25	7.25	7.50	17.00	13.75
F	2.20	4.40	4.20	5.20	7.60	18.00
G	5.00	4.67	6.00	4.00	18.67	15.00
H	0.50	2.50	2.00	5.00	1.50	7.00
I	3.50	6.50	3.00	5.50	12.25	32.00
J	1.50	2.50	3.25	3.50	6.75	8.25
K	2.00	2.00	5.00	3.00	6.00	8.00
L	2.75	2.50	10.00	10.75	10.75	6.75
	Non-Target Students					
Class	In-Degree Fall	In-Degree Spring	Out-Degree Fall	Out-Degree Spring	Alter-Based Fall	Alter-Based Spring
A	5.00	5.31	5.69	5.46	23.23	29.46
B	4.75	3.88	3.88	3.50	18.63	12.50
C	5.70	5.50	4.20	4.20	26.70	26.40
D	4.60	3.80	3.60	2.90	18.90	13.70
E	5.38	5.46	4.23	4.15	25.23	28.62
F	5.17	5.42	4.33	5.08	23.75	26.75
G	4.35	3.76	4.18	3.88	20.35	16.53
H	2.38	3.00	2.00	2.38	4.88	10.25
I	4.27	5.27	4.45	5.64	17.00	25.73
J	3.60	3.20	2.20	2.40	8.20	10.00
K	3.43	2.43	3.00	2.29	11.57	6.57
L	6.93	6.53	5.00	4.33	37.27	30.33

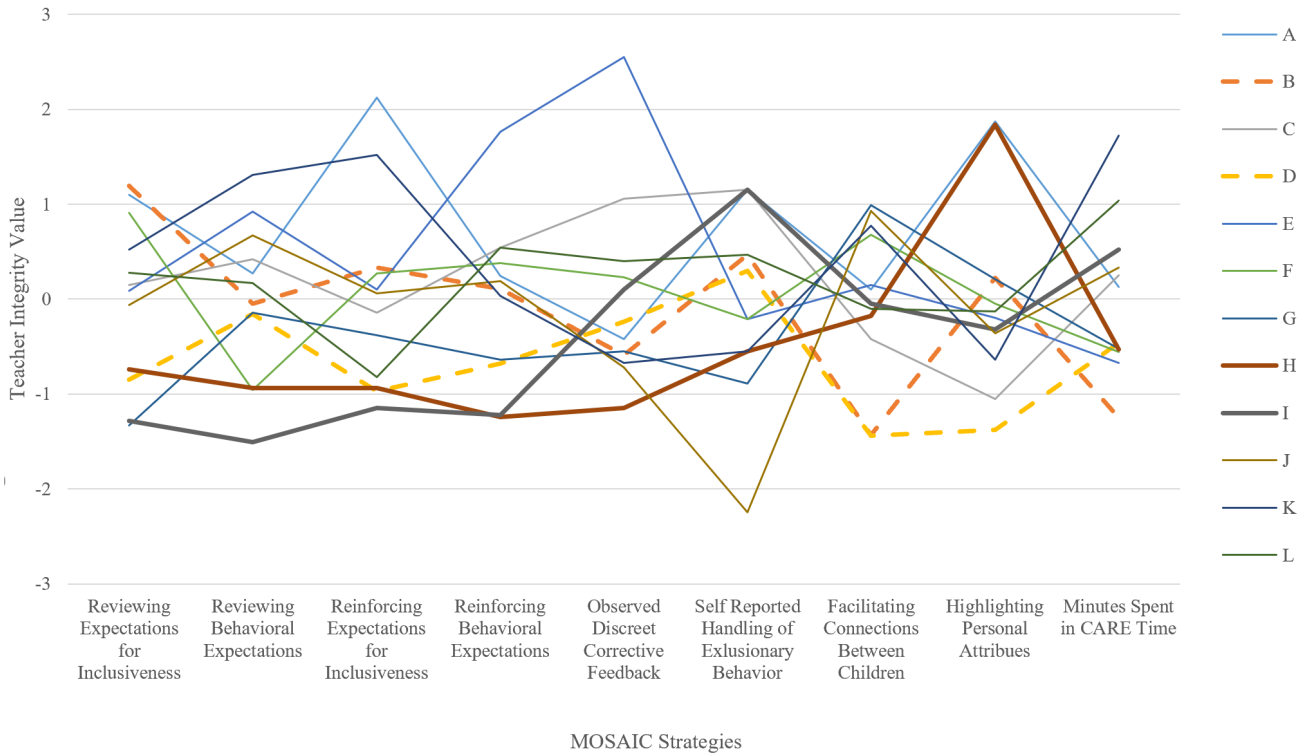
Table D 10

Means of SNA metrics for target and non-target students in negative classroom networks

Class	Target Students			
	In-Degree Fall	In-Degree Spring	Out-Degree Fall	Out-Degree Spring
A	4.20	3.40	2.20	2.20
B	2.50	4.00	1.50	3.00
C	3.60	3.00	1.60	1.60
D	4.75	2.75	2.25	1.25
E	2.75	3.25	1.75	2.00
F	3.20	4.00	0.80	1.00
G	5.00	4.67	2.33	1.33
H	1.50	2.50	1.00	0.50
I	4.00	3.25	2.75	3.25
J	1.75	1.75	1.00	0.50
K	0.00	0.00	0.00	1.00
L	4.50	5.75	2.50	1.25
Class	Non-Target Students			
	In-Degree Fall	In-Degree Spring	Out-Degree Fall	Out-Degree Spring
A	1.85	2.38	2.62	2.85
B	0.50	1.63	0.75	1.88
C	0.60	1.00	1.60	1.70
D	1.20	2.10	2.20	2.70
E	1.15	1.69	1.46	2.08
F	1.25	1.83	2.25	3.08
G	4.35	3.76	1.47	2.06
H	0.88	0.50	1.00	1.00
I	2.18	3.18	2.64	3.18
J	0.60	0.60	1.20	1.60
K	0.14	0.29	0.14	0.14
L	1.07	1.07	1.60	2.27

Figure D 1

Teacher Use of MOSAIC Strategies



Note. Use of MOSAIC Strategies by Teacher. A scatterplot of teacher use of different MOSAIC strategies of was created to examine patterns of use among teachers. Results yield no clear pattern of use among these teachers. Integrity values included in the plot are composite variables created based on observed and self-reported use, except for Discreet Corrective Feedback and Handling of Exclusionary Behavior (see Method for a description of why different integrity values were used for these strategies).

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