Published in final edited form as:

Soc Dev. 2011 May ; 20(2): 376–393. doi:10.1111/j.1467-9507.2010.00582.x.

Seeing Eye to Eye: Predicting Teacher-Student Agreement on Classroom Social Networks

Jennifer Watling Neal,

Department of Psychology, Michigan State University

Elise Cappella,

Department of Applied Psychology, New York University

Caroline Wagner, and

Department of Applied Psychology, New York University

Marc S. Atkins

Department of Psychiatry, University of Illinois at Chicago

Abstract

This study examines the association between classroom characteristics and teacher-student agreement in perceptions of students' classroom peer networks. Social network, peer nomination, and observational data were collected from a sample of second through fourth grade teachers (N=33) and students (N=669) in 33 classrooms across five high poverty urban schools. Results demonstrate that variation in teacher-student agreement on the structure of **students'** peer networks can be explained, in part, by developmental factors and classroom characteristics. Developmental increases in network density partially mediated the positive relationship between grade level and teacher-student agreement. Larger class sizes and higher levels of normative aggressive behavior resulted in lower levels of teacher-student agreement. Teachers' levels of classroom organization had mixed influences, with behavior management negatively predicting agreement, and productivity positively predicting agreement. These results underscore the importance of the classroom context in shaping teacher and student perceptions of peer networks.

Keywords

social networks; classrooms; teacher-student agreement; teacher practices

Elementary schools are important settings for the formation and maintenance of children's peer relationships, with nearly half of children's reported friendships occurring within the same classroom (George & Hartmann, 1996). Patterns of school-based friendships or affiliations (i.e., peer social networks) are important sources of socialization, providing opportunities for children to participate in shared play and negotiate social conflicts (Corsaro & Eder, 1990). Peer social networks also influence childhood and adolescent outcomes, including aggressive behavior (e.g., Cairns, Cairns, Neckerman, Gest, & Garipey, 1988; Kiesner, Poulin, & Nicotra, 2003; Neal, 2009), and academic outcomes (e.g., Kindermann, 2007; Ryan, 2001).

Given the influential nature of children's peer social networks, a growing body of literature has focused on two common school-based reporters' perceptions of these networks: students and teachers. Students are generally seen as "insiders" in the perception of peer relations (Cairns & Cairns, 1994; Gest, 2006; Hartup, 1996), with student self- and peer-reports used to assess peer networks (e.g., Bagwell, Coie, Terry, & Lochman, 2000; Cairns & Cairns, 1994). Peer report methods, such as social cognitive mapping (SCM) (Cairns & Cairns,

1994) and cognitive social structures (CSS) (Krackhardt, 1987; Neal, 2008), are particularly advantageous because they allow the collection of complete network data from only a subset of students in a class or grade, and are positively related to self-report (Neal, 2008, Rodkin & Ahn, 2009) and observational data (Gest, Farmer, Cairns, & Xie, 2003). Although teachers are regarded as “outsiders” in the perception of students’ peer relations (Hartup, 1996), they have regular opportunities to observe students in the classroom, which may make them privy to the structure of their students’ peer networks.

Examining the level of agreement between teacher and student perceptions of peer networks is an emerging area of research, with roots dating to the mid-twentieth century. Research on perceptions of students’ friendships (Gage, Leavitt, & Stone, 1955; Gest, 2006; Pittinsky & Carolan, 2008) and the identification of social groups (Gest, 2006; Pearl, Leung, Van Acker, Farmer, & Rodkin, 2007) has found weak to moderate agreement between teacher and peer reports of school-based peer networks, with teacher-student agreement varying between teachers (Gage et al., 1955; Gest, 2006) and within teachers over time (Pearl et al., 2007; Pittinsky & Carolan, 2008). To date, research on developmental and contextual characteristics that may account for this variability remains underdeveloped. Thus, as a primary goal, this paper extends the literature on teacher-student agreement on peer networks by examining whether student grade and classroom characteristics offer insight into why some teachers are more likely than others to agree with students in their perceptions of students’ peer networks.

Cross-informant reports present a dilemma for researchers interested in child development because they can result in different pictures of childhood behavior that are influenced by the unique vantage points of the reporters as well as measurement error (Achenbach, Kurkowski, Dumenci, & Ivanova, 2005; Achenbach, McConaughy, & Howell, 1987). Although reports from multiple informants are ideal because they allow researchers to triangulate across these unique vantage points, the collection of such data is not always practical, especially when assessing social networks (Gest, 2006). The current study is methodologically informative in addressing conditions that may foster or impede consistency between two main informants of students’ peer networks: peers and teachers. Results will help peer relations researchers assess the comparability of peer- and teacher-reported social networks developmentally in middle childhood and in varying classroom contexts.

In addition to advancing peer relations methodology, this research is critical for substantive advances in the understanding of children’s peer relations and classroom processes. Bullies and individuals who reinforce and assist in bullying behaviors tend to cluster in the same peer networks (e.g., Estell, Cairns, Farmer, & Cairns, 2002; Farmer & Cadwallader, 2000; Salmivalli, Huttunen, & Lagerspetz, 1997). Thus, teachers who are aware of the peer networks in their classroom are better situated to monitor how these networks support bullying behaviors and orchestrate changes in peer roles that constrain opportunities for bullying and facilitate positive social interactions (Farmer, 2000; Gage et al., 1955; Pearl et al., 2007). Furthermore, because participation in cooperative learning activities with friends is associated with positive motivational and academic outcomes (Azmitia & Montgomery, 1993; Hartup, 1996), teachers can capitalize on their knowledge of the classroom peer networks by assigning friends to the same groups (Pearl et al., 2007). Independent of their agreement with student perceptions, teacher perceptions of peer networks may have consequences in their own right for their expectations about student behavior and academic achievement (Pittinsky & Carolan, 2008), which can be powerful determinants of students’ school performance (see Weinstein, 2002). Given levels of student disengagement and social problems in high poverty urban communities (Cappella, Frazier, Atkins, Schoenwald, &

Glisson, 2008), understanding teacher perceptions in these school contexts may be particularly important.

Grade

Developmental differences in peer networks may influence opportunities to directly observe these relationships, resulting in variability in teacher-student agreement. Specifically, older children's networks tend to be more dense and stable than younger children's networks (Cairns, Leung, Buchanan, & Cairns, 1995; Putallaz & Wasserman, 1989). The increased density and stability of older children's networks may make it easier for teachers and students to identify peer network structures, leading to more agreement in higher grades. Similarly, in addition to physical activity (i.e., playground games or "rough-and tumble" play), conversation comprises an increasingly important role in building emotional and social connections among peers as children grow older (Rubin, Chen, Coplan, Buskirk, & Wojslawowicz, 2005). Because teachers can easily observe verbal communication in their classrooms, it is expected that higher-grade teachers would be more likely to view friendship connections among their students. Indeed, research suggests that as grade level increases, elementary school teachers and students demonstrate more agreement in terms of their appraisals of specific peer relationships and peer network structures (Gage et al., 1955; Gest, 2006).

Classroom Characteristics

In addition to developmental influences, classroom characteristics including size, normative behaviors, and organization likely play a role in the degree to which teachers and students concur in their reports of peer networks. Although an early study was unable to demonstrate a significant association between class size and teacher-student agreement on specific friendships (Gage et al., 1955), this is an area in need of more research. In large classrooms, both teachers and students keep track of more individuals, making it more difficult to assess all of the present relationships. Classroom size also influences teacher practices, with larger classrooms requiring more attention to procedural and disciplinary tasks and less time for attention to peer relationships (Bourke, 1986; Finn, Pannozzo, & Achilles, 2003). Additionally, reduced classroom sizes result in altered social processes between teachers and students, leading to increased teacher-student interactions and teacher knowledge of students' lives (Finn et al., 2003; Smith & Glass, 1980, Tseng & Seidman, 2007).

Classrooms vary with respect to their behavioral contexts, including levels of prosocial behavior and aggression (e.g., Henry et al., 2000; Stormshak et al., 1999). Classroom normative behaviors may have implications for agreement between teacher and student perceptions of classroom social networks. Teachers may be more aware of peer relationships in classrooms with high levels of prosocial behaviors, as these are the behaviors that are typically valued and reinforced by teachers (Coalition for Psychology in Schools and Education, 2006). Because prosocial behaviors are associated with friendships among children (Newcomb & Bagwell, 1995), these behaviors may also increase levels of network density, prompting more teacher-student agreement. In contrast, classrooms with high levels of aggression may obscure and destabilize social relationships due to increased conflict and shifting power (see Adler & Adler, 1995; Eder, 1985; Farmer & Xie, 2007). Thus, these behaviors may decrease levels of density, prompting less teacher-student agreement. To date, however, these proposed relationships remain unverified.

Classroom organization (or classroom management) encompasses the degree to which teachers are able to create settings that proactively manage student behavior, provide consistent routines and procedures, and foster active student engagement (Brophy, 1983; Doyle, 1986; Emmer & Stough, 2001; Hamre, Pianta, Mashburn, & Downer, 2007). Two

ways that classroom organization might influence teacher-student agreement involve how it shapes teachers' exposure to classroom peer relationships. Students in well-managed classrooms have limited "down time" (Brophy, 1983, p. 263), which may restrict opportunities for teachers to observe the more natural socialization that students observe in less structured school settings, thus reducing teacher-student agreement. However, it is also possible that high levels of classroom organization may free teachers from time-consuming tasks like disciplining students for misconduct and refocusing students on academic activities, affording them more opportunities to concentrate on other aspects of classroom process, such as peer relationships and social development. Well-organized classrooms may also result in more stable, established peer networks that are more easily discerned by both teachers and students. Currently, the nature of the relationship between classroom organization and teacher-student agreement remains an empirical question.

Aims and Hypotheses

Using social network and observational methodologies, the current study aims investigate the relationships between classroom characteristics and the level of teacher-student agreement on reports of second through fourth grade students' peer social networks in urban high poverty schools. We begin with descriptive analyses designed to demonstrate the extent of match between teacher and student perceptions of classroom peer networks. Consistent with past research (Gest, 2006; Pearl et al., 2007), we anticipate that levels of teacher-student agreement will be moderate on average and will vary considerably between classrooms.

Next, we examine the influence of grade, class size, classroom normative behaviors, and classroom organization on the agreement between teacher and peer reports of peer networks. Each of these classroom-level characteristics is expected to influence teacher-student agreement by shaping teachers' opportunities to observe peer relationships in their classrooms. Developmental differences in network features are expected to provide more opportunities for teachers to observe peer relationships as children grow older. Thus, teacher-student agreement is expected to increase with grade (Hypothesis 1). Increased classroom size is expected to make it more difficult for teachers' to keep track of peer relationships, leading to less teacher student-agreement in larger classrooms (Hypothesis 2). Normative prosocial behavior in the classroom is anticipated to increase opportunities for teachers to observe peer relationships, resulting in higher teacher student agreement (Hypothesis 3). In contrast, normative classroom aggression is anticipated to decrease opportunities for teachers to observe peer relationships resulting in lower teacher-student agreement (Hypothesis 4). Finally, classroom organization will be associated with teacher-student agreement (Hypothesis 5). Given the absence of literature in this area, the hypothesized direction of this effect is exploratory. Specifically, the direction could be (a) negative if high levels of classroom organization restrict opportunities for teachers to observe naturally-occurring peer interactions or (b) positive if high levels of classroom organization free teachers from disciplinary and managerial tasks, allowing them to focus more on their students' peer relationships.

We also explore the process by which grade and classroom normative behaviors influence teacher-student agreement by testing for the mediating effects of network density. We hypothesize that the positive relationship between grade and teacher-student agreement will be partially mediated by increased network density (Hypothesis 6). Likewise, we anticipate that increased network density will partially mediate the positive relationship between normative prosocial behavior and teacher-student agreement (Hypothesis 7). Finally, we expect that the negative relationship between normative aggressive behavior and teacher-student agreement will be partially mediated by decreased network density (Hypothesis 8).

Method

Setting and Participants

Five Chicago public elementary schools in high poverty communities served as the setting for the current study. These schools were participating in the baseline year of a longitudinal intervention trial to examine a school-based mental health model targeting learning among children with disruptive behavior problems (Atkins et al., 2008; Cappella, Frazier, et al., 2008). Schools were selected for participation in the trial based on the following criteria: 85% or more African American students, 85% or more low income students, average reading scores on statewide testing below the 35th percentile ($M = 27.9$, $SD = 3.8$), and school size within a standard deviation of the district mean ($M = 702$, $SD = 306$).

Data were collected on 669 second through fourth grade students and their 33 teachers. Nearly half of the students were female (49%), and the sample was split fairly evenly across second (30%), third (37%), and fourth grade (33%). Students were predominantly African American (99%) and eligible for free lunch (99%). Most teachers in the sample were female (85%) and identified as African American (46%) or White (42%). Teachers had a median of four years of teaching experience, with a minimum of a half year and a maximum of 37 years.

The current study consisted of two levels of research participation: primary and secondary. Primary participants served as respondents by completing research measures, and included all 33 teachers, and 418 students (62.5%) who received active parental consent and provided assent. Secondary participants did not serve as respondents in the study, but their names were included on the research measures. Secondary participants included 251 students (37.5%) who did not receive active parental consent. The use of secondary participants is necessary to accurately assess network data in settings where consent form return rates are low (Klov Dahl, 2005; Neal, 2008). In addition, similar sociometric procedures appear to pose only minimal risk in school-based settings (Bell-Dolan & Wessler, 1992). Therefore, the university research board and school district approved these procedures as following ethical guidelines.

Among students, primary participation rates in each classroom ranged from 45% to 92%. Primary participation rates were not significantly correlated with teacher-student agreement or classroom characteristics included in the analyses. In addition, Fisher's exact tests demonstrated no significant gender imbalances in primary participation.

Measures

Social networks—Cognitive social structures (CSS) were used to measure student and teacher perceptions of classroom peer networks (Krackhardt, 1987; Neal, 2008). Both student primary participants and teachers received a survey with a separate page for each student in the classroom. Each page included a roster listing all students in the classroom. Teachers and participating students were asked to circle the names of peers in their class that the designated child on the page “hangs out with often”. Unlike the more common social cognitive mapping technique (e.g., Cairns & Cairns, 1994), which asks respondents to report groups of individuals who are related, this technique allows for more fine-grained measurement of respondents' perceptions of the presence or absence of a relational tie between each dyad of students in their classrooms.

To assess students' perceptions, data from primary participants in each classroom were aggregated using the following procedures. First, “hanging out” relationships should conceptually be symmetrical. However, student respondents reported asymmetric relationships for an average of 19.51% of the dyads in their classrooms ($SD = 9.36$). To

account for these asymmetries, network data from each respondent was symmetrized by taking the average value of the reported relational tie from classmate i to j and from classmate j to i (Borgatti, Everett, & Freeman, 2002). This yielded a score of 1 for reciprocated reports of relationships and a score of .5 for asymmetric reports of relationships. Then, the symmetrized data from each respondent in the classroom were combined using consensus aggregation to create a classmate-by-classmate matrix, where each cell indicated the number of respondents who identified a “hanging out” tie between a pair of classmates (Krackhardt, 1987). Finally, a binomial test was used to dichotomize the aggregated matrix. This test determined how many respondents needed to report a relationship between a pair of classmates to exceed random chance ($p = .05$) given a set number of trials (i.e., the number of respondents in a classroom) and an underlying probability of success (i.e., the total number of relationships reported in a classroom across all respondents divided by the total possible number of relationships that could be reported across all respondents) (see Neal, 2008).

In order to compare individual teachers’ perceptions of the network to the aggregate student perception in their classrooms, it was necessary to ensure that each matrix was on the same binary, symmetric scale. Therefore, because each classroom had only a single teacher reporter and asymmetric reports likely represent errors of omission, a tie was recorded as present if a teacher reported either a relationship from classmate i to j , or a relationship from classmate j to i .

Grade and class size—Classroom rosters provided by school personnel were used to assess the grade and class size of each classroom.

Classroom normative behaviors—To assess classroom normative behaviors, student primary participants completed an orally administered peer nomination measure, where they were asked to circle the names of all classmates who fit particular behavioral descriptors. Primary participants were allowed unlimited nominations, and were provided with opportunities to self-nominate or circle “no one” for each descriptor. The current study focuses on descriptors from the *Children’s Social Behavior Scale- Peer Report* designed to measure prosocial behavior and aggression perpetration (Crick & Grotpeter, 1995). Prosocial behavior included three items (e.g., “Who says or does nice things for other classmates?”), and aggression perpetration consisted of five items, assessing both physical (e.g., “Who hits, kicks, or punches others at school?”) and verbal (e.g., “Who calls other classmates mean names?”) behaviors. Reliability analyses of prosocial items and aggression items with the current sample resulted in Cronbach’s alphas of .80 and .93 respectively.

For both prosocial and aggressive behavior, percentage scores were calculated for each classroom by tallying the number of nominations all children in the classroom received (excluding self-nominations) and dividing by the total number of possible nominations. Similar procedures have been used in prior studies designed to assess classroom normative behaviors (e.g., Chang, 2004; Kuppens, Grietens, Onghena, Michiels, & Subramanian, 2008).

Classroom organization—Classroom observations were conducted using the Classroom Assessment Scoring System designed to measure teacher-student interactions in pre-kindergarten through fifth grade classrooms (CLASS; Pianta, La Paro, & Hamre, 2008). This observational system is comprised of 10 dimensions scored on a 7-point scale ranging from 1 (low) to 7 (high) that map onto three domains: Emotional Support, Classroom Organization, and Instructional Support. For each dimension, observers used a detailed general description, a behaviorally anchored description of scale points, and a set of behavioral indicators to guide their scoring (see Mashburn et al., 2008).

Because the hypotheses in the current study focused explicitly on Classroom Organization, we focused our attention on the three dimensions that assess this domain: Behavior Management, Productivity, and Instructional Learning Formats (see Table 1 for a list of the behavioral indicators of each dimension). Although these dimensions are often combined to provide a single measure of Classroom Organization (Hamre et al., 2007), recent research suggests that they may have different implications for student networks and behavioral outcomes in urban schools (Cappella, Neal, & Atkins, 2008). Therefore, in the current study, the three dimensions were used as separate predictors of teacher-student agreement on classroom social networks. Each dimension was coded four times per teacher, and these four codes were averaged within teacher (Behavior Management $\alpha = .86$, Productivity $\alpha = .76$; Instructional Learning Formats $\alpha = .76$).

Procedure

Student and teacher surveys—Using classroom rosters provided by school personnel, researchers constructed a CSS survey instrument completed by students and teachers to measure their perceptions of the classroom social network and a peer nomination survey completed by students designed to measure classroom behavior. All primary student participants and teachers completed measures in Winter 2007. CSS and peer nomination surveys took approximately a half hour each to complete, and were group-administered to students in their classrooms during regular school hours. For both surveys, a research staff member provided oral instructions to students, and reviewed example items. During the administration, two to four additional undergraduate research assistants were present to answer students' questions, and aid those identified by teachers as struggling readers. Teachers completed the same CSS survey during the classroom administration. Students without parental consent were provided with age-appropriate word puzzles to complete. All primary student participants who were absent completed the surveys in small groups within two weeks of the original classroom administration. All students in the classroom, regardless of participation in the study, received a small prize valued at less than one dollar.

Classroom observations—Undergraduate and graduate research assistants conducted two-hour classroom observations of teachers and students during morning literacy instruction in late Fall 2006. Following procedures recommended by the CLASS developers, all observers were trained to reliability (Mashburn et al., 2008). Consistent with past assessments of reliability of the CLASS (Hamre, Mashburn, Pianta, Locasale-Crouch, & La Paro, 2006), the percentage of inter-rater agreement within one point across CLASS dimensions ranged from 74% to 90% when compared with videotaped gold standard codes during training, and with master coders in ongoing reliability checks during data collection. Observers sat in an area of the classroom with an unobstructed view, and provided codes for each CLASS dimension four times in twenty-minute intervals across the entire two-hour observation period.

Network density—We used the aggregated peer-report network to assess network density for each classroom because it triangulates across multiple respondents and is robust to measurement error. First, we obtained individual measures of network density by calculating the proportion of present to possible ties between each child's acquaintances in UCINET 6 (Borgatti et al., 2002). Here, isolates and members of isolated dyads received a density score of 0. Second, we obtained a classroom measure of density by averaging the individual measures of network density within classroom.

Results

Descriptive Analyses of Teacher-Student Agreement

To assess the level of agreement between individual teacher and aggregate student perceptions of the network, Jaccard similarity coefficients were calculated in UCINET 6 (Borgatti et al., 2002). This measure ranges from 0 to 1, and is measured by the following equation (Cheetham & Hazel, 1969, p. 1131; Jaccard, 1908):

$$Jaccard = \frac{n_{JK}}{n_{JK} + n_{jK} + n_{jK}} \quad (1)$$

In this equation, n_{JK} is equal to the number of relationships reported in both the individual teacher and aggregate student networks, n_{jK} is equal to the number of relationships reported only in the individual teacher's perception of the network, and n_{jK} is equal to the number of relationships reported only in the aggregate student perception of the network. Thus, the Jaccard similarity coefficient gives the proportion of agreement in the report of present relationships across teacher and aggregate student perceptions of the network. For example, a Jaccard similarity coefficient of .4 would suggest that of all relationships reported in either the teacher or student perception of the network, 40% are reported in both. Because the Jaccard similarity coefficient only measures agreement on the presence of relationships, there is no risk that high levels of agreement can be attributed to consensus on the absence of relationships. Quadratic assignment procedure (QAP) was used to determine whether each Jaccard similarity coefficient was significantly larger than expected by chance. QAP compares the observed Jaccard similarity coefficient to an average value obtained over a set of simulations (in this case, 10,000) where the rows and columns of the teacher and student network matrices are permuted randomly. Similar procedures have been used in past research on teacher and student perceptions of peer networks (Pittinsky & Carolan, 2008).

Jaccard similarity coefficients for the teacher and aggregate student networks were significant in 97% (32 of 33) of the classrooms in the sample, suggesting that teachers and students demonstrated above chance agreement on the presence of student associations. Consistent with expectations, on average, teachers and students displayed a moderate level of consensus with a mean overlap in present relationships of 40%. However, there was considerable variation in teacher-student agreement across classrooms, with Jaccard similarity coefficients ranging from .1 to .71. That is, the overlap between teacher and student perceptions of networks ranged from 10% to 71% (see Table 2).

Effects of Classroom Characteristics on Teacher-Student Agreement

Descriptive analyses revealed variation in class size, dimensions of classroom organization (i.e., behavior management, productivity, and use of instructional learning formats), and classroom normative behaviors (i.e., prosocial and aggressive behavior) across the 33 classrooms sampled (see Table 2). We used ordinary least squares regression to examine the influence of these classroom characteristics and grade on Jaccard similarity coefficients indicating agreement between teacher-reported and aggregate student networks. All predictors were entered in a single step. The equation for the final model is presented below:

$$\begin{aligned}
 Y_{\text{Jaccard}} = & \alpha + \beta_1(\text{Grade}) \\
 & + \beta_2(\text{Class_Size}) \\
 & + \beta_3(\text{Behavior_Management}) \\
 & + \beta_4(\text{Productivity}) \\
 & + \beta_5(\text{Instructional_Learning_Formats}) \\
 & + \beta_6(\text{Prosocial_Behavior}) \\
 & + \beta_7(\text{Aggressive_Behavior}) + e
 \end{aligned}
 \tag{2}$$

Results demonstrated that classroom characteristics explain 67% of the variance in teacher-student agreement on the presence of relationships in the classroom network (see Table 3).

Consistent with Hypothesis 1, findings revealed a significant positive relationship between grade and teacher-student agreement. For every one unit increase in grade, overlap between teacher and aggregate student reports of present relationships increased by 11 percentage points ($B = .11, p < .01$). Classroom size had a significant negative effect on teacher-student agreement, providing support for Hypothesis 2. For every additional child in the classroom, agreement between teachers and students on present relationships decreased by 1 percentage point ($B = -.01, p < .01$). Contrary to Hypothesis 3, classroom prosocial behavior did not significantly predict teacher-student agreement ($B = .37, p > .05$). However, in line with Hypothesis 4, classroom aggressive behavior was negatively associated with teacher-student agreement ($B = -.50, p < .05$). Finally, as suggested in Hypothesis 5, two dimensions of classroom organization, behavior management and productivity, were significantly related to teacher-student agreement. Figure 1 illustrates the predicted influence of behavior management and productivity on teacher-student agreement in the third grade when all other variables in the model are held at their mean. Behavior management was negatively related to teacher student agreement whereas productivity was positively related. Specifically, for every one unit increase in observed behavior management, there was a 6 percentage point decrease in overlap between teacher reported and aggregate student networks ($B = -.06, p < .05$). In contrast, for every one unit increase in observed productivity, there was an 8 percentage point increase in overlap between teacher reported and aggregate student networks ($B = .08, p < .05$).

Mediating Effects of Network Density on Teacher-Student Agreement

To test for the mediating effects of network density on teacher-student agreement, we used procedures outlined by Shrout and Bolger (2002) and Preacher and Hayes (2004). First, we estimated the effect of the predictor of interest (i.e., grade, normative prosocial behavior, or normative aggressive behavior) on network density, holding all other classroom characteristics constant (*a*). Second, we estimated the effect of network density on teacher-student agreement, holding the predictor of interest and all other classroom characteristics constant (*b*). Third, we calculated the indirect effect by multiplying *a* and *b*. Fourth, we used the *sgmediation* command in Stata 11 to estimate bias-corrected confidence intervals using a sampling distribution derived from 10,000 bootstrapped samples (StataCorp, 2009). The use of bootstrapping is recommended for testing indirect effects in small samples (Preacher & Hayes, 2004).

Supporting Hypothesis 6, tests for mediation demonstrated that grade predicted increased levels of network density ($B = .09, p = .05$), and network density predicted increased levels of teacher-student agreement ($B = .35, p < .01$). The indirect effect of network density on the relationship between grade and teacher-student agreement was significant ($B = .03$, Bias-

Corrected 95% CI: .002 to .076). Contrary to Hypotheses 7 and 8, tests for the mediating effects of network density were not significant for the relationship between normative prosocial behavior and teacher-student agreement ($B=.17$, Bias-Corrected 95% CI: $-.22$ to $.70$) and the relationship between normative aggressive behavior and teacher-student agreement ($B= -.19$, Bias-Corrected 95% CI: $-.62$ to $.09$).

Discussion

Building on past research (e.g., Gest, 2006; Pearl et al., 2007), the current study demonstrated variation in the degree to which teachers and students see eye to eye on the structure of classroom peer networks, and sought to explain this variation by examining associations between classroom characteristics and levels of teacher-student agreement. Here, teacher-student agreement, measured by Jaccard correlation coefficients, reflects consensus among teachers' and students' viewpoints of their classroom peer networks. Results revealed that classroom grade, size, normative behavior, and organization explain roughly two-thirds of the variation in the match between teacher and student perceptions of classroom peer networks, suggesting the importance of classroom contexts. In particular, classroom characteristics may shape opportunities for observing classroom peer relationships, thus enhancing or impeding the ability for teachers and students to develop a shared viewpoint of classroom peer networks.

Findings provided support for a developmental influence on teacher-student agreement, and inform our understanding of the processes that account for this influence. Consistent with prior research (Gage et al., 1955; Gest, 2006), teachers and students exhibited more agreement on peer networks as classroom grade increased. In addition, increases in classroom grade were associated with developmental increases in network density that made it easier for teachers and students alike to observe peer relationships, boosting teacher-student agreement. Methodologically, these findings suggest that teacher and student reports of peer networks are likely to become more compatible as children advance through middle childhood. However, more research with a larger age range is needed to see whether this developmental trend continues through early adolescence as students experience a developmental shift toward increased social differentiation and declines in network density (Neal, in press; Shrum & Cheek, 1987).

Analyses offer support for the hypothesis that smaller class sizes boost agreement by facilitating occasions for teachers and students to monitor peer relations. In contrast to the null findings of past research (Gage et al., 1955), this study found a negative relationship between classroom size and teacher-student agreement on peer networks. As classroom size decreased, teachers and students exhibited higher levels of agreement on the structure of classroom peer networks. Therefore, researchers should expect more similarity in reports of peer networks when classrooms are relatively small. In addition, to the extent that levels of agreement influence teachers' effectiveness in fostering a positive peer environment (Farmer, 2000; Gage et al., 1955; Pearl et al., 2007), this finding highlights another benefit to keeping classrooms small.

Results suggest that the association between classroom normative behavior and the teacher-student agreement on peer networks depends, in part, on the type of normative behavior under investigation. Normative *prosocial* behavior was unrelated to teacher-student agreement. In contrast, higher levels of normative *aggressive* behavior were related to lower levels of teacher-student agreement. These findings suggest that aggressive norms influence teacher student consensus in a way that prosocial norms may not. In particular, aggressive norms may be highly salient to teachers and students, and may impede opportunities to observe classroom peer affiliations by focusing teacher and student attention on antipathies.

Reversing the causal ordering, it is also possible that teacher-student consensus on peer networks provides teachers with the shared knowledge and opportunity to successfully reduce aggressive behaviors, but this does not translate to encouraging prosocial behaviors.

This study underscores how distinct aspects of classroom organization are differentially associated with teacher-student agreement on peer networks. Classrooms where teachers stressed proactive behavior management exhibited significantly lower levels of teacher-student agreement. Because these classrooms emphasize clear rules and the prompt redirection of misbehavior, they may restrict spontaneous opportunities for peers to socialize, thus limiting teachers' and students' abilities to observe peer relationships. Similarly, when teachers are focused on using preventive behavior management techniques in a clear and consistent way, it may leave them with less time and attention to focus on the unfolding classroom social relationships. In contrast, classrooms with high levels of productivity exhibited significantly higher levels of teacher-student agreement. Because these classrooms maximize learning time and routines, they tend to run smoothly. Therefore, teachers in these classrooms may be less preoccupied with disciplining and refocusing students, providing more freedom to closely observe peer relationships in the classroom. Finally, instructional learning formats did not significantly influence teacher-student agreement on peer networks. It may be that teacher ability to engage students in learning (the academic domain) is a separate competence that does not translate to the ability to observe student relationships (the social domain). Also, although teachers' use of instructional learning formats is statistically related to behavior management and productivity, the educational literature has maintained these as separate areas of competence (Brophy, 1983; Doyle, 1986). Thus, these findings imply that the three dimensions can have distinct relationships with certain classroom processes and should, in certain cases, be explored separately.

Features of the current study's sample and design present some limitations that should be addressed in future research. Because the study focused on setting-level questions (e.g., what classroom characteristics influence teacher-student agreement about peer networks?), setting-level analyses were necessary. Securing a sufficient sample size to conduct these types of analyses is difficult, especially in the case of network studies where data collection is highly resource intensive. The presence of significant results despite the small sample of classrooms is an encouraging indicator of the potential importance of classroom characteristics for teacher-student consensus on peer networks. However, the generalizability of present findings is constrained by the homogeneity of the classrooms, which were located in urban schools serving predominantly low-income, African American students. Although it is critical to conduct research on peer relations and classroom processes in contexts at risk for student academic and social problems, additional research is needed to generalize these findings to demographically and geographically diverse samples.

Another limitation of this study is the cross-sectional nature of the analyses. Although results indicate that certain classroom characteristics are associated with teacher-student agreement on peer networks, longitudinal research is needed to establish the direction of these relationships. As interpreted above, classroom characteristics may alter teachers' and students' opportunities to observe classroom peer relationships, leading to more or less agreement. However, it is also plausible that differences in teacher-student agreement lead to different teacher practices that, in turn, influence certain classroom characteristics (e.g., classroom norms and classroom organization). Longitudinal analyses would also allow for the distinction between grade or developmental effects and cohort effects in teacher-student agreement on peer social networks. Finally, longitudinal analyses would provide an opportunity to assess the stability of classroom peer relationships over time, allowing

researchers to formally test the theory that grade level increases in teacher-student agreement are partially mediated by increased stability in classroom peer relationships.

Despite these limitations, this study contributes to both the methodological and substantive literature on classroom peer relationships. Methodologically, this study extends the work of Gest (2006) by demonstrating that teachers vary in their agreement with peer reports of classroom affiliations, and identifying the classroom conditions under which researchers can be more confident that teacher and student reports will match. This may be especially critical for inferring comparability when researchers are only able to collect data from one type of informant. Substantively, this study advances the understanding of classroom characteristics that influence teachers' awareness of their students' social relationships in high poverty urban schools. Illuminating these characteristics is important given that they may enable teachers to create positive learning environments for students (Farmer, 2000; Gage et al., 1955; Pearl et al., 2007) as well as foster powerful teacher expectations about student behavior and achievement (Pittinsky & Carolan, 2008).

To conclude, not all classrooms are the same with respect to teacher-student agreement on peer networks. The current study adds to the existing literature by demonstrating how classroom characteristics, including size, norms, and organization, explain variation in teacher-student agreement. Results underscore the need to consider the role of the classroom context in shaping teacher and student perceptions of peer social networks, providing important implications for sociometric methods, and teacher effectiveness and expectations. Future research that generalizes these findings to other populations and adopts a longitudinal perspective will further enhance our understanding of why some teachers are more likely than others to see eye to eye with their students.

Acknowledgments

This research was conducted within the context of a larger NIMH intervention study (PI: Atkins, R01 MH073749), and has been approved by the University of Illinois at Chicago's Institutional Review Board (Research Protocol #2005-0133). We would like to thank Zachary Neal and the three anonymous reviewers for their helpful feedback. We would also like to thank Michael Barry, Christle Domingo, Tiffany France, Tara Galloway, Camille Hayes, Tamara Love, Mike Moynihan, Lyneth Romero, Lisa Rydygier, Mubeena Siddiqui, Erin Stachowicz, Nicole Tabeta, and Raechel Torf for their help with data collection and entry. Finally, we express our gratitude to the teachers, staff, and students at the five schools where the data were collected.

References

- Achenbach TM, Krukowski RA, Dumenci L, Ivanova MY. Assessment of adult psychopathology: Meta-analyses and implications of cross-informant correlations. *Psychological Bulletin*. 2005; 131(3):361–382. [PubMed: 15869333]
- Achenbach TM, McConaughy &, Howell CT. Child/adolescent behavioral and emotional problems: Implications of cross-informant correlations for situational specificity. *Psychological Bulletin*. 1987; 101(2):213–232. [PubMed: 3562706]
- Adler PA, Adler P. Dynamics of inclusion and exclusion in preadolescent cliques. *Social Psychology Quarterly*. 1995; 58(3):145–162.
- Atkins, MS.; Mehta, T.; Frazier, SL.; Cappella, E.; Martinez-Lora, A.; Shernoff, E., et al. Links to Learning: School and community mental health resource alignment in support of children's learning in high-poverty urban schools. Paper symposium at the annual meeting of the American Psychological Association; Boston, MA. August. 2008
- Azmitia M, Montgomery R. Friendship, transactive dialogues, and the development of scientific reasoning. *Social Development*. 1993; 2:202–221.
- Bagwell CL, Coie JD, Terry RA, Lochman JA. Peer clique participation and social status in preadolescence. *Merrill-Palmer Quarterly*. 2000; 46(2):280–305.

- Bell-Dolan D, Wessler AE. Ethical administration of sociometric measures: Procedures in use and suggestions for improvement. *Professional Psychology: Research and Practice*. 1994; 25(1):23–32.
- Borgatti, S.; Everett, M.; Freeman, L. UCINET for Windows: Software for social network analysis. Analytic Technologies; Harvard, MA: 2002.
- Bourke S. How small is better: Some relationships between class size, teaching practices, and student achievement. *American Educational Research Journal*. 1986; 23(4):558–571.
- Brophy JE. Classroom organization and management. *The Elementary School Journal*. 1983; 83:4–285.
- Cairns, RB.; Cairns, BD. Lifelines and risks. Cambridge, UK: Cambridge University Press; 1994.
- Cairns RB, Cairns BD, Neckerman HJ, Gest SD, Garipey JL. Social networks and aggressive behavior: Peer support or peer rejection? *Developmental Psychology*. 1988; 24(6):815–823.
- Cairns RB, Leung M, Buchanan L, Cairns BD. Friendship and social networks in childhood and adolescence: Fluidity, reliability, and interrelations. *Child Development*. 1995; 66:1330–1345. [PubMed: 7555219]
- Cappella E, Frazier SL, Atkins MS, Schoenwald SK, Glisson C. An ecological model of school based mental health services: Enhancing schools' capacity to support children in poverty. *Administration and Policy in Mental Health and Mental Health Services Research*. 2008; 35(5):395–409. [PubMed: 18581225]
- Cappella, E.; Neal, JW.; Atkins, MS. Teacher practices and student social networks in urban classrooms. Paper presented at the annual meeting of the American Educational Research Association; New York, NY. 2008 March.
- Chang L. The role of classroom norms in contextualizing the relations of children's social behaviors to peer acceptance. *Developmental Psychology*. 2004; 40(5):691–702. [PubMed: 15355159]
- Cheetham AH, Hazel JE. Binary (presence-absence) similarity coefficients. *Journal of Paleontology*. 1969; 43(5):1130–1136.
- Coalition for Psychology in Schools and Education. Report on the Teacher Needs Survey. Washington, D.C: American Psychological Association, Center for Psychology in Schools and Education; 2006 August.
- Corsaro WA, Eder D. Children's peer cultures. *Annual Review of Sociology*. 1990; 16:197–220.
- Crick NR, Grotpeter JK. Relational aggression, gender, and social-psychological adjustment. *Child Development*. 1995; 66:710–722. [PubMed: 7789197]
- Doyle, W. Classroom organization and management. In: Wittrock, MC., editor. *Handbook of Research on Teaching*. New York: MacMillian Publishing; 1986. p. 392-431.
- Eder D. The cycle of popularity: Interpersonal relations among female adolescents. *Sociology of Education*. 1985; 58(3):154–165.
- Emmer ET, Stough LM. Classroom management: A critical part of educational psychology with implications for teacher education. *Educational Psychologist*. 2001; 36(2):103–112.
- Estell DB, Cairns RB, Farmer TW, Cairns BD. Aggression in inner-city early elementary classrooms: Individual and peer-group configurations. *Merrill-Palmer Quarterly*. 2002; 48(1):52–76.
- Farmer TW. The social dynamics of aggressive and disruptive behavior in school: Implications for behavior consultation. *Journal of Educational and Psychological Consultation*. 2000; 11(3/4):299–321.
- Farmer TW, Cadwallader TW. Social interactions and peer support for problem behavior. *Preventing School Failure*. 2000; 44(3):105–109.
- Farmer TW, Xie H. Aggression and school social dynamics: The good, the bad, and the ordinary. *Journal of School Psychology*. 2007; 45(5):461–478.
- Finn JD, Pannozzo GM, Achilles CM. The "why's" of class size: Student behavior in small classes. *Review of Educational Research*. 2003; 73(3):321–368.
- Gage, NL.; Leavitt, GS.; Stone, GC. Psychological Monographs No. 106. Washington D.C: American Psychological Association; 1955. Teachers' understanding of their pupils and pupils' ratings of their teachers.
- George TP, Hartmann DP. Friendship networks of unpopular, average, and popular children. *Child Development*. 1996; 67(5):2301–2316.

- Gest SD. Teacher reports of children's friendships and social groups: Agreement with peer reports and implications for studying peer similarity. *Social Development*. 2006; 15(2):248–259.
- Gest SD, Farmer TW, Cairns BD, Xie H. Identifying children's peer social networks in school classrooms: Links between peer reports and observed interactions. *Social Development*. 2003; 12:513–529.
- Hamre, BK.; Mashburn, AJ.; Pianta, RC.; Locasale-Crouch, J.; La Paro, KM. Classroom Assessment Scoring System: Technical manual. Charlottesville, VA: University of Virginia; 2006.
- Hamre, BK.; Pianta, RC.; Mashburn, AJ.; Downer, JT. Building a science of classrooms: Application of the CLASS framework in over 4,000 U.S. early childhood and elementary classrooms. Paper presented at the Biennial Meeting of the Society for Research on Child Development; Boston, MA. 2007.
- Hartup WW. The company they keep: Friendships and their developmental significance. *Child Development*. 1996; 67(1):1–13. [PubMed: 8605821]
- Henry D, Guerra N, Huesmann R, Tolan P, VanAcker R, Eron L. Normative influences on aggression in urban elementary school classrooms. *American Journal of Community Psychology*. 2000; 28(1):59–81. [PubMed: 10824274]
- Jaccard P. Nouvelle recherches sur la distribution florale. *Bull de la Societe Vaudoise des Sciences Naturelles*. 1908; 44:223–270.
- Kiesner J, Poulin F, Nicotra E. Peer relations across contexts: Individual-network homophily and network inclusion in and after school. *Child Development*. 2003; 74(5):1328–1343. [PubMed: 14552401]
- Kindermann TA. Effects of naturally existing peer groups on changes in academic engagement in a cohort of sixth graders. *Child Development*. 2007; 78(4):1186–1203. [PubMed: 17650133]
- Klov Dahl AS. Social network research and human subjects protection: Towards more effective infectious disease control. *Social Networks*. Special Issue: Ethical Dilemmas in Social Network Research. 2005; 27:119–137.
- Krackhardt D. Cognitive social structures. *Social Networks*. 1987; 9:109–134.
- Kuppens S, Grietens H, Onghena P, Michiels D, Subramanian SV. Individual and classroom variables associated with relational aggression in elementary school aged children: A multilevel analysis. *Journal of School Psychology*. 2008; 46:639–660. [PubMed: 19083377]
- Mashburn AJ, Pianta RC, Hamre BK, Downer JT, Barbarin OA, Bryant D, et al. Measures of classroom quality in pre-kindergarten and children's development of academic, language, and social skills. *Child Development*. 2008; 79:732–749. [PubMed: 18489424]
- Neal JW. "Kracking" the missing data problem: Applying Krackhardt's Cognitive Social Structures to School-Based Social Networks. *Sociology of Education*. 2008; 81:140–162.
- Neal JW. Network ties and mean lies: A relational approach to relational aggression. *Journal of Community Psychology*. 2009; 37(6):737–753.
- Neal JW. Hanging out: Features of urban children's peer social networks. *Journal of Social and Personal Relationships*. (in press).
- Newcomb AF, Bagwell CI. Children's friendship relations: A meta-analytic review. *Psychological Bulletin*. 1995; 117(2):306–347.
- Pearl R, Leung M, Van Acker R, Farmer TW, Rodkin PC. Fourth and fifth grade teachers' awareness of their classrooms' social networks. *The Elementary School Journal*. 2007; 108(1):25–39.
- Pianta, RC.; La Paro, KM.; Hamre, BK. Classroom Assessment Scoring System: K-3 Manual. Baltimore, MD: Brookes Publishing; 2008.
- Pittinsky M, Carolan BV. Behavioral versus cognitive classroom friendship networks: Do teacher perceptions agree with student reports? *Social Psychology of Education*. 2008; 11:133–147.
- Preacher KJ, Hayes AF. SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*. 2004; 36(4):717–731.
- Putallaz M, Wasserman A. Children's naturalistic entry behavior and sociometric status: A developmental perspective. *Developmental Psychology*. 1989; 25(2):297–305.

- Rodkin P, Ahn H. Social networks derived from affiliations and friendships, multi-informant and self-reports: Stability, concordance, placement of aggressive and unpopular children, and centrality. *Social Development*. 2009; 18:556–576.
- Rubin, KH.; Chen, X.; Coplan, R.; Buskirk, AA.; Wojslawowicz, JC. Peer relationships in childhood. In: Bornstein, MH.; Lamb, ME., editors. *Developmental science: An advanced textbook*. Mahwah, N.J: Lawrence Erlbaum Associates, Inc; 2005.
- Ryan AM. The peer group as a context for the development of young adolescent motivation and achievement. *Child Development*. 2001; 72(4):1135–1150. [PubMed: 11480938]
- Salmivalli C, Huttenen A, Lagerspetz KMJ. Peer networks and bullying in schools. *Scandinavian Journal of Psychology*. 1997; 38:305–312.
- Shrout PE, Bolger N. Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*. 2002; 7(4):422–445. [PubMed: 12530702]
- Shrum W, Cheek NH. Social structure during the school years: The onset of the degrouping process. *American Sociological Review*. 1987; 52(2):218–223.
- Smith ML, Glass GV. Meta-analysis of research on class size and its relationship to attitudes and instruction. *American Educational Research Journal*. 1980; 17(4):419–433.
- StataCorp. *Stata Statistical Software: Release 11*. College Station, TX: StataCorp LP; 2009.
- Stormshak EA, Bierman KL, Bruschi C, Dodge KA, Coie JD. the Conduct Problems Prevention Research Group. The relationship between behavior problems and peer preferences in different classroom contexts. *Child Development*. 1999; 70(1):169–182. [PubMed: 10191521]
- Tseng V, Seidman E. A systems framework for understanding social settings. *American Journal of Community Psychology*. 2007; 39:217–228. [PubMed: 17436080]
- Weinstein, RS. *Reaching higher: The power of expectations in schooling*. Cambridge, MA: Harvard University Press; 2002.

Figure 1.
Predicted influence of classroom behavior management and productivity on teacher-student agreement about peer networks

Table 1**Behavioral Indicators for the CLASS Dimensions of Classroom Organization**

CLASS Dimension	Behavioral Indicator
Behavior Management	Rules and expectations for behavior are clear and consistent
	Teachers effectively and efficiently redirect misbehavior
	Student behavior indicates that they are following the rules
	Teachers are proactive and prevent problems from developing
Productivity	Learning time is maximized
	Routines are established and student know what to do
	Transitions are quick and efficient
	Teachers are fully prepared for activities and lessons
Instructional Learning Formats	Teachers effectively and actively facilitate students' engagement
	Participation is promoted through the a variety of modalities and materials
	Students are interested and engaged
	Students' attention is focused on learning objectives

* Pianta et al., 2008

Table 2
Descriptive Statistics and Intercorrelations for Teacher-Student Agreement and Classroom Characteristics (N=33)

Variable	Mean	SD	Min.	Max.	1.	2.	3.	4.	5.	6.	7.
1. Jaccard Similarity Coefficient	.40	.15	.10	.71	--						
2. Class Size	20.27	6.92	10	34	-.45**	--					
3. Behavior Management	4.80	1.24	2.50	6.75	-.08	.20	--				
4. Productivity	4.59	.99	2.75	6.50	.20	.10	.79**	--			
5. Inst. Learning Formats	3.87	1.15	1	6.67	.08	.09	.56**	.61**	--		
6. Prosocial Behavior	.23	.08	.09	.36	.48**	-.65**	-.05	-.02	-.15	--	
7. Aggressive Behavior	.24	.11	.10	.51	.11	-.55**	-.12	-.16	-.25	.47**	--
8. Network Density	.62	.17	.19	.95	.62**	.02	-.04	.11	-.04	.18	-.12

**
p < .01

Table 3

Influence of Classroom Characteristics on Jaccard Similarity Coefficients Indicating Teacher-Student Agreement about Classroom Networks (N=33)

Variable	B	SE B	β
Grade	.11	.03	.54**
Class Size	-.01	.00	-.57**
Behavior Management	-.06	.02	-.44*
Productivity	.08	.03	.48*
Instructional Learning Formats	.01	.02	.08
Prosocial Behavior	.37	.33	.19
Aggressive Behavior	-.50	.21	-.36*

Note. $R^2 = .67$.

*
p < .05,

**
p < .01