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Title:

Measuring Teacher Knowledge of Classroom Social Networks: Convergent and Predictive Validity in Elementary School Classrooms

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Abstract Body
Limit 4 pages single-spaced.

Background / Context:

The social dynamics of elementary school classrooms are complex, encompassing patterns of affiliation (friendships, cliques), status (acceptance, rejection, popularity) and social behavior (bullying, victimization, helping). Social dynamics have important implications for children's social and academic adjustment. For example, in classrooms with relatively wide disparities in status, peer norms are more supportive of aggression (Ahn, Garandeanu, & Rodkin, 2010); whereas children who perceive their classroom to be a caring community of students are more motivated in school (Battistich, Solomon, Kim, Watson, & Schaps, 1995).

Teachers may play an important role in these classroom social dynamics, as well as the overall social-affective climate of the classroom (Gest & Rodkin, 2011; Hamm, Farmer, Dadisman, Gravelle, & Murray, 2011). A growing focus on the role of classroom relationships in children's social and academic outcomes has led researchers to examine how teachers might foster positive classroom social dynamics (Hamm et al., 2011). Because many strategies to manipulate classroom social dynamics involve subtle actions that may go unnoticed by students, they are often described as the teacher's "invisible hand" (Cairns & Cairns, 1994).

One potentially important precondition for teacher management of student social relationships is the teacher's attunement to classroom social dynamics. Teachers who are highly attuned to peer group affiliations and status structures may be better equipped to implement strategies that improve social dynamics, such as giving leadership roles to neglected children (Farmer, 2000). Indeed, there is growing evidence that teacher attunement to social dynamics is associated with students' greater sense of classroom belonging. Moreover, students of highly-attuned teachers are more likely to report that they would protect bullied peers, and believe that their classmates would protect them in an instance of bullying (Hamm et al., 2011).

Purpose / Objective / Research Question / Focus of Study:

This study contributes to a growing body of literature focused on the role of the teacher's "invisible hand" in managing students' social relationships. We focus on one specific aspect of attunement, teachers' social network knowledge, which we conceptualize as the completeness and accuracy of the teacher's perceptions of students' peer affiliation patterns. Two premises of this work are that: (a) teachers who possess accurate network knowledge are in a better position to manage peer relationships in ways that support a positive classroom climate and achievement motivation; and (b) network knowledge is a potentially malleable element of teaching quality which can be targeted for professional development. Because past research suggests that hierarchical social structures in classrooms may contribute to a negative climate, we were especially interested in understanding whether teachers with better network knowledge might counteract the negative effect of social hierarchies.

Aim 1: Establish the stability and validity of a measure of teacher network knowledge

- (a) Individual-difference stability: We expected teachers to show rank-order stability in their scores of network knowledge.
- (b) Changes in mean levels: We expected significant increases in network knowledge across the school year.
- (c) Convergent and divergent validity: We expected teacher network knowledge to be significantly correlated with observers' ratings of teachers' sensitivity and responsiveness to students, but not with observers' ratings of instructional support and classroom organization.

Aim 2: Examine the association between teacher network knowledge and student attitudes towards school and perceptions of teacher support.

(a) Associations with student reports: We expected that higher teacher network knowledge would be associated with student perceptions of more teacher support and more positive attitudes toward school.

(b) Moderation of hierarchy effects: We expected that teacher network knowledge would moderate the association between gender-specific status hierarchies and student outcomes.

Setting:

The final sample includes students and teachers from Illinois, Indiana, and Pennsylvania. Two school districts in IL served small- to mid-size cities (populations 70,000 and 35,000) These districts were diverse in ethnic (43% African-American, 8% Asian, 3% Hispanic students) and socioeconomic status (44% disadvantaged). Students in the large urban district in IN were drawn from schools in low socioeconomic neighborhoods that were either predominantly African American or a heterogeneous mix of African American, Latino, and European American. In PA, data were collected from three racially homogenous (>97% European-American) but economically diverse (35% disadvantaged) school districts that serve rural areas and small cities. Preliminary results presented include the two IL districts and one PA district.

Population / Participants / Subjects:

The full sample (Year 1 and Year 2) includes 2055 students enrolled in 95 classrooms in 16 schools. Teachers and students were followed across an academic year. Written consent was obtained from all classroom teachers; parental consent was obtained for 1,742 students, of whom 1,690 (82% of total) provided written assent (3rd and 5th graders) or oral assent (1st graders). The preliminary results presented here include only the first year of the study (N = 42 classrooms, N = 800 students) . One teacher provided data only for the first wave and was excluded from analyses. After accounting for dissenting children, absences, and the excluded classroom, 608 children (52% male) children were enrolled at all three time points and participated in at least one survey (88% participated in all three waves).

Intervention / Program / Practice:

This study examined natural variation in elementary school teachers' network knowledge. Our study is not an intervention, but improving teacher network knowledge is an element of at least one existing teacher professional development program (Hamm et al., 2011).

Research Design:

The current project is a non-experimental, longitudinal correlational study. In each classroom, teacher and student assessments were collected three times during a single school year: within the first 8 weeks of school, approximately 8 weeks later, and within 8 weeks of the end of the school year. In our multi-year project, approximately 50 new classrooms are sampled each year.

Data Collection and Analysis:

Student data were collected with group-administered surveys (3rd and 5th grade) or individual interviews (1st grade). Descriptive statistics from Year 1 are provided in Table 1.

(please insert Table 1 here)

Teaching practices were evaluated with the Classroom Assessment Scoring System (CLASS; Pianta et al., 2008). Two observers visited the classroom on a single day and independently completed ratings for four 20-minute cycles. Inter-rater reliability was high: Emotional Support (Intraclass Correlation = .92), Instructional Support (ICC = .95) and Classroom Organization (ICC = .94). Scores were averaged across observers. Scores from mid-year observations were used.

Teacher knowledge of the student network was measured as the concordance between the teacher and student reports of kids who “hang around together a lot” using Cairns’ social cognitive map procedure (SCM). Students circled the names of children with whom they hung around and were then asked, “Are there other kids in your classroom who hang around together a lot?” and were instructed to write the names of those children in separate boxes, indicating different groups. Teachers completed a similar form in which they wrote the names of students in different groups in separate boxes. Student reports within a classroom were aggregated into a co-nomination matrix in which each cell summarized the number of times two students were placed in a group together. A co-nomination matrix was also constructed based on the teacher report, with each cell indicating whether the two students were placed in the same group (=1) or not (=0). Within each classroom at each of the three assessments, the teacher and student matrices were correlated to quantify the teacher’s network knowledge. Fisher’s r to z transformation was used to arrive at network knowledge scores based on a normal distribution, which could then be used as variables in statistical analyses.

Status hierarchies were calculated from child reports of friendship. At each assessment, children circled friends’ names on a classroom roster. Only same-gender friendship nominations were used given the high gender segregation in elementary students’ friendships (Rodkin, Pearl, Farmer, & Van Acker, 2003). We used R’s Social Network Analysis package to calculate each student’s eigenvector centrality among same-gender classmates. Eigenvector centrality is a measure of how many times a student is named as a friend, but with greater weight on nominations received from peers who were themselves named by many classmates. Next, the distribution of eigenvector centrality scores within each classroom was summarized with a centralization index, which is scaled such that a minimally hierarchical classroom (in which everyone has the same eigenvector centrality) has a score of zero, and a maximally hierarchical classroom (in which all friendship nominations are directed to a single individual) has a score of 1. Thus, higher scores on the centralization index indicated a more hierarchical classroom.

Teacher support was conceptualized as the degree to which students perceived a warm, caring relationship with their teacher. It was measured using seven items adapted for student-report from the Closeness subscale of the Student-Teacher Relationship Scale ($\alpha_1 = .80$, $\alpha_2 = .84$, $\alpha_3 = .88$, $r_{1,2} = .61$, $r_{2,3} = .60$, $r_{1,3} = .46$; e.g., “My teacher is kind to me”; Pianta, 1992). The strong negative skew in Teacher Support was reduced by exponentiating scores prior to analysis. Scores were averaged across the three surveys.

Attitudes toward school were measured with two scales. *Affect* toward school was measured with eight items that assessed children’s general feelings about school and achievement ($\alpha_2 = .88$, $\alpha_3 = .91$, $r_{1,2} = .70$, e.g., “I like going to school”; “Schoolwork is interesting to me”). Academic *striving* was measured with eight items assessing the degree to which children cared about and put effort into school ($\alpha_2 = .77$, $\alpha_3 = .83$, $r_{1,2} = .46$, e.g., “Doing well in school is important to me”, “I work hard at school”). Affect and striving were only measured at the second and third time points; for each scale, the average across the two waves was used for analysis.

Hypotheses were tested with two-level multilevel models (children nested within classrooms). Separate models were analyzed for each gender and outcome. A main effects model was tested first, followed by a model including interactive effects of teacher network knowledge and status hierarchy. All models controlled for grade.

Findings / Results:

Aim 1. Teacher network knowledge showed significant rank-order stability across the three time points ($r_{T1,T2} = .60$, $r_{T2,T3} = .50$, $\rho s < .01$). Paired-sample *t*-tests revealed a significant increase in teacher network knowledge between T2 and T3, $t(36) = -2.93$, $p < .01$, see Table 1. The correlation between teacher network knowledge and observed emotional support was significant, $r = .36$, $p < .05$. In contrast, correlations were nonsignificant with instructional support ($r = .21$, $p = .19$) classroom organization ($r = .11$, $p = .11$).

Hierarchical linear models with only main effects revealed significant negative effects of status hierarchy on girls' affect toward school ($p < .05$) and a marginally significant negative effect on boys' academic striving ($p < .10$). Teacher network knowledge was negatively associated with boys' affect and striving ($p < .05$), and positively associated with girls' perceived teacher support ($p < .05$). The interaction between teacher network knowledge and status hierarchy was significant for all outcomes, but only for boys ($p < .05$): In classrooms with relatively hierarchical status structures among boys, students reported more positive outcomes when their teachers demonstrated greater network knowledge (see Figure 1).

Conclusions:

These analyses provide preliminary support for the reliability and validity of a relatively simple index of teacher network knowledge. Correlating teacher and student reports of student peer affiliation patterns provided a index that demonstrated individual-difference stability across the year, sensitivity to within-year growth in network knowledge, and convergent-discriminant validity with regard to other measures of teaching practices.

We have also shown that teacher network knowledge may moderate the negative association between boys' hierarchical classroom structures and student reports of academic striving, affect toward school, and perceived teacher support. The processes that may account for this association cannot be determined from the present results, but we believe that identifying a reliable association between teacher network knowledge and more positive student outcomes validates our premise that teacher attunement to classroom social dynamics may be an important precondition for managing these dynamics. In future analyses of the present data set, we will conduct analyses to link variations in teacher network knowledge to other measures of the broader construct of teacher attunement, and to a range of teacher-reported and observer rated teaching strategies.

In the meantime, the present results provide promising support for the premise of intervention efforts that target teacher network knowledge as potentially important and modifiable facet of the broader construct of teacher attunement (Hamm et al., 2011).

Final analyses will add the Year 2 sample, which will increase the diversity of classrooms represented in the analyses, as well as doubling the sample size and allowing more precise estimates of effect size.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

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- Rodkin, P. C., Pearl, R., Farmer, T. W., & Van Acker, R. (2003). Enemies in the gendered societies of middle childhood: Prevalence, stability, associations with social status, and aggression. *New Directions for Child and Adolescent Development, 102*, 73-88.

Appendix B. Tables and Figures
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Table 1
 Descriptive Statistics (Year 1)

	N	M	SD	Min.	Max
Teacher network knowledge ¹					
Time 1	35	.41	0.20	0.07	0.93
Time 2	39	.46	0.22	0.04	1.19
Time 3	39	.57	0.28	0.14	1.26
Average T ₂ ,T ₃	41	.51	0.21	0.12	1.13
Observed Teaching Practices (average T ₂ , T ₃)					
Emotional Support	41	5.23	0.78	3.31	6.56
Instructional Support	41	3.44	0.93	1.50	5.50
Classroom Organization	41	5.27	0.69	3.79	6.29
Boys' Self-Reports					
Perceived Teacher Support	297	4.33	0.65	1.57	5.00
Affect toward school	307	3.52	1.07	0.75	5.00
Academic striving	304	4.11	0.69	1.23	5.00
Girls Self-Reports					
Perceived Teacher Support	283	4.58	0.55	1.41	5.00
Affect toward school	293	3.89	0.89	0.75	5.00
Academic striving	292	4.24	0.57	1.63	5.00
Status Hierarchy					
Boys' Eigenvector Centralization	41	0.21	0.12	0.04	0.59
Girls' Eigenvector Centralization	41	0.19	0.10	0.00	0.41

Note: If a score was missing from one time point, the score at the other time point was used as the average.

¹Teacher network knowledge was calculated as a correlation coefficient. Z-scores computed with Fisher's r to z transformation are presented here.

Table 2

Multi-level models predicting youth reports of affect toward school

Variable	Boys		Girls	
	Est.	(SE)	Est.	(SE)
Intercept	4.09***	(0.16)	4.38***	(0.12)
Grade	-0.19***	(0.05)	-0.16***	(0.04)
Teacher network knowledge	-0.34	(0.41)	0.09	(0.29)
Gender-Specific Status Hierarchy	-1.31 [†]	(0.68)	-1.44*	(0.66)
Teacher Net. Knowledge * Hierarchy	13.91***	(3.83)	-0.42	(3.20)

Note. Models control for nesting within classrooms (n = 40) and fixed effects of school (n = 7). Network knowledge and hierarchy scores were centered at the grand mean. Parallel models were tested for outcomes of academic striving and perceived teacher support.

[†] p < .10 * p < .05, **p < .01, ***p < .001

Figure 1: For boys in classrooms with greater status hierarchies, higher teacher network knowledge is associated with better affect toward school.

