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Effects of the structure of classmates' perceptions of peers' academic abilities on children's perceived cognitive competence, peer acceptance, and engagement ☆

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Abstract

This study examined the effects of classroom indegree for ability (the degree to which peer nominations as academically capable show high consensus and focus on a relatively few number of children in a classroom) on first grade children's peer acceptance, teacher-rated classroom engagement, and self-perceived cognitive competence. Participants were 291 children located in 84 classrooms. Participating in sociometric interviews were 937 classmates. Consistent with social comparison theory, classroom indegree moderated the associations between children's achievement and classroom engagement and peer liking. Children with lower ability, relative to their classmates, were less accepted by peers and less engaged in classrooms in which students' perceptions of classmates' abilities converged on a relatively few number of students than in classrooms in which peers' perceptions were more dispersed. High indegree was associated with lower self-perceived cognitive competence regardless of ability level.

Keywords

Peer perceptions; Sociometric assessment; Academic ability; Elementary students; Classroom context; Peer acceptance; School engagement; Perceived cognitive competence; Social comparison theory; Differential teacher behavior

1. Introduction

Considerable research conducted over three decades has documented the impact of teacher practices that highlight differences in children's relative abilities on children's achievement, motivation, and self-views (Ames, 1992; Brophy, 1983; Kuklinski & Weinstein, 2001; Mac Iver, 1987; Rosenthal & Jacobson, 1968; Urdan & Midgley, 2003; Weinstein, Marshall, Sharp, & Botkin, 1987). This body of evidence is drawn from research on teacher expectancy effects (for review see Jussim & Harber, 2005), classroom goal structure (for review see Urdan & Midgley, 2003), classroom task structures (Simpson & Rosenholtz, 1986), and teacher frame of reference (Marsh & Craven, 2002). The literature from these separate but overlapping traditions has identified teacher practices that are associated with the self-fulfilling prophecy effect (Rosenthal & Jacobson, 1968) and with students' academic motivation and perceived competence (Dweck & Leggett, 1988; Lüdtke, Köller, Marsh, & Trautwein, 2005; Urdan, Midgley, & Anderman, 1998). These practices, collectively referred to in the teacher

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expectancy literature as high-differentiating practices, include providing more emotional support, choice, praise, response opportunities, and special privileges to high achievers and more criticism and direction to low achievers; frequent classroom reminders of the importance of not making mistakes and of earning good grades; more frequent and more public performance feedback (Brophy, 1983; Jussim, 1986; Mac Iver, 1988; Weinstein et al., 1987), and grading in reference to comparison with others rather than in relation to personal improvement (Marsh & Craven, 2002).

1.1. Implications of teacher differentiating practices for student motivation and perceived cognitive competence

One method of identifying high differentiating classrooms involves asking students to describe their teacher's likely interactions with hypothetical high and low ability students (Weinstein et al., 1987). In those classrooms in which students perceive more differentiating teacher treatment to high and low ability students, teacher expectancy effects are larger and students' self-perceptions more closely match those of the teacher (Brattesani, Weinstein, & Marshall, 1984; Weinstein et al., 1987).

One might question the age at which children are capable of reporting accurately about teacher practices in the classroom or about their own or other students' abilities. When interviewed individually with items that are concretely worded, children as young as 4 years of age provide reliable and meaningful information about teachers' behaviors toward them (Montzicopoulos & Neuharth-Pritchett, 2003). Children as young as first grade are aware of teacher differential behavior to high and low ability students (Weinstein et al., 1987), and their rankings of classmates' relative abilities align with teacher ratings (Stipek, 1981; Stipek & Tannatt, 1984). Weinstein et al. (1987) investigated developmental shifts between first and fifth grade in students' awareness of differential teacher behavior. Although first graders were as accurate as third and fifth graders in detecting patterns of differential teacher behavior to high and low achieving students, when they described their own interactions with the teacher, both first and third graders were less likely than fifth graders to see differences in their own treatment as a function of teacher expectations, or to be as accurate about the relative level of their teachers' expectations for them. The researchers interpreted this finding to mean that first graders may apply knowledge of differential teacher behavior to others before they apply this knowledge to themselves.

Generally, students in high differentiating classrooms report lower self perceptions of cognitive ability (Dweck & Leggett, 1988; Elliott & Dweck, 1988; Mac Iver, 1988; Lüdtke et al., 2005; Stipek & Daniels, 1988). However, most of this research has been conducted with middle childhood or older children. A developmental shift in the application of awareness of differential teacher practices to one's self perceptions of ability suggests that the differences in teacher differentiating practices may not affect students' perceived cognitive competence in the early grades.

Research emanating from goal orientation theory (Dweck & Leggett, 1988; Nicholls, 1984; Urdan & Midgley, 2003; Urdan et al., 1998) has documented associations between teacher differentiating practices and students' adoption of either performance or mastery goals for achievement. Students who adopt a *performance goal* orientation (sometimes referred to as an ability goal orientation) are motivated to maintain a sense of self-worth through performing well (Ames, 1992; Dweck, 1986). Learning itself is viewed only as a way to demonstrate ability, and energy is directed toward achieving normatively defined success (Nicholls, 1984). In contrast, students who adopt a *mastery* orientation (sometimes referred to as a learning goal orientation) attribute success to effort and are oriented toward developing new skills and improving their level of competence (Ames, 1992). A personal mastery goal orientation is associated with greater effort, persistence, and a preference for challenging tasks (Dweck,

1986; Elliott & Dweck, 1988). In classrooms characterized by a mastery goal structure (i.e., where the focus is on individual improvement, understanding is emphasized, evaluations are private instead of public, and mistakes are viewed as a part of learning), students are more likely to adopt a personal mastery goal orientation that supports effort, persistence, and positive affect (Ames, 1992; Urda et al., 1998). Furthermore, classroom goal structure affects student academic motivation and engagement in learning indirectly via its effect on personal goal orientation (Anderman & Midgley, 1997).

1.2. Teacher practices and the structure of students' perceptions of ability

Classroom differences in the cues provided to students regarding students' relative abilities have implications not only for students' academic motivation and perceived competence, affect, and achievement but also for the structure, or distribution, of students' perceptions of classmates' abilities. In a classroom in which teachers use more differentiating practices, students have more information regarding their own and classmates' relative performance. Consequently, in high differentiating classrooms, students demonstrate a higher degree of consensus in their perceptions of classmates' abilities, and students' ability perceptions tend to focus on relatively few children (Filby & Barnett, 1982; Rosenholtz & Simpson, 1984a). In a study with upper elementary students, students relied more on social comparison in their self-evaluation of math competence in classrooms with a greater emphasis on grades and relative performance (Mac Iver, 1987). In a study with first grade students, Ames and Felkner (1979) found that children rated the performance of hypothetical students more similarly in cooperative than in competitive classroom environments. The authors interpreted this finding as indicating that students in competitive classrooms use social comparison information to make more distinctions in performance among students.

Simpson and Rosenholtz (1986) describe the social processes by which shared perceptions of ability differences develop in classrooms in which students have more opportunities to compare their performance with classmates and to discern differences in classmates' relative abilities: "We come to know that something is a fact through an interactive process in which *each of us learns that others seem to regard it as fact*. Although teachers may have the power to define individuals' performance levels, peers' collective acceptance objectivates [sic] those levels as fact" (Rosenholtz & Simpson, 1984b, p. 40). According to Rosenholtz and Simpson, such conversations lead to greater peer consensus regarding classmates' relative ability levels. As a result of this process, peer perceptions also become both more aligned with those of teachers (Rosenholtz & Simpson, 1984a) and focused on relatively fewer children (Mac Iver, 1988).

1.3. Differential effect of teacher differentiating practices on higher and lower achievers

Differentiating teacher practices and the more centralized perceptions of relative ability they foster might differentially impact high and low ability children in a classroom. Consistent with this view, children who lack confidence in their ability are especially likely to respond to classrooms that emphasize performance over mastery goals with ineffective problem-solving strategies, task avoidance, and negative self-attributions of ability (Dweck & Leggett, 1988; Elliott & Dweck, 1988; Urda & Midgley, 2003). Additionally, Mac Iver (1988) found that in classrooms in which ability cues are more available to students, low ability students were more likely than were high ability students to depress self-perceptions of math ability.

The availability of social comparison information may also have consequences for children's peer relations. Because peers' perceptions of classmates' ability is associated with their liking for classmates (Ladd, Birch, & Buhs, 1999), lower ability students may experience lower levels of peer acceptance in classrooms where everyone is aware of each other's academic performance. In an early study, Schuncke (1978) found that in 5th and 6th grade classrooms that employed ability grouping, a practice that makes relative ability highly salient (Filby &

Barnett, 1982), low ability students were less accepted by their classmates than were those in classrooms that did not use ability grouping. “The academic status of boys... was daily brought to the attention of the total class as the teacher worked with different ability groups. Because it was reinforced, this hierarchy was much more available for pupils of ability-grouped classes to use as a basis for allocating status in the other dimensions (academic ability and social influence) of the classroom social structure” (Schuncke, 1978, p. 307). Schuncke’s results need to be interpreted with caution due to the fact that very small cell sizes did not permit statistical tests of the theorized moderation effects.

1.4. Study purpose

Our interest focuses on the impact of the *structure* of peers’ perceptions of classmates’ academic abilities on children’s social acceptance, perceived cognitive competence, and classroom engagement. In particular, we are interested in the social and motivational consequences of the degree to which classmates’ perceptions of ability are centralized, defined as perceptions that are consensual and focused on a relatively small number of students. We borrow a construct from social network analysis (Scott, 2000) to assess the centrality of peer perceptions of classmates’ abilities. Social network analysis is concerned with communication and affiliation patterns within a social group and yields information about individuals’ social relatedness on several dimensions. An individual’s centrality refers to an individual’s position in a social network (Scott, 2000) and is indexed by *degree* (the number of a member’s connections with other network members) and *betweenness* (the intermediary position of a member who acts like a connecting bridge between some network members or groups). Additionally, an entire social network can be characterized with respect to its “indegree,” a measure of the extent to which a few individuals in a group enjoy a central position in members’ perceptions of some attribute (Freeman, 1979).

In summary, the measure of indegree is a measure of the degree to which classmates agree on perceptions of who is smart and the perceptions center on a relatively few number of students. In such an environment, social comparison processes are expected to be stronger. Consequently, the associations between actual ability and one’s social status and academic motivation and perceived cognitive competence are expected to be stronger in high indegree classrooms. Based on this reasoning and using hierarchical linear modeling (HLM) in which students are nested in classrooms, we predict that classroom indegree will moderate the associations between individual academic ability and peer acceptance, school engagement, and perceived cognitive competence. Specifically, we expect that the positive relation between ability and peer acceptance, engagement, and perceived cognitive competence will be stronger in high ability indegree classrooms.

We investigate the moderating effect of classroom indegree on student outcomes with a sample of academically at-risk first grade children who are participating in a larger, prospective study on the effects of grade retention. Participants were selected for the larger study based on scoring below the median of their school district on a district-wide test of literacy administered at the beginning of first grade and being enrolled in first grade for the first time (see methods section for details). Because children who begin their formal schooling with low literacy skills are at increased risk for long-term academic and social difficulties in school (Entwisle & Alexander, 1988) they represent a population of special concern to educators. For those children who are “doubly disadvantaged” due to lower academic skills at entry and less supportive social relations in the classroom, the odds of academic failure are greatly increased (for review see Perry & Weinstein, 1998).

2. Method

2.1. Participants

Participants were 291 (53% male) first-grade children attending two small city school districts in South Central Texas, drawn from a larger sample ($N = 335$) of children participating in a longitudinal study examining the impact of grade retention on academic achievement. They were distributed across 84 classrooms (31 from one district and 53 from the other). Participants were recruited in first grade during the fall of 2002. Children were eligible to participate in the longitudinal study if they scored below the median score on a state approved district-administered measure of literacy administered in September of 1st grade, were in regular education classrooms, and had not been previously retained in first grade. Of 598 children who were eligible to participate in the study, parent consent for the longitudinal study was obtained for 335 (56%). The 335 children with consent did not differ from the 263 without consent on ethnic status, eligibility for free or reduced lunch, gender, literacy, or status as Limited English Proficiency. Of the 335 study participants, 291 (86%) had complete information for all study variables, including peer sociometric data, teacher-reported child engagement, and perceptions of cognitive competence. These 291 participants did not differ from the 44 children without complete data on any demographic or study variable.

For the sample of 291, at entrance to first grade, children's mean age was 6.55 ($SD = .33$) years. Children's intelligence as measured with the Universal Non-verbal Intelligence Test (UNIT, Bracken & McCallum, 1998) was 94.74 ($SD = 14.33$). The UNIT is a nationally standardized non-verbal measurement of general intelligence and cognitive ability with reported test-retest and internal consistency reliabilities for 7-year-olds of .84 and .83, respectively, and strong evidence of construct validity (Bracken & McCallum, 1998). Based on family income, 65.3% ($N = 190$) of participants were eligible for free or reduced lunch. For 37.5%, the highest educational level in the household was a high school certificate or less. The sample ethnic composition was 39.5% Hispanic ($N = 115$), 36.1% Caucasian ($N = 105$), 21% African-American ($N = 61$), 1.7% Asian/ Pacific Islander ($N = 5$), 0.3% Native American/Alaskan Native ($N = 1$), and 1.4% other ($N = 4$). The majority of the sample (91.8%) spoke English in the home. Approximately 15.1% ($N = 44$) were bilingual.

2.2. Measures

Between November and March, research staff individually administered tests of reading and math achievement. Measures of children's perceived cognitive competence were administered in individual interviews between February and May. In March, teachers were mailed a questionnaire packet for each study participant. This packet included the measures of the teacher's perception of student engagement. Teachers received \$25.00 compensation for completing and returning the questionnaires. Individual peer sociometric interviews were completed between February and May.

2.2.1. Academic achievement—The *Woodcock Johnson Tests of Achievement*, 3rd edition (WJ-III; Woodcock, McGrew, & Mather, 2001) is an individually administered measure of academic achievement for individuals ages 2 to adulthood. For our purposes we used the WJ-III Broad Reading age-based Standard Scores (Letter-Word Identification, Reading Fluency, Passage Comprehension subtests) and the WJ-III Broad Math age-based Standard Scores (Calculations, Math Fluency, and Math Calculation Skills subtests). Broad Reading and Broad Math age standard scores have a mean for the standardization sample of 100 and standard deviation of 15. Extensive research documents the reliability and constructs validity of the WJ-III and its predecessor (Woodcock & Johnson, 1989; Woodcock et al., 2001). The 1-year stability for this age group ranges from .92 to .94 (McGrew, Werder, & Woodcock, 1991).

The *Bateria Woodcock-Muñoz: Pruebas de aprovechamiento—Revisada (Bateria-R*; Woodcock & Munoz, 1996) is the comparable Spanish version of the *Woodcock-Johnson Tests of Achievement—Revised (WJ-R*; Woodcock & Johnson, 1989), the precursor of the *WJ-III*. If children or their parents spoke any Spanish, children were administered the *Woodcock-Munoz Language Test* (Woodcock & Munoz-Sandoval, 1993) to determine the child's language proficiency in English and Spanish and selection of either the *WJ-III* or the *Bateria-R*. The Woodcock Compuscore (Woodcock & Munoz-Sandoval, 1993) program yields scores for the *Bateria-R* that are comparable to scores on the *WJ-R*. The Broad Reading and Broad Mathematics Age Standard Scores were used in this study. In all analyses, we report the age scores for Reading and Math from the *WJ-III* or the *Bateria-R* and refer to these scores as reading and math achievement scores.

2.2.2. Child engagement—This teacher-report, 10-item scale is comprised of 8 items from the Conscientious scale of the Big Five Inventory (BFI; John & Sirvastava, 1999) and 2 items taken from the Social Competence Scale (Conduct Problems Prevention Research Group, 2004) that were consistent with our definition of classroom engagement (effort, attention, persistence, and cooperative participation in learning). Items are rated from 1 to 5. Although the BFI is conceptualized as a measure of personality traits, the selected items from the Conscientious scale are similar to items used by other researchers to assess classroom engagement (Ladd et al., 1999; Ridley, McWilliam, & Oates, 2000). Example items are “Is a reliable worker,” “Perseveres until the task is finished,” “Tends to be lazy” (reverse scored), and “Is easily distracted.” The two items from the Social Competence Scale were “Sets and works toward goals” and “Turns in homework.” The internal consistency of these 10 items for our sample was .95.

2.2.3. Child perceived cognitive competence—The Cognitive Competence scale of the Pictorial Scale of Perceived Competence and Social Acceptance for Young Children (PSPCSA; Harter & Pike, 1981) assessed children's self-perceptions of cognitive competence. The Cognitive Competence subscale consists of six items. For each item, children are presented with pictures of two children who were described in contrasting ways (e.g., “This girl is good at spelling; this girl is not good at spelling”). Then children are asked which child was more like them. After making their choice, they were asked if that child was a little or a lot like themselves. The procedure yields a 4-point scale for each item. For example, if a girl selects the girl who is not good at spelling and states that the girl is “a lot like me,” she would receive a score of 1. If a girl selects the girl who is good at spelling and states that the girl is “a lot like me,” she would receive a score of 4. The six items are “good at numbers”; “knows a lot in school”; “Can read alone”; “Good at writing words”; “Good at spelling”; and “Good at adding.” The internal consistency of these 6 items for our sample was .78.

2.2.4. Sociometric assessment—Sociometric (peer) interviews were conducted with study participants and with all of their classmates with written parent consent to participate in the interviews. Research assistants individually interviewed 937 children at school. Children were asked to indicate their liking for each child in the classroom on a 5-point scale. Specifically, the interviewer named each child in the classroom and asked the child to point to one of five faces ranging from sad (1 = do not like at all) to happy (5 = like very much). The mean ratings a child received from classmates constituted the child's peer liking score. Because we were interested in children's relative social standing in the classroom, scores were standardized within classrooms. The peer liking mean ratings has been found to have good test-retest reliabilities and stability across the elementary school years (Hughes, 1990).

Children were also asked to nominate as few or as many classmates as they wished who could best play each of several parts in a class play (Masten, Morison, & Pellegrini, 1985). Children

could not nominate themselves. Of interest to this study are three items that ask children to nominate children who are academically capable. The three items are listed below.

- Some kids are best at *schoolwork*. They almost always get good grades and teachers often use their work as examples for the rest of the class. (Schoolwork)
- Some kids are best in *reading*. They usually get good grades in reading, and the teacher calls on them to read aloud or read hard words. (Reading)
- Some kids are best in *math*. They almost always get good grades in math and the teacher calls on them to work hard math problems. (Math)

After each item, the interviewer asks the child, “What kids in your class are like this?” Because reliable and valid sociometric data can be collected using the unlimited nomination approach when as few as 40% of children in a classroom participate (Terry, 1999), sociometric scores were computed only for children located in classrooms in which more than 40% of classmates participated in the sociometric assessment. The mean rate of classmate participation in sociometric administrations was .65 (range .40-.95), and the median number of children in a classroom providing ratings was 12. Although only children with written parent consent provided ratings and nominations, all children in the class were rated and eligible for nomination. Thus, children’s *z* scores were standardized based on scores for all children in the classroom. Children as young as first grade are reliable reporters of classmates’ classroom behaviors (Conduct Problems Prevention Research Group, 1999; Ialongo, Edelsohn, Werthamer-Larsson, & Crockett, 1996).

2.2.5. Classroom indegree for academic ability—First an indegree for reading, math, and school work was computed respectively, based on the distribution of nominations for each of these three items. Specifically, indegree was computed according to the following formula:

$$\text{indegree} = \text{sum} [\max(P_i) - P_i] / n(m - 1),$$

where $\max(P_i)$ is the maximum number of nominations received by any child in the classroom. P_i is the number of nominations each student received; n is the number of individuals providing ratings (i.e., the number of students who were administered the sociometric interview), and m is the total number of students in the classroom (Laura Koehly, personal communication, October 2004). When a relatively small number of students receive a large number of nominations and many students receive few nominations, the classroom indegree is high. Table 1 presents examples of the computation of indegree for two classrooms varying in indegree for reading. Student #1 in class A received 1 nomination ($P_i = 1$) as best in reading. In her class, the maximum number of nominations (MaxP) received by any student was 8 (received by student #7). Thus, student #1’s $\text{maxP} - P_i$ equals 7. In this classroom, n (the number of students participating in the sociometric procedure) = 14 and m (the number of students in the classroom) = 18.

Because the three indegree scores (school work, reading, and math) were moderately correlated (correlation coefficients ranged from .52 to .63), to reduce the number of analyses and probability of chance findings, an indegree for perceptions of academic ability was computed as the mean indegree scores for the three ability items. Because the application of indegree to the structure of peers’ perceptions of ability is new, it is important to establish its distinctiveness from classroom variance in nominations and from mean level of classroom ability. In our sample of 84 classrooms, the variance of nominations within classrooms and classroom indegree for that same item were not significantly correlated (average $r = .06$). Indegree is also independent of the mean ability level of classrooms, as assessed by the average score on the district measure of literacy (the correlation between classroom ability indegree and mean literacy score was .03).

3. Results

3.1. Descriptive statistics and overview of analysis

The zero-order bivariate correlations together with the means and standard deviations of the student-level variables are reported in Table 2. No gender differences were found on analysis variables with the exception of Reading Achievement and school engagement (both p values were less than .01). Girls scored higher on the Reading Achievement score and were perceived by teachers as being more engaged in the classroom.

Separate hierarchical linear models were tested for the three outcomes (i.e., peer liking, school engagement, and cognitive competence). Because the correlation between Reading and Math achievement scores was low to moderate ($r = .35$), a composite achievement score was not computed. Due to concerns with power to detect interaction effects when multiple predictors are included in the same model (Aguinis & Stone-Romero, 1997), separate hierarchical linear models were tested for Reading and Math predictors. Thus, there were a total of six models with two unique predictors and three outcomes testing six cross-level interaction effects.

3.2. Hierarchical linear modeling analyses

With the sample 291 participants nested in 84 classrooms, a set of two-level hierarchical linear models were fitted in HLM6 (HLM; Raudenbush, Bryk, & Congdon, 2004) to determine the main effect of classroom ability indegree on peer liking, school engagement, cognitive competence, and the moderating effect of classroom ability indegree on the relation between academic achievement (i.e., reading achievement, or math achievement) and each of the three student outcomes (peer liking, school engagement, and cognitive competence). To take into account the nested structure of the data, HLM conducts a second regression at the cluster level by taking the slopes from the individual level regression as the outcomes of some cluster characteristics at the higher level.

In the present study, the classroom ability indegree served as the second-level/contextual predictor. First level predictors included academic achievement (Reading or Math), gender (females as 0 and males as 1), and the ethnic contrast of majority versus minority, where Caucasians were coded as 0 while all other ethnic groups were coded as 1. A particular focus was the hypothesized cross-level interaction between the classroom ability indegree and academic achievement in predicting student outcomes. We expected significant interactions between Classroom Ability Indegree (level 2) and children's achievement (level 1) in predicting three student outcomes: peer liking, school engagement, and perceived cognitive competence. Specifically, we expected classroom ability indegree (Level 2) would predict the random coefficients resulting from regressing Level 1 student outcomes on the Level 1 student predictors. When a Level 2 (Classroom Ability Indegree in the present study) coefficient is of the same sign as the Level 1 coefficient (student level in the present study), the Level 2 predictor strengthens the Level 1 association in the same direction as indicated by the Level 1 coefficient. When the two levels are of opposite signs, a significant Level 2 predictor weakens or affects the Level 1 association in the direction opposite to that indicated by the Level 1 coefficient. The possible interactions for gender and ethnicity (majority versus minority) at the individual level (level 1) were also examined.

For each of the six models the residual files of both levels were saved to check the assumptions of HLM analyses. For all the models except for the one in which child perceived cognitive competence was predicted from math, the residuals at level-1 had a mean of 0 and were normally distributed (Kolmogorov-Smirnov statistic ranged from .024 to .057 with df of 245). Violation of normality assumption for Level 1 residuals will not bias the estimation for level 2 effects but may introduce bias to standard error estimates at both levels, which in turn would

influence the computation of confidence intervals and hypothesis testing. The level-2 residual file indicated a linear relationship between the slope of achievement (reading or math) and the classroom indegree for academic ability, which met the assumption of independence of level-2 residuals against the predictor at this level. Tables 3-5 report the results of these HLM analyses for peer liking, school engagement, and cognitive competence, respectively, including Level-1 and Level-2 regression coefficients with either reading or math achievement.

3.3. Peer liking as outcome

3.3.1. Analyses involving reading achievement—None of the first or second level predictors was significant on peer liking including gender, majority versus minority ethnic contrast, reading achievement, all the first-level interactions, and the Classroom Indegree for Academic Ability at the second level. The only significant effect was the cross-level interaction between reading achievement and classroom ability indegree ($t(82) = 2.051, p < .05$). The positive relationship between reading achievement and peer liking was stronger in classrooms with higher classroom ability indegree. Following Aiken and West's (1991) recommendation for depicting interaction effects, we divided classrooms into high indegree (1 *SD* above the mean) and low indegree (1 *SD* below the mean). The mean indegree was .52 ($SD = .15$). Fig. 1 shows the results for the moderating effect of classroom indegree on the association between reading achievement and predicted peer liking scores. The detrimental effect of low reading ability on peer liking was stronger for children in classrooms where students' perceptions of peers as academically capable were more consensual (shared) and focused on relatively few students.

3.3.2. Analyses involving math achievement—None of the effects in the hierarchical model was significant at the .05 level.

3.4. School engagement as outcome

3.4.1. Analyses involving reading achievement—Gender was a significant predictor for school engagement ($t(236) = -2.065, p < .01$). Girls were perceived by their teachers to be engaged at school more so than boys, controlling for other factors such as ethnicity and reading achievement. None of the other first level predictors had significant effects on school engagement including majority versus minority ethnic contrast, reading achievement and all the first-level interactions. The main effect of the second level predictor, classroom ability indegree, was not significant.

As hypothesized, the cross-level interaction between reading achievement and classroom ability indegree was significant for school engagement ($t(82) = 3.078, p < .01$). The positive relationship between reading achievement and school engagement was stronger in classrooms with higher classroom ability indegree. Fig. 2 depicts the interaction effect. This finding indicated that children with low reading performance were perceived by their teachers to be less engaged at school. The negative effect was stronger for low achieving students in classrooms where students' perceptions of peers as academically capable were more consensual (shared) and focused on relatively few students.

3.4.2. Analyses involving math achievement—When math achievement was entered as a first-level predictor with gender and ethnicity, with classroom ability indegree being the second-level predictor, the only significant effect was the cross-level interaction between math achievement and classroom ability indegree on school engagement ($t(82) = 2.367, p < .05$). The interaction effect is depicted in Fig. 3. The positive relationship between math achievement and school engagement was stronger in classrooms with higher Classroom Ability Indegree. Similar to the effect of reading achievement, this suggested that children with low math achievement were perceived by their teachers to be less engaged in learning. The detrimental

effect was stronger for children in classrooms where classmates' perceptions were more consensual and focused on relatively few children.

3.5. Cognitive competence as outcome

3.5.1. Analyses involving reading achievement—The only significant first-level predictor was the interaction between reading achievement and gender ($t(252) = 2.002, p < .05$). The non-significant positive relationship between reading achievement and cognitive competence was stronger for boys than for girls. None of the other first-level predictors had significant effects on cognitive competence including gender, majority versus minority ethnic contrast, reading achievement and all the other first-level interactions.

The main effect of the second-level predictor, classroom ability indegree was significant ($t(82) = -2.217; p = .05$). Classroom ability indegree was negatively associated with Perceived cognitive competence. Participants in classrooms where there was high consensus in terms of who were the “smart” ones reported lower levels of perceived cognitive competence. The cross-level interaction between reading achievement and classroom ability indegree was not significant for cognitive competence.

3.5.2. Analyses involving math achievement—When math achievement was entered as a first-level predictor with Gender and Ethnicity, with classroom ability indegree being the second-level predictor, the only significant effect was the main effect of classroom ability indegree on perceived cognitive competence ($t(82) = -2.195, p < .05$). Participants in classrooms with high classroom ability indegree scores reported lower levels of perceived cognitive competence, relative to participants in classrooms with lower classroom ability indegree. The cross-level interaction between math achievement and classroom ability indegree on cognitive competence was not significant.

4. Discussion

This study applied a measure borrowed from social network analysis—network indegree—to assess the structure of students' perceptions of classmates as academically capable. This measure assesses the degree to which peer nominations show high consensus and focus on a relatively few number of children in a classroom. Indegree is distinct from variance in students' nominations which was used by other researchers to index the structure of peer perceptions (Filby & Barnett, 1982; Mac Iver, 1988). Separate indegree scores were computed for peers' perceptions of academically capable students on three items: general school work, reading, and math. The moderate correlation between Reading and Math Indegree suggests similar classroom processes may account for the similarity in the structure of students' perceptions of abilities. Importantly, the measure of centralization of peer perceptions is independent of both mean level of achievement in the classroom and variance in peers' perceptions of classmates' abilities. Thus it is unlikely that study results are due to the actual ability composition of classrooms.

We expected classroom ability indegree would interact with child ability in predicting child peer acceptance, perceived cognitive competence, and classroom engagement. The expected interaction was found for peer liking for reading ability (but not for math ability) and for classroom engagement for both reading and math ability. Specifically, children with lower reading ability in classrooms with centralized perceptions of academic abilities were more likely to experience lower levels of peer acceptance and to be less engaged in school, relative to children with similarly low reading ability in classrooms with less centralized perceptions of academic abilities. These effects were not moderated by gender or majority versus minority status. Differences in findings for reading and math ability may be due to the fact that reading instruction assumes approximately twice the amount of classroom time in these first grade

classrooms as math instruction does. Thus, there are more opportunities for children to observe classmates' reading performance. Also, in these schools, same ability grouping practices are more common in reading instruction than in math instruction.

The finding that classroom ability indegree interacted with children's abilities in predicting both peer acceptance and classroom engagement is of educational importance because both peer acceptance and engagement in learning are associated with concurrent and future achievement (Furrer & Skinner, 2003; Guay, Boivin, & Hodges, 1999). Furthermore, low peer acceptance and a lack of a sense of belonging to school forecasts school avoidance and disaffected patterns of engagement (Furrer & Skinner, 2003; Guay et al., 1999). For example, Ladd et al. (1999) found that peer acceptance in kindergarten predicted subsequent levels of classroom participation and achievement. Classroom engagement, in turn, is a good predictor of children's long-term academic achievement (Skinner, Zimmer-Gembeck, & Connell, 1998).

The finding of a main effect of classroom ability indegree on children's perceived cognitive competence, though not predicted, is consistent with research with older students demonstrating a negative effect of teacher differentiating practices on children's perceived cognitive competence (Dweck & Leggett, 1988; Elliott & Dweck, 1988; Lüdtke et al., 2005; Mac Iver, 1988; Stipek & Daniels, 1988). The failure to find an interaction between Classroom indegree and ability in predicting perceived cognitive competence is consistent with the finding that young children rely less than older children on social comparison processes in evaluating their abilities (Filby & Barnett, 1982; Stipek & Mac Iver, 1989). The failure to find a moderating role for classroom indegree is also consistent with studies demonstrating that students do not apply knowledge of differential teacher behavior to perceptions of their own ability until 3rd grade or later (Kuklinski & Weinstein, 2001; Stipek, 1981; Weinstein et al., 1987). It will be important to test the main and moderating effects of classroom ability indegree on the perceived cognitive competence of students in older grades.

The main effect of indegree on children's academic perceived cognitive competence may be explained in terms of a hastening of normative age-related declines in perceived perceptions of competence that begin in first grade. In first grade, children's self-perceptions tend to be overly optimistic and become more realistic (and negative) with time in school-presumably because positive perceptions are challenged by objective evidence (Marsh, Craven, & Debus, 1998). High indegree first grade classrooms may hasten the normative age-related decline in perceived cognitive competence for children of all ability levels. This interpretation is consistent with Stipek and Daniels's (1988) finding that in kindergarten to fourth grade classrooms where there was more social comparison information available, children reported lower self perceived cognitive competence. The finding that ability indegree suppressed children's perceived cognitive competence is important because self-perceptions of academic ability are associated with concurrent and future academic performance, via a reciprocal effects model (Marsh, 1990; Marsh, Trautwein, Lüdtke, Koller, & Baumert, 2005).

In this sample of relatively low achieving first grade students, neither reading nor math achievement was significantly associated with peer liking or school engagement. This finding is inconsistent with previous research that has found associations between achievement and both liking and school engagement (Estell, Farmer, Cairns, & Cairns, 2002; Furrer & Skinner, 2003; Ladd, 1990; Ladd et al., 1999). The failure to find such an association may be due to the restricted range of ability in this sample.

Study findings need to be interpreted in light of certain strengths and limitations. Study strengths include the relatively large sample size, use of HLM to study classroom effects, the integration of research from diverse theoretical orientations, and the use of outcome measures

from multiple sources. The fact that participants were selected on the basis of scoring below their school district's median on a test of literacy is a limitation, because results may not generalize to higher-achieving samples. However, it is reasonable to expect that the moderating effects of classroom indegree on associations between ability and outcomes would be stronger, not weaker, in a sample that included the entire range of classroom ability levels. Second, our sample composition did not permit separate analysis of each ethnic group. Thus, our failure to find a moderating role for ethnicity may be due to our inability to test for each ethnic contrast. Third, because teacher practices were not analyzed in this study, we can only speculate on teacher practices that are responsible for variations in classroom indegree. It will be important for future researchers to include measures of classroom ability indegree and teacher practices and to investigate both direct and indirect (i.e., via the structure of peers' perceptions) effects of differential teacher practices on peer acceptance, school engagement, and perceived cognitive competence. The identification of classroom experiences responsible for high ability indegree classrooms will have implications for teacher preparation and professional development programs.

These findings add to a growing body of literature indicating the importance of the classroom social context on children's development (Hughes, Cavell, Meehan, Zhang, & Collie, 2005; Perry & Weinstein, 1998). Classroom social context has been assessed in terms of student characteristics such as normative levels of aggression or achievement values (Brand, Felner, Shim, Seitsinger, & Dumas, 2003; Chang, 2003; Stormshak et al., 1999). This study suggests that another social feature of classrooms—the structure of peers' perceptions of classmates may have implications for children's adjustment to school.

References

- Aguinis H, Stone-Romero E. Methodological artifacts in moderated multiple regression and their effects on statistical power. *Journal of Applied Psychology* 1997;92:192–206.
- Aiken, LS.; West, SG. *Multiple regression: Testing and interpreting interactions*. Sage Publications; Newbury Park, CA: 1991.
- Ames C. Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology* 1992;84:251–271.
- Ames C, Felkner D. An examination of children's attributions and achievement-related evaluations in competitive, cooperative, and individualistic reward structures. *Journal of Educational Psychology* 1979;71:413–420.
- Anderman EM, Midgley C. Changes in personal achievement goals and the perceived classroom goal structures across the transition to middle level schools. *Contemporary Educational Psychology* 1997;22:269–298. [PubMed: 9237829]
- Bracken, BA.; McCallum, S. *Universal nonverbal intelligence test*. Riverside; Chicago: 1998.
- Brand S, Felner R, Shim M, Seitsinger A, Dumas T. Middle school improvement and reform: Development and validation of a school-level assessment of climate, cultural pluralism, and school safety. *Journal of Educational Psychology* 2003;95:570–588.
- Brattesani KA, Weinstein RS, Marshall HH. Student perceptions of differential teacher treatment as moderators of teacher expectation effects. *Journal of Educational Psychology* 1984;76:236–247.
- Brophy J. Research on the self-fulfilling prophecy and teacher expectations. *Journal of Educational Psychology* 1983;75:631–661.
- Chang L. Variable effects of children's aggression, social withdrawal, and prosocial leadership as functions of teacher beliefs and behaviors. *Child Development* 2003;74:535–548. [PubMed: 12705571]
- Conduct Problems Prevention Research Group. Initial impact of the Fast Track prevention trial for conduct problems: II. Classroom effects. *Journal of Consulting and Clinical Psychology* 1999;67:648–657. [PubMed: 10535231]

- Conduct Problems Prevention Research Group. Teacher social competence. [Accessed September 24, 2004]. 2004 from <http://www.fasttrackproject.org/techrept/t/tsc/>
- Dweck CS. Motivational processes affecting learning. *American Psychologist* 1986;41:1040–1048.
- Dweck CS, Leggett EL. A social-cognitive approach to motivation and personality. *Psychological Review* 1988;95:256–273.
- Elliott ES, Dweck CS. Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology* 1988;54:5–12. [PubMed: 3346808]
- Entwisle DR, Alexander KL. Early schooling as a “critical period” phenomenon. *Research in the Sociology of Education and Socialization* 1988;8:27–55.
- Estell DB, Farmer TW, Cairns RB, Cairns BD. Social relations and academic achievement in inner-city early elementary classrooms. *International Journal of Behavioral Development* 2002;26:518–528.
- Filby NN, Barnett BG. Student perceptions of “Better Readers” in elementary classrooms. *The Elementary School Journal* 1982;82:435–449.
- Freeman LC. Centrality in social networks: Conceptual clarification. *Social Networks* 1979;1:215–239.
- Furrer C, Skinner E. Sense of relatedness as a factor in children’s academic engagement and performance. *Journal of Educational Psychology* 2003;95(1):148–162.
- Guay F, Boivin M, Hodges EVE. Predicting change in academic achievement: A model of peer experiences and self-system processes. *Journal of Educational Psychology* 1999;91:105–115.
- Harter, S.; Pike, R. The pictorial scale of perceived competence and social acceptance for young children. University of Denver; Denver, CO: 1981.
- Hughes, J. Assessment of children’s social competence. In: Reynolds, CR.; Kamphaus, R., editors. *Handbook of psychological and educational assessment of children*. Guilford; New York, NY: 1990. p. 423–444.
- Hughes JN, Cavell TA, Meehan BT, Zhang D, Collie C. Adverse school context moderates the outcomes of selective interventions for aggressive children. *Journal of Consulting and Clinical Psychology* 2005;73:731–736. [PubMed: 16173861]
- Ialongo N, Edelsohn G, Werthamer-Larsson L, Crockett L. The course of aggression in first-grade children with and without comorbid anxious symptoms. *Journal of abnormal child psychology* 1996;24:445–456. [PubMed: 8886941]
- John, OP.; Sirvastava, S. The big five taxonomy: History, measurement, and theoretical perspectives. In: Pervin, LA.; John, OP., editors. *Handbook of personality: Theory and research*. Guilford; New York: 1999. p. 102–138.
- Jussim L. Self-fulfilling prophecies: A theoretical and integrative review. *Psychological Review* 1986;93:429–445.
- Jussim L, Harber KD. Teacher expectations and self-fulfilling prophecies: Knowns and unknowns, resolved and unresolved controversies. *Personality and Social Psychology Review* 2005;9:131–155. [PubMed: 15869379]
- Kuklinski MR, Weinstein RS. Classroom and developmental differences in a path model of teacher expectancy effects. *Child Development* 2001;72:1554–1578. [PubMed: 11699687]
- Ladd GW. Having friends, keeping friends, making friends, and being liked by peers in the classroom: Predictors of children’s early school adjustment? *Child Development* 1990;61:1081–1100. [PubMed: 2209179]
- Ladd GW, Birch SH, Buhs ES. Children’s social and scholastic lives in kindergarten: Related spheres of influence? *Child Development* 1999;70:1373–1400. [PubMed: 10621962]
- Lüdtke O, Köller O, Marsh HW, Trautwein U. Teacher frame of reference and the big-fish-little-pond effect. *Contemporary Educational Psychology* 2005;30:263–285.
- Mac Iver D. Classroom factors and student characteristics predicting students’ use of achievement standards during ability self-assessment. *Child Development* 1987;58:1258–1271. [PubMed: 3665644]
- Mac Iver D. Classroom environments and the stratification of pupils’ ability perceptions. *Journal of Educational Psychology* 1988;80:495–505.
- Marsh HW. The causal ordering of academic self-concept and academic achievement: A multi-wave, longitudinal panel analysis. *Journal of Educational Psychology* 1990;82:646–656.

- Marsh, HW.; Craven, R. The pivotal role of frames of reference in academic self-concept formation: The big fish little pond effect. In: Pajares, F.; Urdan, T., editors. *Adolescence and education. II*. Information Age; Greenwich, CT: 2002. p. 83-123.
- Marsh HW, Craven R, Debus R. Structure, stability, and development of young children's self-concepts: A multicohort-multioccasion study. *Child Development* 1998;69:1030–1053. [PubMed: 9768485]
- Marsh HW, Trautwein U, Ludtke O, Koller O, Baumert J. Academic self-concept, interests, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development* 2005;76:397–416. [PubMed: 15784090]
- Masten AS, Morison P, Pellegrini DS. A revised class play method of peer assessment. *Developmental Psychology* 1985;21:523–533.
- McGrew, KS.; Werder, JK.; Woodcock, RW. WJ-R technical manual. DLM; Allen, TX: 1991.
- Montzicopoulos P, Neuhauser-Pritchett S. Development and validation of a measure of access head start children's appraisals of teacher support. *Journal of School Psychology* 2003;41:431–451.
- Nicholls, JG. Conceptions of ability and achievement motivation. In: Ames, R.; Ames, C., editors. *Research on motivation in education. 1*. Academic Press; San Diego, CA: 1984. p. 39-73.
- Perry KE, Weinstein RS. The social context of early schooling and children's school adjustment. *Educational Psychologist* 1998;33:177–194.
- Raudenbush, SW.; Bryk, AS.; Congdon, R. HLM6: Hierarchical linear and nonlinear modeling. Scientific Software International, Inc; 2004.
- Ridley SM, McWilliam RA, Oates CS. Group engagement as an indicator of child care program quality. *Early Education and Development* 2000;11:133–146.
- Rosenholtz SJ, Simpson C. Classroom organization and student stratification. *The Elementary School Journal* 1984a;85:21–37.
- Rosenholtz SJ, Simpson C. The formation of ability conceptions: Developmental trend or social construction? *Review of Educational Research* 1984b;54:31–63.
- Rosenthal, RJ.; Jacobson, L. *Pygmalion in the classroom: Teacher expectations and pupils' intellectual development*. Holt, Rinehart, & Winston; New York: 1968.
- Schuncke GM. Social effects of classroom organization. *Journal of Educational Research* 1978;71:303–307.
- Scott, J. *Social network analysis: A handbook*. 2nd ed.. Sage; London: 2000.
- Simpson, CH.; Rosenholtz, SJ. Classroom structure and the social construction of ability. In: Richardson, JG., editor. *Handbook of theory and research for the sociology of education*. Greenwood Press; New York: 1986. p. 113-138.
- Skinner, EA.; Zimmer-Gembeck, MJ.; Connell, JP. *Monographs of the Society for Research in Child Development*. 63. 1998. Individual differences and the development of perceived control. Serial No. 254
- Stipek DJ. Children's perceptions of their own and their classmates' ability. *Journal of Educational Psychology* 1981;73:404–410.
- Stipek DJ, Daniels D. Declining perceptions of competence: A consequence of changes in the child or the educational environment. *Journal of Educational Psychology* 1988;80:352–356.
- Stipek DJ, Mac Iver D. Developmental change in children's assessments of intellectual competence. *Child Development* 1989;60:521–538.
- Stipek DJ, Tannatt LM. Children's judgments of their own and their peers' academic competence. *Journal of Educational Psychology* 1984;76:75–84.
- Stormshak EA, Bierman KL, Bruschi C, Dodge KA, Coie JD, The Conduct Problems Prevention Research Group. The relation between behavior problems and peer preference in different classroom contexts. *Child Development* 1999;70:169–182. [PubMed: 10191521]
- Terry, R. Measurement and scaling issues in sociometry: A latent trait approach; Paper presented at the biennial meeting of the Society for Research in Child Development; Albuquerque, New Mexico. 1999;
- Urdan T, Midgley C. Changes in the perceived classroom goal structure and pattern of adaptive learning during early adolescence. *Contemporary Educational Psychology* 2003;28:524–551.

- Urdan T, Midgley C, Anderman E. The role of classroom goal structure in students' use of self-handicapping strategies. *American Educational Research Journal* 1998;35:101–122.
- Weinstein RS, Marshall HH, Sharp L, Botkin M. Pygmalion and the student: Age and classroom differences in children's awareness of teacher expectations. *Child Development* 1987;58:1079–1093. [PubMed: 3608657]
- Woodcock, RW.; Johnson, MB. Woodcock-Johnson psycho-educational battery-revised. DLM Teaching Resources; Allen, TX: 1989.
- Woodcock, RW.; Munoz, AF. Bateria Woodcock-Munoz pruebas de habilidad cognoscitiva-revisada. Riverside Publishing; Chicago: 1996.
- Woodcock, RW.; Munoz-Sandoval, AF. Woodcock-Munoz language survey. Riverside; Itasca, IL: 1993.
- Woodcock, RW.; McGrew, K.; Mather, N. Woodcock-Johnson III tests of achievement. Riverside Publishing; Riverside, CA: 2001.

Fig. 1.
Decomposition of cross-level interaction of reading by classroom ability indegree on peer liking.

Fig. 2.
Decomposition of cross-level interaction of reading by classroom ability indegree on school engagement.

Fig. 3.
Decomposition of cross-level interaction of math by classroom ability indegree on school engagement.

Table 1

Examples of two actual classrooms with low and high indegree for reading ability

Student	Class A		Class B	
	P_i	$\text{Max}P - P_i$	P_i	$\text{Max}P - P_i$
1	1	7	1	12
2	7	1	0	13
3	0	8	0	13
4	1	7	0	13
5	7	1	0	13
6	4	4	10	3
7	8	0	13	0
8	0	8	0	13
9	5	3	0	13
10	0	8	1	12
11	4	4	2	11
12	6	2	10	3
13	0	8	5	8
14	5	3	3	10
15	0	8	0	13
16	6	2	0	13
17	0	8	0	13
18	4	4	0	13
	Sum	86	Sum	189
Reading indegree	0.368		0.808	

Note. Formula of classroom indegree for reading ability: $\text{sum}(\text{max } P_i - P_i)/n*(m - 1)$ (see the text for meanings of each term). Both classes have 18 students, with 14 participants in sociometric interviews.

Table 2

Bivariate correlations and descriptive data of student-level variables

Variable	1	2	3	4	5	6
1 Reading achievement						
2 Math achievement	.315***					
3 Peer liking	0.112***	0.004				
4 School engagement	.370***	0.073	.353***			
5 Cognitive competence	.080	.053	.026	.110**		
6 Gender ^a	-.192**	.034**	.041	-.232**	.024	
7 Ethnic Contrast ^b	-.011	-.312**	-.107	-.025	0.052	-.161**
Mean	100.76	103.28	-.17	3.94	3.44	
SD	18.26	12.71	.93	1.32	5.19	
Median	100	103	-.12	4.00	3.50	
Minimum	52	65	-2.97	1.00	1.17	
Maximum	159	143	1.83	6.00	4.00	

^a Females were coded as 0 and males as 1.^b The ethnic contrast was formed as majority versus minority groups where Caucasians were coded as 0 while all other ethnic groups were coded as 1. Mean items scores are reported for school engagement and cognitive competence.**
 $p < .01$.***
 $p < .001$.

Table 3

HLM analyses with peer liking

Variable	Coefficient	SE	t test
<i>Analyses with reading achievement</i>			
Gender (L1) ^a	0.850	0.640	1.329
Ethnic contrast (L1) ^b	-0.016	0.825	-0.019
Reading achievement (L1)	0.009	0.007	1.19
Classroom indegree for academic ability (L2)	0.351	0.343	1.021
Reading × classroom indegree ^c	0.045	0.022	2.051*
Reading × gender (L1)	-0.006	0.006	-0.956
Reading × ethnicity (L1)	-0.001	0.008	-0.1
Reading × gender × ethnicity (L1)	-0.003	0.003	-1.247
<i>Analyses with math achievement</i>			
Gender (L1)	1.227	1.491	0.823
Ethnic Contrast (L1)	0.093	1.212	0.077
Math Achievement (L1)	0.015	0.013	1.146
Classroom indegree for academic ability (L2)	0.352	0.343	1.025
Math × classroom indegree ^c	-0.010	0.033	-0.317
Math × gender (L1)	-0.010	0.013	-0.719
Math × ethnicity (L1)	-0.002	0.011	-0.151
Math × gender × ethnicity (L1)	-0.004	0.003	-1.281

Note. L1 denotes the effect at the first-level while L2 denotes the effects at the second-level.

^aFor gender females were coded as 0 and males as 1.

^bThe ethnic contrast was formed as majority versus minority groups where Caucasians were coded as 0 while all other ethnic groups were coded as 1.

^cThis is the cross-level interaction.

*
 $p < .05$.

Table 4

HLM analyses with school engagement

Variable	Coefficient	SE	t test
<i>Analyses with reading achievement</i>			
Gender (L1) ^a	-1.595	0.773	-2.065 *
Ethnic contrast (L1) ^b	-1.320	0.996	-1.326
Reading achievement (L1)	0.004	0.010	0.448
Classroom indegree for academic ability (L2)	0.415	0.846	0.491
Reading × classroom indegree ^c	0.080	0.026	3.078 **
Reading × gender (L1)	0.014	0.008	1.690
Reading × ethnicity (L1)	0.014	0.009	1.484
Reading × gender × ethnicity (L1)	-0.002	0.004	-0.568
<i>Analyses with math achievement</i>			
Gender (L1)	-1.134	1.570	-0.722
Ethnic contrast (L1)	-2.024	1.558	-1.299
Math achievement (L1)	0.005	0.017	0.270
Classroom indegree for academic ability (L2)	0.401	0.845	0.474
Math × classroom indegree	0.116	0.049	2.367 *
Math × gender (L1)	0.006	0.014	0.442
Math × ethnicity (L1)	0.018	0.015	1.258
Math × gender × ethnicity (L1)	0.0001	0.003	0.036

Note. L1 denotes the effect at the first-level while L2 denotes the effects at the second-level.

^aFor gender females were coded as 0 and males as 1.

^bThe ethnic contrast was formed as majority versus minority groups where Caucasians were coded as 0 while all other ethnic groups were coded as 1.

^cThis is the cross-level interaction.

*
 $p < .05$.

**
 $p < .01$.

Table 5

HLM analyses with cognitive competence

Variable	Coefficient	SE	t test
<i>Analyses with reading achievement</i>			
Gender (L1) ^a	-.586	.348	-1.682
Ethnic contrast (L1) ^b	.736	.706	1.042
Reading achievement (L1)	.005	.006	.763
Classroom indegree for academic ability (L2)	-.413	.186	-2.217*
Reading × classroom indegree ^c	.016	.018	.878
Reading × gender (L1)	.008	.004	2.002*
Reading × ethnicity (L1)	-.006	.007	-.963
Reading × gender × ethnicity (L1)	-.002	.002	-.999
<i>Analyses with math achievement</i>			
Gender (L1)	-.456	.617	-.740
Ethnic contrast (L1)	1.288	.831	1.551
Math achievement (L1)	.011	.008	1.370
Classroom indegree for academic ability (L2)	-.401	.186	-2.195*
Math × classroom indegree	.015	.020	.727
Math × gender (L1)	.005	.006	.877
Math × ethnicity (L1)	-.012	.007	-1.628
Math × gender × ethnicity (L1)	.00001	.002	.062

Note. L1 denotes the effect at the first-level while L2 denotes the effects at the second-level.

^aFor gender females were coded as 0 and males as 1.

^bThe ethnic contrast was formed as majority versus minority groups where Caucasians were coded as 0 while all other ethnic groups were coded as 1.

^cThis is the cross-level interaction.

*
 $p < .05$.