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Peer Group Contexts of Girls' and Boys' Academic Experiences

Robert Crosnoe,

University of Texas at Austin

Catherine Riegler-Crumb,

University of Texas at Austin

Kenneth Frank,

Michigan State University

Sam Field, and

University of Pennsylvania

Chandra Muller

University of Texas at Austin

Abstract

Girls have caught up with boys in math course taking in high school but reasons for taking math still differ by gender. This study, therefore, investigated gender differences in the linkage between peer relations and math course taking by applying multilevel modeling to a nationally representative data set that includes peer networks and school transcripts ($N = 6,457$ American 9th to 11th graders, aged 13 – 19). For all adolescents, math course taking was associated with the achievement of their close friends and, to a lesser extent, their coursemates. These associations tended to be stronger toward the end of high school and weaker among adolescents with a prior record of failure in school. Each of these patterns was somewhat more consistent among girls.

Girls outperform boys on almost every academic indicator in secondary school. Historically, however, girls' achievement in math has trailed behind boys—fueling an intense public debate on gender and education; generating a good deal of research cataloging the social, psychological, and institutional reasons behind this disparity; and pointing toward methods of remedying it (Esptein, 1998; Hyde & Kling, 2001; Mickelson, 1989). These remedies do indeed seem to be working, as multiple national-level data collections have recently documented that girls have effectively caught up with boys in math course taking (Bae, Chow, Geddes, Sable, & Snyder, 2000; Shettle et al., 2007; Xie & Shauman, 2003). Yet, the wealth of multidisciplinary research on gender differences in decision making and performance in this academic domain suggests that boys and girls take very different routes to the same endpoint in their math careers (Eccles, 1994). If, indeed, math course taking in high school is a gendered case of *equifinality*, then identifying key processes to the same outcome will reveal valuable information about how to best serve boys and girls in school. It will also shed light on a crucial span of development: the period shortly before high school graduation that impacts the transition to adulthood.

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Correspondence concerning this article should be addressed to Robert Crosnoe, Department of Sociology and Population Research Center, University of Texas at Austin, 1 University Station A1700, Austin, TX 78712-1088. Electronic mail may be sent to crosnoe@mail.la.utexas.edu.

This study attempts such an identification by drawing on the rich body of scientific research on peer relations. From this research, we know that boys and girls have different relationships with their peers and respond differently to these relationships, which suggests that peer contexts could be a source of gender variability in the seemingly equivalent—or equifinal—math careers of girls and boys (Giordano, 1995; Riegle-Crumb, Farkas, & Muller, 2006; Ryan, 2001). This study, therefore, carefully delineates gender differences in the influence of two, overlapping layers of social life in school—the close circle of friends and the larger strata of coursemates in which this circle is usually embedded (Brown & Klute, 2003)—on the math course taking of students with different academic statuses at various stages of high school. This endeavor is made possible by a new data source that combines peer network data and official high school transcripts in a nationally representative sample of adolescents (Muller, 2005).

This study contributes to two scientific literatures focusing on young people. First, it addresses important tensions in the developmental literature about how and when peer contexts are related to positive development. Second, it informs the educational literature by identifying who is at risk in a curriculum that has long-term consequences for educational attainment as well as when intervention may have the greatest impact. Importantly, this research also strengthens linkages between these literatures by revealing the ways in which personal relationships pattern girls' and boys' navigation of the formal structures of schools and by employing methodological techniques and data that will allow such cross-pollination.

Gender and Math in Secondary School

Historically, American girls have demonstrated lower rates of persistence and achievement in math than boys. Strikingly, this gender difference is orthogonal to the myriad ways, such as grades and participation, that girls outperform boys in school (Esptein, 1998; Hyde & Kling, 2001). According to one explanation, gender socialization has typed math as a male activity leading to future careers that will not be conducive with adult female family roles. Consequently, girls perceive math classrooms as inhospitable to them (Hyde & Kling, 2001; Jacobs, 1991; Johnson, Oesterle, & Mortimer, 2001; Koehler, 1990; Sandler & Hall, 1986). According to another explanation (Eccles & Wigfield, 2002), girls are often less optimistic about their chances in math, more likely to view problems in math as proof of low ability, and more likely to devalue math relative to other subjects compared to boys, regardless of actual ability (Catsambis, 1994; Correll, 2001; Eccles, 1994; Eccles & Wigfield, 2002). Bringing these two explanations together, socialization processes create gender differences in motivations, expectations, and values. The end result is that dropping out of math has traditionally been more justifiable for girls than boys.

Yet, traditions aside, today's girls are closing the gap with boys. Indeed, the most recently collected national-level data have consistently shown that girls no longer drop out of math at a higher rate than boys. For example, contemporary girls and boys are equally likely to take calculus. Moreover, this equaling out of course taking is eroding gender differences in math achievement (Bae et al., 2000; Riegle-Crumb, 2006; Shettle et al., 2007; Xie & Shauman, 2003). This new pattern should be the end of an old story in the social and behavioral sciences. Yet, the story is extended if girls and boys wind up in the *same* place year after year for *different* reasons. Uncovering this part of the story—a story of equifinality—is an important goal.

Gender, Peers, and Math

To explore gender equifinality in math, this study focuses on an important element of the social ecology of adolescence—peer relations—for two reasons. First, peers loom large in adolescence, when the task of establishing autonomy from parents significantly increases the socializing power of peers (Berndt & Murphy, 2002; Crosnoe, 2000). Indeed, even controlling

for selection, the norms and characteristics of peers profoundly influence adolescents' academic behavior through direct and indirect mechanisms—social approval of behavior, self-enhancement through perceived social competence, modeling and social learning, overt peer pressure, group regulation, adult treatment related to group reputation, expectations of accomplishment, and instrumental assistance for meeting goals (Berndt & Keefe, 1995; Chen, Chang, & He, 2003; Ma, 2001; Radziwon, 2003; Ryan, 2000). Second, gender differences in peer relations are well established. Girls tend to have fewer, closer friendships and are more embedded in these friendships. Boys tend to maintain more diffuse peer networks in which they are less emotionally involved (Davies & Kandel, 1981; Giordano, 2003; Van Houtte, 2004).

Studying peer relations, therefore, provides insight into a key socialization agent of adolescence that shapes the motivations, expectations, and values that are so important to understanding gender differences in math pathways. This study, then, examines gender differences in the connection between the general academic norms of peers in one year and the math enrollment of girls and boys in the subsequent year.

Competing Hypotheses About Gender, Peers, and Math

This investigation has three parts, each focusing on a specific dimension of the connection between peer norms and course taking. As a rhetorical device, we set up three sets of competing hypotheses about this connection—one for each dimension—and then lay out expectations for how the answers to these competing hypotheses will differ by gender.

The first set of competing hypotheses concerns two *levels* of the peer context. The first level is the close circle of friends (a clique), characterized by sustained interaction and emotional ties (Brown & Klute, 2003; Hartup & Stevens, 1997). The second level consists of classmates who are similar in number and kinds of courses shared (e.g., the science specialists, fine arts kids, college preparatory students). Classmates spend time together, share a similar academic/social space in school, and likely have some common identity (Field, Frank, Schiller, Riegler-Crumb, & Muller, 2005; Friedkin & Thomas, 1997). Classmates may be friends and vice versa, but the two are distinct conceptual aspects of the peer context in school. The *friend hypothesis* contends that the academic achievement of friends will be more strongly associated with math course taking than the achievement of classmates. The sustained interaction that occurs among friends is more likely to maximize the sharing of information, definition of norms, and emotional bonding. These qualities strengthen support, persuasion, and the desire to stay together (Brown & Klute, 2003; Hartup & Stevens, 1997). Conversely, the *classmate hypothesis* argues that classmates are weak ties that provide access to more varied information channels that open opportunities for learning and elevating status (Giordano, 1995; Granovetter, 1995; Tarrant et al., 2001). Compared to cliques, the more diffuse, impersonal nature of this context might also make adolescents less secure in their positions and less adept at working through interpersonal differences, thereby heightening the benefits of conformity (Bearman & Bruckner, 1999; Chen et al., 2003; DeRosier, Kupersmidt, & Patterson, 1994; Harter & Fischer, 1999; Van Houtte, 2004).

Which of these competing hypotheses receives the most empirical support is likely to differ by gender. After all, girls place a greater emphasis than boys on building and maintaining strong relationships within their close circle of friends and boys are more concerned than girls with their status in larger social hierarchies (Fagot, 1994; Giordano, 2003; Van Houtte, 2004). Thus, we would expect the friend hypothesis to hold more for girls than boys. Alternatively, the classmate hypothesis, which emphasizes broader networks of social identity and status, would hold for boys more than girls.

The second set of competing hypotheses concerns age-graded change in the connection between the academic achievement of peers and the math course taking of adolescents. According to the *developmental hypothesis*, this connection will be weaker at the end of high school. A good deal of evidence suggests that homophily and the susceptibility of young people to peer influence declines toward the end of high school as they become more independent, gain confidence, and widen their social networks (Brown, Eicher, & Petrie, 1986; Hartup & Stevens, 1997). According to the *institutional constraints hypothesis*, however, this association will be stronger at the end of high school. In earlier grades, math course taking is constrained because adolescents have to enroll in math and have fewer math options. These constraints are lifted over time so that, in the later grades, adolescents are no longer required to take math at all and can choose from a variety of math classes if they do persist (Powell, Farrar, & Cohen, 1985; Schiller & Muller, 2003). How much peers can play a role in math course taking, therefore, varies as a function of how many institutional constraints are placed on course taking. As the constraints lift, the potential for peer influence to make a difference increases.

Again, support for these competing hypotheses will likely be gender specific. One reason that girls drop out of math is that they view math classrooms as inhospitable (Catsambis, 1994; Seymour & Hewitt, 1997). Consequently, girls will need extra support to keep enrolling in math once it is optional. Friends and peers can make the classroom more hospitable to girls, thereby keeping them in the math curriculum. Alternatively, boys have high self-confidence in math that appears to exist somewhat independently of feedback from others. Thus, boys are less likely than girls to need social support to stay in math once they have a choice (Correll, 2001; Riegle-Crumb et al., 2006). Consequently, we would expect the institutional constraints hypothesis to hold more for girls and the developmental hypothesis to hold more for boys.

As for the third set of competing hypotheses, the academic significance of some peer norm may vary as a function of specific adolescent characteristics. Both stratification and prevention research address the issue of whether the already advantaged or disadvantaged benefit more from exposure to some social resource (Bryk, Lee, & Holland, 1993; Ceci & Papierno, 2005). The *cumulative advantage* hypothesis suggests that the connection between peer achievement and adolescent math course taking will be strongest among adolescents already doing well in school. They will benefit more from academically oriented peers because their prior success will elicit more support from such peers, they have an existing academic foundation on which such peer influences can build, and they will more effectively use the information derived from such peer associations (Chen et al., 2003; Crosnoe & Needham, 2004; Nichols & White, 2001). Alternatively, the *protection* hypothesis asserts that this association will be strongest among students struggling in school. Given that prior course failures are a major risk factor for dropping out of math, the many resources available in academically oriented peer groups (e.g., instrumental assistance, support) will buffer this risk and reduce achievement-related differentials in math course taking (Crosnoe, Cavanagh, & Elder, 2003; Ma, 2001).

Once again, girls and boys will likely provide different levels of support for each of these competing hypotheses. Girls often shape their behavior and attitudes to maintain harmony in their close relationships. Alternatively, boys do so to maintain their status in the social hierarchies of their peer networks (Giordano, 2003). This pattern implies that girls' peer groups will prize congruence in academic behavior so that academically successful girls will be less likely to leave behind their less successful peers and more likely to help these peers. This pattern also implies that boys will be more concerned with separating themselves from the pack so that academically successful boys will be motivated to top their peers by taking higher level courses and less likely to help their struggling peers catch up in school. If so, then the protection hypothesis would hold for girls and the cumulative advantage hypothesis would hold for boys.

Overview of the Study

This study investigates gender differences in the academic contributions of peers to understand the potential equifinality in girls' and boys' navigation of the math curriculum of secondary school. It posits that girls' pathways through this institutional structure are more closely related to the academic achievement of their close friends, especially in the later grades of high school and especially when they are having trouble in school. It also posits that boys' same pathways are more closely related to the achievement of their coursemates, especially in the earlier grades of high school and especially when they are already successful at school.

The value of this framework is that it sets up the indepth exploration of gender differences in the role of peers in education that can be built on in the future. For example, future studies can identify the mechanisms of peer influence/selection that contribute in different ways to the math course taking of girls and boys, cover long-term trajectories of peer and academic pathways rather than year-to-year changes, and incorporate more fully the role of personal development. This kind of research establishes a strong, conceptual link between developmental and educational research by focusing attention on the social side of school.

Method

Data Source

Studying the connection between peers and course taking on a national scale was made possible by the combination of the National Longitudinal Study of Adolescent Health (Add Health), a leading public-use survey on the social and health behavior of American adolescents, and the Adolescent Health and Academic Achievement study (AHAA), a collection of high school transcripts linked to the Add Health sample. Next, we describe each of these data sets.

First, Add Health is a nationally representative sample of 7th to 12th graders in 1995 (Bearman, Jones, & Udry, 1997). Sampling began with the random selection of high schools from a sampling frame stratified by region, urbanicity, sector, racial composition, and size. These schools were then matched to a set of their feeder middle schools selected with a probability proportional to the feeder's student contribution to the high school. During the 1994 – 1995 academic year, nearly all students in these 132 sample schools completed the in-school survey, a paper-and-pencil questionnaire designed to create an individual-level sampling frame for later data collections. Of these 90,118 students, a subgroup selected evenly across high school—feeder school pairs participated in the in-home interview between April and December 1995 (Wave I, $N = 20,745$). These data were supplemented by data collected from a school administrator and parent for each adolescent. Except for high school seniors, Wave I respondents were followed up between April and September 1996 (Wave II, $N = 14,738$). Next, the Wave I respondents, this time including the original high school seniors, were followed up between August 2001 and April 2002 (Wave III, $N = 15,197$).

Second, AHAA collected the detailed educational data that were originally missing from Add Health (Muller et al., 2007). During the Wave III in-home interview, 91% of respondents authorized study personnel to collect their official school transcript from the last schools they had attended, leading to the eventual collection of official transcripts for 12,250 young people. These educational data are being released to the public in stages (see Muller, 2005).

The core sample for the present study consisted of Add Health adolescents enrolled in 9th to 11th grades in Wave I. Add Health had a multicohort design, and so some respondents participated in the Wave I inhome interview (the data source for the majority of variable construction in this study) as 7th graders, some as 8th graders, and so on. Yet, the design of our analyses (described later) required that we have Wave I interview data (to measure

adolescent characteristics and friends' characteristics) and high school transcript data (to measure coursemates' characteristics) in one year, followed by transcript data (to measure math course taking) in the next year. Only 9th, 10th, and 11th graders met this requirement. For example, 7th graders would not have Wave I interview data and high school transcript data in consecutive years, and 12th graders would not have transcript data in the year after their Wave I in-home interview. Although this narrower focus excluded a portion of the original Wave I sample, it did not bias the sample but instead shifted its representativeness to the 9th- to 11th-grade population.

From this sample of 11,396 adolescents in 72 high schools, we selected an analytical sample with two selection filters (53% White, 19% African American, 17% Latino/a, 8% Asian American, and 3% other race or ethnicity). Table 1 provides statistics for each stage of this selection process. The first filter limited the sample to the original Wave I respondents who were also Wave III participants in AHAA. The second excluded respondents who were not assigned sampling weights, which correct for Add Health design effects (see Chantala & Tabor, 1999). These filters led to a slight overrepresentation of younger, higher achieving White girls. Although not negligible, these biases were balanced by the necessity of each selection filter.

Measures

Adolescent academic factors—Two aspects of adolescents' academic performance were assessed: math course taking (the outcome of this study) and course failure index (a key independent variable). First, the standardized, hierarchical nature of math course enrollment in American secondary education lends itself to the identification of well-defined course sequences. Past research has used the National Educational Longitudinal Study to capture such sequences (Stevenson, Schiller, & Schneider, 1994), which are similar to those created with the AHAA transcript data. On any given transcript, each math class was assigned a Classification of Secondary School Courses code to create standardized categories across schools. These codes were then leveraged to identify 10 hierarchically ordered categories (0 = *No Math*; 1 = *Remedial Math*; 2 = *General Math*; 3 = *Pre-Algebra*; 4 = *Algebra I*; 5 = *Geometry*; 6 = *Algebra II*; 7 = *Advanced Math*, including *Algebra III*, *Statistics and Probability*, and *Discrete Math*; 8 = *Pre-Calculus*; 9 = *Calculus*). Students' values on this sequence for any grade level then designated the level of math in which they were enrolled during that year. As already discussed, the matching of the transcripts to Wave I can be complex because the first year of the transcript could correspond to Wave I or to 2 years before or after Wave I. Consequently, we adopted a Wave I + 1 strategy for the transcript data. For example, for 9th graders in Wave I, we used their 10th-grade course-taking information for the outcome, which was then predicted by independent variables created with Wave I data corresponding to 9th grade. Second, for the school year corresponding to Wave I, we created an index of academic failure capturing the ratio between the number of classes failed in that year to the number of classes taken. This taps low performance, as students who fail a higher percentage of their classes are clearly at-risk academically.

Friends' academic achievement—Network techniques allowed the identification of adolescents' close friends and the assessment of their academic achievement. In Add Health's in-school survey, adolescents were asked a battery of questions about specific friends, a maximum of five female and five male friends. Because the in-school survey was a near census of each school, most of these nominated friends also participated in Add Health. This network design allowed for the characteristics of most nominated friends to be measured directly from those friends (for more on network studies in Add Health, see Cavanagh, 2004; Haynie, 2001; Moody, 2001). The measure of friends' academic achievement, therefore, was the mean of all nominated friends' self-reported grade point averages (on a standard 4-point scale).

These network measures are valuable tools in peer research because they minimize problems associated with the tendency of young people to overestimate the degree to which their peers are similar to them and the incomplete information adolescents have about the lives of their peers (Kandel, 1996). Yet, they also introduce some other potential problems. For example, approximately one third of the analytical sample was missing on the friends' academic achievement variable. The largest portion of this group attended the few schools that did not allow the in-school survey to be administered there but did allow their students to participate in the in-home interviews. For these adolescents, we calculated friends' academic achievement with Wave I network data (which followed the in-school survey by a matter of months) and substituted that value. The next largest portion was missing because students nominated friends who did not attend Add Health schools or who did not report on their own grades. For this group, the sample mean of friends' academic achievement was imputed. The smallest portion consisted of social isolates who nominated no friends in the in-school survey. Of these isolates, the overwhelming majority did nominate friends in the Wave I survey, and therefore, again, we calculated friends' achievement with their Wave I network data and substituted that value. A small number of these isolates ($n = 43$) also nominated no friends in Wave I. These isolates were dropped from all analyses. Binary markers designating the three different kinds of imputation were included in all analyses in which the friends' achievement variable was used. These markers did not frequently or consistently predict the outcome (as a main effect or as part of an interaction term), suggesting that any bias introduced by imputation was small. This finding echoes past network research with Add Health (Crosnoe & Needham, 2004).

Coursemates' academic achievement—To gauge the characteristics of coursemates, this study drew on a novel use of the AHAA transcript data that identified peer groups that were more general than cliques but more socially defined than academic curricular tracks. A complete description of these techniques is available in a 2005 article by Field and colleagues, but the basic premise can be summarized here. Essentially, the AHAA team developed a clustering algorithm that adapted conventional network techniques to two-mode data (Frank, 1995). This algorithm reduced the data according to associations between pairs of students taking the same classes and pairs of courses that appeared together on student transcripts; in other words, it identified courses and student transcripts that grouped together. Each cluster—what Field and colleagues referred to as “local positions”—represents a specific, nonoverlapping course-taking pattern. One might be defined by participation in high-level coursework equivalent to a college-preparatory track. Another might be defined by band membership and the courses that go along with such membership, which has no track equivalent. These clusters, therefore, represent the fellow students with whom adolescents share similar social space in the high school and with whom they are most likely to interact. In this way, they fit the traditional definition of peers—similar to others who may or may not be friends (Steinberg, Brown, & Dornbusch, 1996).

In each Add Health high school, an average of 15 clusters was identified by applying this algorithm to all transcripts in the 1994 – 1995 school year (corresponding to Wave I) with Kliquefinder (Field et al., 2005; Frank, 1995). Adolescents were then assigned to clusters based on the degree to which their course-taking patterns fit the courses contained in the cluster. This strategy requires a few additional comments. First, the transcript information is on the level of courses (e.g., physics) and not classes (e.g., sixth-period physics), so that the clusters represent students taking the same kinds of courses and not necessarily those in the same classroom. Second, the clusters were created with transcript data from the 1994 – 1995 school year, but some schools had too few transcripts collected in this year to identify meaningful clusters. Consequently, the clustering analyses in these schools were supplemented with transcript data from the same students in the 1995 – 1996 school year, which assumed that clusters were relatively stable across years within schools. Third, some clusters that emerged from this analysis contained only one or two students. If these students' course-taking patterns had a

high probability of fitting another cluster, then they were reassigned. With this clustering solution, summary statistics of each cluster could be measured, including mean grade point average.

School-level control variables—Four school-level factors were included in all analyses to account for the different contexts of math course taking and the different pools of potential friends and classmates organized by schools. Reports of school administrators allowed the measurement of school sector (1 = *private*, 0 = *public*) and school size (number of students on school roster). In the in-school survey, adolescents reported the level of education of their most educated parent (1 = *less than high school*, 2 = *high school graduate*, 3 = *some post-secondary education*, 4 = *college graduate*, 5 = *post-graduate degree*). This individual-level measure was then averaged across all students in the school to approximate the socioeconomic status of the school. Finally, this aggregation procedure also allowed the measurement of school academic achievement using the individual-level grade point average measure.

Individual-level control variables—Five Wave I factors were controlled to account for demographic variability in the associations between peer relations and course taking: gender (1 = *female*, 0 = *male*), age (in years), race or ethnicity (dummy variables for White, African American, Hispanic American, Asian American, Other), parent education (described previously), and family structure (1 = *two biological parents*, 0 = *other family form*). Two other measures were included to account for varying levels of peer orientation: number of friends (a count of all friendship nominations) and involvement with friends. The latter replicated Cavanagh's (2004) Add Health measure, which consisted of the sum of adolescent reports of whether or not they had gone to the friend's house, hung out somewhere with the friend, talked on the telephone with the friend, and spent time with the friend, averaged across all nominated friends ($\alpha = .64$).

Procedure

Separately for girls and boys, math course taking was regressed on the individual- and school-level controls, course failure, and the two peer factors (academic achievement of friends and classmates). These models tested the friend and classmate hypotheses for each gender. Because math course taking in secondary school is largely sequential, the meaning of a math course varies across grades. For example, Algebra I enrollment connotes a different level of academic progress in 9th grade than in 11th grade. All models, therefore, had to be estimated within grade levels. These models tested the developmental and institutional constraints hypotheses for each gender. Finally, two interaction terms (each peer factor with the course failure index) were added to these gender-by-grade level models. Examination of these interaction terms tested the cumulative advantage and protection hypotheses for each gender.

The execution of this modeling plan was complicated by several factors. First, Add Health had a complex, school-based sampling frame with an unequal probability of selection. This violation of independence (e.g., two adolescents in the same school were likely more similar than two adolescents randomly drawn from the American population) and potential threat to representativeness (e.g., the over-sampling of some groups, like Cuban Americans) must be corrected. Second, the classmate clusters added a third layer to the multilayer nature of Add Health. All students were nested in classmate clusters, which, in turn, were nested in schools. Again, this structure had to be taken into account to produce accurate coefficients. We should note that the friendship measures did not introduce the same problem because they were in fact individual-level measures (e.g., unique to every individual) and not of a higher order.

For these reasons, all regressions were estimated with multilevel modeling. The mixed procedure in SAS (Singer, 1998) took Add Health's complex sampling frame into account,

allowed weighting, and estimated three levels (adolescent as Level 1, coursemate cluster as Level 2, and school as Level 3). Because we did not center the independent variables within clusters or schools, any cluster effects can be interpreted as the effect of all cluster members except the adolescent, any school effect as the effect of schoolmates not in the adolescents' coursemate cluster. For 9th-grade girls, the intraclass correlation for math course taking was .23 for the coursemate cluster and .18 for the school, meaning that about 23% of the variation in girls' math course taking occurred between coursemate clusters as opposed to within them and another 18% of this variation occurred between schools as opposed to within them. Corresponding values for the other groups were .33 and .11 (10th-grade girls), .33 and .05 (11th-grade girls), .36 and .27 (9th-grade boys), .41 and .13 (10th-grade boys), and .29 and .07 (11th-grade boys).

Of course, selection is an issue here. Essentially, associations between peer factors and course taking could result from the influence of peers or from adolescents' selection of peers for academic reasons (Crosnoe, 2000). Although this study could not completely disentangle these two processes, it did take steps to minimize the potential for selection bias. All models included a Wave I measure of the academic performance of the adolescents themselves, which protected against spurious associations between Wave I peer achievement (either friend or coursemate) and later math course taking. Moreover, all models were reestimated with a control for Wave I math course-taking level. Despite the conservative nature of this lagged modeling strategy (see Glazerman, Levy, & Myers, 2003), it did not substantially alter the results of this study.

Results

Overall Comparisons of Girls and Boys

Before turning to multivariate analyses, we first provide a basic overview of the analytical sample, including a direct comparison of girls and boys on specific factors. Table 2 presents descriptive statistics for—and correlations among—all study variables. Table 3 presents descriptive statistics for the academic and peer factors separately for girls and boys.

Focusing on Table 3, girls had a slightly but significantly higher math course level, on average, than boys. Yet, we should point out that Algebra I (4 on the math course sequence scale) was roughly the average for both girls and boys in our sample, which makes sense given that 10th grade was the modal grade level. Girls also failed a significantly smaller proportion of their courses than boys, and their friends and classmates tended to make slightly better grades than those of boys. Thus, girls and their peers were more academically oriented, overall, than boys during high school.

Peer Context and the Math Course Taking of Adolescent Girls and Boys

Table 4 contains the results of the three-level (students nested in coursemate clusters nested in schools) model of girls' math course taking by grade level. Table 5 contains the corresponding results for boys. These results can adjudicate between each of the first two sets of competing hypotheses, but before doing that, we make mention of a few general patterns across the six gender-by-grade level models contained in these two tables.

Controlling for demographic characteristics and aspects of peer orientation (number of and involvement with friends), adolescent course failure in one school year predicted lower levels of math course taking in the subsequent year for 9th- and 10th-grade girls and for boys in each grade. Friends' academic achievement also predicted higher levels of later math course taking across the board. Moreover, classmates' achievement significantly predicted higher levels of later math course taking in the 11th and 10th grades for girls.

At the same time, taking the two peer factors in and out of the models in Table 4 and Table 5 revealed that their inclusion always improved model fit (as evidenced by a significant decrease in the 2 Res Log Likelihood statistic relative to the change in degrees of freedom) and always attenuated the association between adolescent course failure and later math course taking. This attenuation was typically greater for boys and increased across grade levels for both boys and girls. Among the demographic characteristics, age, parent education, and family structure were the most consistent predictors of math course taking across gender-by-grade level models. Finally, the school factors were weakly associated with math course taking in general once all individual, family, and peer characteristics were taken into account, especially for girls.

Friends Versus Coursemates

The first set of competing hypotheses concerned whether friends' or coursemates' academic achievement better predicted adolescent math course taking. Recall that we expected the former to be truer for girls, the latter for boys. In both Table 4 and Table 5, the β coefficients are the focus. These coefficients were standardized to take into account the grade-level differences in variation in the predictors and outcome. They represent the standard deviation change in the outcome associated with a one-unit change in the predictor. Thus, comparing β coefficients for friends' achievement to those for coursemates' achievement *within* each gender-by-grade level model reveals which is most strongly associated with the outcome in that model.

For girls, the β coefficient for friends' achievement significantly exceeded the β coefficient for coursemates' achievement in 9th and 10th grades. Boys' β coefficients for friends' achievement significantly exceeded their β coefficients for coursemates' achievement in 9th and 11th grades. The exception was 10th grade boys for whom the β coefficient for coursemates' achievement exceeded the β coefficient for friends' achievement.

The weight of the evidence in Table 4 and Table 5, therefore, points toward the friend hypothesis over the coursemate hypothesis. This *relatively* greater importance of friends was more clearly evident among girls than boys, in that coursemates never outweighed friends for the former but did outweigh friends in at least one grade for the latter. Thus, in line with expectations, the friend hypothesis had more consistent support among girls.

Development Versus Institutional Constraints

The second set of competing hypotheses concerned whether the contribution of the two peer factors to adolescent math course taking increased or decreased across grade levels. Our expectation was that girls would be more likely to demonstrate an increase, boys a decrease. Recall that Table 4 and Table 5 contain β coefficients. Technically, B coefficients are the appropriate focus for this comparison (with t tests) of coefficients for the same variables in different models. Yet, the two kinds of coefficients both reveal the same pattern in Table 4 and Table 5 and therefore either set of coefficients can be examined.

For girls, the association between friends' achievement and math course taking did not differ significantly between 9th and 10th grades. This association, however, was significantly stronger for the 11th-grade girls than for either the 9th- or 10th-grade girls. This exact same pattern held for coursemates' achievement. In other words, the achievement level of peers was most strongly associated with girls' math course taking at the end of high school. For boys, the association between friends' achievement and math course taking was also strongest in the 11th-grade model. The association between coursemates' achievement and their math course taking, however, was strongest in the 10th-grade model.

In sum, these within-gender grade-level comparisons revealed more evidence for the institutional constraints hypothesis than the developmental hypothesis. In general, the peer

factor was most closely related to course taking in the highest grade examined. Again, boys' coursemates were the one exception. Thus, in line with expectations, the institutional constraints hypothesis had more consistent evidence among girls.

Cumulative Advantage Versus Protection

The final set of competing hypotheses concerned the interplay of peer factors with adolescent course failure and the contribution of this interplay to math course taking. Recall that we expected the association between the peer factors and the math course taking to be stronger for girls struggling in school—a pattern referred to as protection because a peer resource for success matters more for students already at a *disadvantage* in school. We also expected this association to be stronger for boys doing well in school—a pattern referred to as cumulative advantage because a peer resource for success matters more for students already at an *advantage* in school. Thus, our interest was not in who had the highest math course taking but instead in who benefited the most from academically oriented peers. To assess these hypotheses, we added interaction terms (course failure index with both friends' and coursemates' achievement) to each of the gender-by-grade level models described previously. See Table 6 for the partial results for girls and Table 7 for the corresponding results for boys.

According to Table 6, adolescent course failure interacted with one peer factor in each grade level among girls: Failure Index $\times$ Coursemates' Achievement (9th grade), Failure Index $\times$ Friends' Achievement (10th grade), and Failure Index $\times$ Coursemates' Achievement (11th grade). According to Table 7, it interacted significantly with coursemates' achievement in 10th and 11th grades among boys.

Raw coefficients for interactions terms are difficult to interpret, and therefore one conventional method of interpretation is to graph significant interactions by calculating predicted levels of the outcome for different archetypal groups in the sample representing the different possible combinations of the two independent variables in the interaction term (see Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995). To interpret the five interaction terms in Table 6 and Table 7, we calculated and graphed the mathcourse-taking level for four types of adolescents within each gender and grade level: (a) students who had low levels of academic failure (1 *SD* below the sample mean of the failure index) and who scored low on the peer factor (1 *SD* below the mean for friends' achievement or coursemates' achievement, depending on the model), (b) students who had low levels of academic failure and who scored high on the peer factor (1 *SD* above the sample mean for friends' achievement or coursemates' achievement, depending on the model), (c) students who had high levels of academic failure (1 *SD* above the sample mean of the failure index) and who scored low on the peer factor, (d) students who had high levels of academic failure and who scored high on the peer factor. All other variables in each model were held to their sample means or modes.

These calculations—which were based on the unstandardized *B* coefficients—revealed that all significant interaction terms followed a similar pattern. Figure 1, which charts the predicted levels of math course taking for the four archetypal groups of 10th-grade girls, shows this representative pattern in graphical form. The first set of bars in Figure 1 compares the math course taking of girls with no prior record of course failure. In this group, girls with low-achieving friends were in a significantly lower math course level the next year (5.27, or geometry) compared to their counterparts with high-achieving friends (6.0, or Algebra II). The same pattern is evident in the second set of bars in Figure 1, which compares the math course taking of girls who had previously failed at least one class. Girls with low-achieving friends had a lower math level the next year (4.11, hovering around the pre-algebra/Algebra I distinction) than girls with high-achieving friends (4.44, or Algebra I).

The difference between the two sets of bars in Figure 1, therefore, was not in the benefit of high-achieving friends (they were associated with higher course taking for both groups of girls) but, instead, in the degree of this benefit (this association was stronger for girls who had not failed any classes). In other words, high-achieving friends always had a positive effect, but this positive effect was less pronounced for girls who had already struggled in school. In the end, the advantage of prior success in school over prior problems in school was amplified by the presence of high-achieving friends. It accumulated. Again, this pattern held—with some variation in absolute levels and group differences—across the five focal interaction terms.

Thus, Table 6 and Table 7 provide consistent evidence for the cumulative advantage hypothesis over the protection hypothesis, in that peers' achievement (sometimes friends, sometimes coursemates) was associated with larger math-course-taking gaps between academically struggling and successful adolescents rather than smaller ones. Overall, this pattern held for both girls and boys. It was, however, somewhat more consistent for the former, suggesting that the cumulative advantage unexpectedly held more for girls than boys.

Discussion

The focal point of this study was the potential for a gendered equifinality in the math careers of girls and boys in secondary school and, more specifically, the role of peers in this equifinality. Recall that, as a rhetorical device, we established three sets of competing hypotheses—each with its own gender expectation—to pinpoint various aspects of this divergence. These three sets will organize this discussion. For each set, we identify the hypothesis with the most support and then discuss the implications of these results for the peer and educational literatures. Before doing this, we should note something very important. Girls and boys were more alike than different in the connection between their peer contexts and their math course taking. They took similar routes to the same endpoint, but the slight gender deviations along these routes were telling in their own ways. Understanding these gender deviations identifies when girls and boys may be at risk of dropping out of math and what resources they made need to counter this risk.

Starting with the first set of competing hypotheses, the relative contribution of friends' and coursemates' academic achievement to adolescents' math course taking was assessed. According to the friend hypothesis, the achievement of friends should be the important factor in adolescents' navigation of the math curriculum. According to the coursemate hypothesis, the achievement level of fellow students who take similar kinds of classes should be more important. Consistently across gender-by-grade level models, friends' achievement had stronger associations with adolescents' math course taking than did coursemates' achievement. This pattern lent support for the friend hypothesis over the coursemate hypothesis. As expected, this pattern was more consistent among girls (for whom coursemates were never more important than friends) than among boys (for whom coursemates were more important than friends in at least one grade). Worth stressing is that, in general, *both* friends' and coursemates' achievement were associated with adolescents' course taking in math, even after controlling for a variety of demographic and school factors. Yes, family factors, such as parent education and family structure, were important to adolescent course taking and so the family context cannot be discounted. Yet, close relationships with academically oriented peers, especially friends, may be a key resource for adolescents from all types of family backgrounds as they navigate educational trajectories in math.

In terms of the peer literature, these findings reveal the independent ways that different levels of peer context are connected to adolescent development. Studying close friends is certainly an important part of understanding child and adolescent development. These friendships mean a great deal to young people and they serve as context for learning about the world and learning about the self (Collins & Laursen, 2004; Hartup & Stevens, 1997). For these reasons,

adolescents are going to look to their close friends when they make important decisions such as whether to take math and what math class to take (Chen et al., 2003; Ryan, 2001). Yet, close friends are not the only peers in an adolescent's life and they are not the only source of influence. The larger band of peers in school from which friendships often arise is also important. As demonstrated by psychologists (Brown & Klute, 2003), sociologists (Giordano, 2003), and economists (Akerlof & Kranton, 2002), this band of peers has influence that goes beyond emotional attachments. It provides the standards by which adolescents evaluate themselves, a pool of competitors, and the people who need to be impressed. Interest in this band of peers does not negate interest in friends. Nor does the importance of friends imply that larger circles of the peer context are less valuable foci of research. This study has demonstrated that both close friends and coursemates matter. Each provides *additive* power.

This distinction between close friends and peers echoes the distinction between strong ties and weak ties in the sociological and economic literatures on adults (see Granovetter, 1995). In these literatures, constantly comparing and contrasting the value of strong ties to weak ties, rather than focusing on one or the other, has contributed to the development of theoretical models about the connection between adults' lives and their social networks and communities. This strategy can be applied to adolescence. Recent attempts to employ such a strategy are starting to reveal new insights about the connections between peers, youth culture, and adolescent development (Giordano, 2003; Orenstein, 1994). This study has extended that developmental focus to consider education. Some research in this area has paid special attention to gender (Bearman & Bruckner, 1999). This study found many gender similarities in the relative importance of friends and coursemates to adolescent math course taking, but it also revealed gender differences in this relative importance at certain points of high school (see 10th-grade results). Both similarities and differences are important to understanding the socializing power of peers during adolescence.

The second set of competing hypotheses concerned grade-level differences in the associations of the two peer factors with adolescents' math course taking. According to the developmental hypothesis, peers should matter *less* among older adolescents, who are typically more dissatisfied with conformity, are more mature and have wider social networks. According to the institutional constraints hypothesis, peers should matter *more* among older adolescents, who have much larger choice sets in deciding their course-taking schedules. Consistently, both friends' achievement and coursemates' achievement had stronger associations with math course taking in the later grades of high school than in the earlier grades. Among girls, this pattern held for friends' achievement and coursemates' achievement. Among boys, it held for friends' achievement. Together, this evidence supports the institutional constraints hypothesis more than the developmental hypothesis. Past research in developmental psychology and criminology has effectively demonstrated that peer influences on general adolescent behavior decline with age and, by proxy, grade (Brown et al., 1986; Warr, 1993), but this developmental phenomenon did not apply to the educational outcome in this study.

This greater evidence for the institutional constraints hypothesis is relevant to both the peer and the educational literatures. As coursework becomes more optional in the shopping mall high school (Powell et al., 1985), social factors have more room to influence course-taking decisions. Thus, peer norms matter more to coursework at the end of high school even though general peer influences (e.g., influences on drinking, delinquency, or dress) are weakening. Alternatively, peer influences may be more important to course-taking decisions at the end of high school because that is the stage of high school in which the direct link between current academic decisions and future educational trajectories will be most apparent to students. Either way, this finding of a pattern orthogonal to the conventional age-graded pattern of peer influence suggests that the connection between peer norms and adolescent behavior is conditioned by the opportunities and restrictions put in place by social and institutional contexts

of adolescence. The tendency for both levels of peer context to demonstrate this institutional constraints pattern among girls suggests that girls may particularly benefit from the support of academically oriented peers at the critical point of the decision to enroll in voluntary advanced math classes (e.g., calculus) that they perceive as inhospitable. In both cases, a consideration of changes in peer context and influence over time should be taken into account in attempts to promote math course taking in secondary school.

As for the third set of competing hypotheses, the possibility that the significance of peers varies across different types of adolescents was assessed. The protection hypothesis was drawn from the risk and resilience literature (Jessor et al., 1995). Essentially, protection occurs when a peer resource matters more for an adolescent already at a disadvantage at school; in this case, an academically struggling student. Alternatively, the cumulative advantage hypothesis was drawn from the stratification literature (Mirowsky & Ross, 2003). Cumulative advantage occurs when a peer resource matters more for an already successful student. The significant interactions between peer achievement and adolescent course failures consistently indicated that the association between friends' and coursemates' achievement on one hand and adolescents' math course taking on the other was stronger among students who had no prior record of academic failure than among students with such a record. In other words, the course-taking advantage of academically successful students over academic struggling students was larger in high-achieving peer contexts than in other peer contexts. This pattern held in each grade level for girls and in two grade levels for boys. Overall, this evidence supports the cumulative advantage hypothesis—a peer advantage amplified an academic advantage—over the protection hypothesis.

This observed process of cumulative advantage echoes a major theme of both educational and developmental research. In the educational system, students who are already well positioned for success are often better able to capitalize on new resources. This pattern has been demonstrated in relation to curriculum, school organization, and other structural and institutional factors (Lucas, 1999). The results of this study suggest that this same pattern extends to the informal, social processes of schooling too. Beyond the academic realm, cumulative advantage occurs in a variety of developmental and behavioral interventions. Essentially, efforts to supply at-risk youth with positive supports and opportunities help them do better. Yet, they do even more to help youth who are not at risk, which leads to larger disparities between groups (Ceci & Papierno, 2005). In this study, the at risk students (those with a history of failure) did benefit from associations with high-achieving peers in that they persisted farther in math than they might have otherwise. Yet, despite this benefit, they still lost ground. Thus, educational policies that are relevant to the peer organization of schools (e.g., curricular design, school enrollment strategies) must assess the possible trade-offs between increased overall performance levels and increased within-school performance disparities. Research on race and education (see Ainsworth-Darnell & Downey, 1998; Moody, 2001) has begun to inform educational policy in this way and research on gender and education should do the same.

Future research can tackle the mechanisms largely unexplored by this study. Specifically, mechanisms can refer to the different ways that various peer contexts exert influence on adolescents (see Berndt & Keefe, 1995) or the pathways by which peer contexts are related to the personal beliefs and self-evaluations that shape academic decision making (see Eccles & Wigfield, 2002). Also needed is a clearer resolution of the selection issue. This study controlled for academic competencies and related individual and contextual factors that could select adolescents into academically oriented peer contexts and higher level courses, but more sophisticated statistical techniques (e.g., propensity score matching) could be useful. Another necessary improvement to this line of research is the switch from a comparison of short longitudinal windows (e.g., comparison of 2-year periods across grade levels) to a longer term

longitudinal framework in which students' pathways are charted from the beginning to the end of high school. Doing so was not possible in this study but may be possible with other data sources.

This study has been woven around two important, but often disconnected, themes in research on young people: differences in girls' and boys' experiences in math and the developmental significance of peer relations. Our argument is that these two themes can be integrated to the benefit of both literatures. First, given the evidence of the role of social influences on decision making in math (Hyde & Kling, 2001), a careful consideration of peer relations in educational research can inform attempts to understand points of divergence *and* convergence in the school careers of girls and boys. Second, given evidence that math course taking in secondary school is crucial to long-term educational and occupational trajectories (Adelman, 1999), a careful consideration of math outcomes in peer research can help to identify concrete mechanisms by which peer relations in adolescence shape the transition into adulthood. Integrating the theory and data of multiple disciplines is the best way to meet both of these goals.

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Figure 1.
Math-course-taking level in two groups of 10th-grade girls.

Table 1

Sample Characteristics at Each Stage of Selection Process

Adolescent characteristics	Sample 1 (<i>n</i> = 11,396)		Sample 2 (<i>n</i> = 6,799)		Sample 3 (<i>n</i> = 6,457)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Female (proportion)	0.50	0.50	0.51	0.50	0.51	0.50
Age (years)	16.50	1.01	16.45	1.21	16.45	1.00
White (proportion)	0.50	0.50	0.52	0.50	0.53	0.50
Academic achievement (grade point average)	2.69	0.77	2.75	0.77	2.76	0.77

Note. Sample 1 included all 9th-, 10th-, and 11th-grade students in Wave I. Sample 2 included all members of Sample 1 who also participated in Wave III and had transcripts collected. Sample 3 (the final analytical sample of the study) included all members of Sample 2 who also had valid sampling weights.

Table 2

Descriptive Statistics for All Study Variables ($n = 6,457$)

Study variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Gender (female)	—	—																	
Age	-.09**	-.05**																	
White	-.02	-.01	—																
African American	.06**	.04*	—	—															
Hispanic American	-.02	.03**	—	—	—														
Asian American	-.04**	-.01	—	—	—	—													
Other race/ethnicity	.01	-.10**	—	—	—	—	—												
Parent education	-.03*	.12**	.03	-.26**	.09**	-.01	—												
Family structure (1 = <i>two parent</i>)	-.02	-.06**	.08**	-.20**	.03*	.10**	.01	.13**	—										
Involvement with friends	.04**	.08**	.15**	-.11**	-.04**	-.05**	-.01	.03**	-.01	—									
Number of friends	.15**	-.11**	.13**	-.06**	-.09**	-.04**	.04*	.10**	.04**	.24**	—								
Adolescent course failure index	-.09**	.08**	-.07**	.03*	.10**	-.07**	-.01	-.18**	-.13**	.04**	-.11**	—							
School sector (1 = <i>private</i>)	-.05	-.05**	.08**	-.37**	-.07*	.00	.01	.17**	.08**	-.01	.05**	-.12**	—						
School size	-.01	.08**	-.35**	-.02	.41**	.13**	-.04**	-.06**	-.01	-.04*	-.14**	.09**	-.30**	—					
School socioeconomic status	-.01	-.08**	.16**	-.04**	.11**	.19**	-.01	.31**	.08**	-.01	.00	-.09**	.41**	.25**	—				
School academic achievement	.00	-.08**	.26**	-.12**	-.23**	.03*	-.02*	.19**	.11**	.05**	.06**	-.16**	.41**	-.32**	.29**	—			
Friends' academic Achievement	.01	-.05**	.12**	-.12**	-.13**	.14**	-.03*	.19**	.12**	-.02*	.06**	-.26**	.14**	-.13**	.13**	.37**	—		
Coursemates' academic achieve	.04**	-.06**	.18**	-.11**	-.17**	.06**	-.01*	.21**	.12**	.03*	.11**	-.30**	.26**	-.18**	.22**	.51**	.33**	—	
Math course taking	.03**	-.18**	.03*	-.02*	-.08**	.12**	-.02*	.24**	.15**	-.05**	.14**	-.29**	.10**	.04**	.18**	.13**	.24**	.23**	—
<i>M</i>	.051	16.45	.053	.019	.017	.008	.003	3.01	.056	2.25	5.58	.014	0.07	1379.38	2.59	2.76	2.80	2.79	4.33
<i>SD</i>	0.50	1.00	0.50	0.39	0.37	0.28	0.17	1.25	0.50	0.91	4.19	0.24	0.26	828.17	0.31	0.23	0.50	0.32	2.76

* $p < .05$.

**. $p < .01$.

Table 3

Descriptive Statistics for Adolescent and Peer Factors, by Gender

Adolescent/peer factors	Girls (<i>n</i> = 3,314)		Boys (<i>n</i> = 3,143)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Adolescent Academic Factors				
Math course taking	4.42 _a	2.75	4.23 _b	2.77
Adolescent course failure index	0.12 _a	0.22	0.16 _b	0.25
Peer Factors				
Friends' academic achievement	2.81	0.50	2.79	0.50
Coursemates' academic achievement	2.81 _a	0.32	2.78 _b	0.31

Note. Means with different subscripts differ significantly ($p < .01$) according to one-way analysis of variance and Duncan tests.

Table 4
Coefficients From Multilevel Models Predicting Girls' Course Taking, by Grade

Predictors	9th grade (<i>n</i> = 955)			10th grade (<i>n</i> = 1,078)			11th grade (<i>n</i> = 1,016)		
	<i>B</i>	<i>SE B</i>	<i>β</i>	<i>B</i>	<i>SE B</i>	<i>β</i>	<i>B</i>	<i>SE B</i>	<i>β</i>
Age (years)	−0.36	0.09	−.12**	−0.30	0.12	−.07**	−0.27	0.20	−.04
Race/ethnicity (vs. White)									
African American	−0.17	0.16	−.04	0.43	0.22	−.07†	0.40	0.35	−.05
Hispanic American	0.12	0.19	−.03	0.43	0.27	−.06	0.36	0.41	.03
Asian American	−0.09	0.31	−.01	0.19	0.40	.02	1.49	0.56	.13**
Other race/ethnicity	0.24	0.23	.03	−1.18	0.39	−.08*	0.06	0.63	.00
Parent education	0.19	0.04	.14**	0.16	0.06	.07*	0.18	0.10	.06*
Family structure (1 = <i>two parent</i>)	0.23	0.10	.07*	0.38	0.13	.07**	0.33	0.22	.05
Number of friends	0.02	0.02	.04	0.08	0.03	.10*	0.00	0.04	.00
Involvement with friends	−0.01	0.06	−.01	−0.18	0.08	−.06*	0.16	0.13	.04
School sector (1 = <i>private</i>)	0.16	0.39	.03	0.89	0.66	.09	0.47	0.86	.03
School size	0.00	0.00	.02	0.01	0.00	.22*	0.01	0.00	.02
School socioeconomic status	−0.21	0.35	−.04	0.88	0.59	.10	0.07	0.79	.01
School academic achievement	−0.21	0.48	−.03	−0.43	0.84	−.04	2.44	1.09	.23**
Adolescent and Peer Factors									
Adolescent failure index	−2.20	0.23	−.29**	−3.63	0.33	−.31**	−0.56	0.54	−.05
Friends' achievement	0.49	0.11	.13**	0.66	0.15	.13**	1.15	0.23	.16**
Coursemates' achievement	0.03	0.25	.01	0.34	0.37	.04	1.30	0.53	.13*

Note. All models had three levels (students, coursemate clusters, and schools) with a random intercept for the outcome across coursemate clusters and schools. Binary markers of imputation for peer variables were included as controls.

† $p < .10$.

* $p < .05$.

** $p < .01$.

Δlog likelihood (vs. baseline model) = −17.1** (9th), −21.4** (10th), −44.8** (11th).

Table 5
Coefficients From Multilevel Models Predicting Girls' Course Taking, by Grade

Predictors	9th grade (<i>n</i> = 891)			10th grade (<i>n</i> = 978)			11th grade (<i>n</i> = 1,001)		
	B	SE B	β	B	SE B	β	B	SE B	β
Age (years)	−0.48	0.08	−.18**	−0.57	0.11	−.15**	−0.38	0.16	−.07*
Race/ethnicity (vs. White)									
African American	0.03	0.18	−.01	0.20	0.24	−.03	−0.29	0.37	−.03
Hispanic American	−0.06	0.21	−.01	0.06	0.26	.00	−0.45	0.38	−.05
Asian American	0.22	0.25	.03	0.80	0.36	.09*	0.65	0.51	.06
Other race/ethnicity	−0.09	0.33	−.01	0.38	0.37	.03	1.13	0.79	.05
Parent education	0.08	0.05	.05*	0.37	0.07	.18**	0.27	0.09	.10*
Family structure (1 = <i>two parent</i>)	0.27	0.11	.07*	0.24	0.15	.05	0.23	0.21	.03
Number of friends	0.05	0.02	.10**	0.07	0.02	.09**	0.02	0.04	.02
Involvement with friends	−0.07	0.06	−.03	−0.14	0.08	−.05†	−0.20	0.10	−.06
School sector (1 = <i>private</i>)	0.24	0.41	.04	0.22	0.58	.02	−0.33	0.80	−.02
School size	0.01	0.00	.09†	0.00	0.00	.16**	0.00	0.00	.05
School socioeconomic status	0.89	0.38	.15*	0.56	0.55	.07	1.39	0.75	.12†
School academic achievement	−0.18	0.52	−.02	−1.07	0.79	−.09	−0.80	1.00	−.05
Adolescent and Peer Factors									
Adolescent failure index	−1.14	0.22	−.16**	−1.70	0.31	−.17**	−2.06	0.48	−.14**
Friends' achievement	0.65	0.10	.18**	0.46	0.17	.09*	1.45	0.24	.22**
Coursemates' achievement	0.40	0.26	.06	2.01	0.42	.21**	0.36	0.45	.04

Note. All models had three levels (students, coursemate clusters, and schools) with a random intercept for the outcome across coursemate clusters and schools. Binary markers of imputation for peer variables were included as controls.

†
 $p < .10$.

*
 $p < .05$.

**
 $p < .01$.

Δ log likelihood (vs. baseline model) = −44.1** (9th), −29.0** (10th), −116.3** (11th).

Table 6
Selected Coefficients From Multilevel Models Predicting Girls' Math Course Taking, by Grade, With Interaction Terms

Predictors	9th grade (<i>n</i> = 955)			10th grade (<i>n</i> = 1,078)			11th grade (<i>n</i> = 1,016)		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Adolescent and Peer Factors									
Adolescent failure index (AFI)	6.17	2.59	.81*	0.57	3.01	.05	12.58	5.08	.75*
Friends' achievement (FA)	0.62	0.12	.19**	1.01	0.18	.20**	1.32	0.27	.19**
Coursemates' achievement (CA)	0.37	0.29	.06	-0.05	0.42	-.01	1.57	0.46	.15**
Adolescent $\times$ Peer Interactions									
AFI $\times$ FA	-0.74	0.53	-.26	-2.40	0.73	-.52**	-0.91	1.08	-.14
AFI $\times$ CA	-2.15	0.90	-.76*	0.90	0.97	.20	-3.85	1.84	-.61**

Note. Models controlled for age, race or ethnicity, parent education, family structure, number of friends, involvement with friends, and school sector, size, socioeconomic status, and achievement. Models had three levels with a random intercept. Binary markers of imputation for peer variables were included as controls and were interacted with the failure index.

*
 $p < .05$.

**
 $p < .01$.

Δ log likelihood (vs. baseline model) = -30.6** (9th), -26.3** (10th), -25.5** (11th).

Table 7
Selected Coefficients From Multilevel Models Predicting Boys' Math Course Taking, by Grade, With Interaction Terms

Predictors	9th grade (<i>n</i> = 891)			10th grade (<i>n</i> = 978)			11th grade (<i>n</i> = 1,001)		
	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
<i>Adolescent and Peer Factors</i>									
Adolescent failure index (AFI)	−0.93	1.88	−.13	2.35	3.17	.23	8.53	2.62	.57*
Friends' achievement (FA)	0.51	0.13	.14**	0.58	0.21	.11**	1.58	0.27	.23**
Coursemates' achievement (CA)	0.61	0.31	.10*	2.08	0.49	.22**	1.11	0.53	.11*
<i>Adolescent × Peer Interactions</i>									
AFI × FA	0.55	0.46	.21	−0.50	0.70	−.13	−1.00	1.03	−.17
AFI × CA	−0.75	0.58	−.28	−1.03	1.12	−.27**	−3.24	1.15	−.56*

Note. Models controlled for age, race or ethnicity, parent education, family structure, number of friends, involvement with friends, and school sector, size, socioeconomic status, and achievement. Models had three levels with a random intercept. Binary markers of imputation for peer variables were included as controls and were interacted with the failure index.

* $p < .05$.

** $p < .01$.

Δ log likelihood (vs. baseline model) = −8.5* (9th), 18.3** (10th), −34.4** (11th).