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The Contribution of Extracurricular Activities to Adolescent Friendships: New Insights through Social Network Analysis

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Abstract

Extracurricular activities are settings that are theorized to help adolescents maintain existing friendships and develop new friendships. The overarching goal of the current investigation was to examine whether co-participating in school-based extracurricular activities supported adolescents' school-based friendships. We utilized social network methods and data from the National Longitudinal Study of Adolescent Health to examine whether dyadic friendship ties were more likely to exist among activity co-participants while controlling for alternative friendship processes, namely dyadic homophily (e.g., demographic and behavioral similarities) and network-level processes (e.g., triadic closure). Results provide strong evidence that activities were associated with current friendships and promoted the formation of new friendships. These associations varied based on school level (i.e., middle versus high school) and activity type (i.e., sports, academic, arts). Results of this study provide new insight into the complex relations between activities and friendship that can inform theories of their developmental outcomes.

Keywords

adolescence; extracurricular activities; social networks; friendships; homophily

According to Ecological theory (Bronfenbrenner & Morris, 2006), adolescents' friendships are nested within multiple larger settings, such as schools. A question that is all too often overlooked is why do certain adolescents within these larger settings become friends but not others? The peer homophily literature emphasizes similarities between people as the primary factor promoting friendships (e.g., McPherson, Smith-Lovin, Cook, 2001; Hallinan & Williams, 1989; Hamm, 2000). However, of the homophilous friendships that are possible only a small number ever form. Another mechanism that has received attention by developmentalists is extracurricular activities. Much of this research has focused on the positive outcomes of school-based extracurricular activities, including high school graduation and development of critical life skills (Mahoney, Vandell, Simpkins, & Zarrett, 2009). Although scholars have theorized that activity-based friendships play a prominent role in producing these outcomes (e.g., Urberg, Degirmencioglu, & Tolson, 1998; Eccles & Barber, 1999), very little work has directly examined how activity settings promote friendships at the dyadic and network levels.

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The overarching goal of the current investigation is to examine whether co-participating in a school-based extracurricular activity supported friendships among adolescents at the same school. To address this goal, we utilize social network analysis to answer developmental questions about adolescents' extracurricular activities and friendships. We use the National Longitudinal Study of Adolescent Health (Add Health) to examine whether friendships were more likely among activity co-participants while controlling for processes the psychology and sociology literatures have shown promote friendships, namely dyadic homophily (e.g., demographic and behavior similarities) and network-level processes (e.g., triadic closure). In addition to this overarching goal, we examine whether the association between activity co-participation and friendship varied (a) between middle and high school, (b) based on the type of activity (i.e., sports, academic, arts), and (c) across time.

The Role of Extracurricular Activity Settings in Adolescents' Friendships

Theory and empirical work suggest that extracurricular activity settings have three characteristics that promote friendships. First, Focus Theory posits that regular, sustained contact centered around an activity increases the likelihood that friendships will develop (Feld, 1981). The consistency of extracurricular activities provides the basic environment for adolescents to spend time with each other. Second, extracurricular activities afford experiences that build relationships among co-participants, such as teamwork and emotion regulation (Larson, 2000). These skills learned during activities can help adolescents maintain current friendships and develop new ones. Third, extracurricular activities tend to bring together adolescents with similar interests who are, hence, appealing to one another as friends (Fredricks et al., 2002; Loder & Hirsch, 2003; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). In fact, activity co-participation has been shown to promote friendships that are unlikely according to the peer homophily literature, such as cross-race and cross-age friendships (Dworkin et al., 2003; Hansen et al., 2003; Khmelkov & Hallinan, 1999).

Prior research has largely focused on the concurrent relation between activity participation and friendships (e.g., Darling, Caldwell, & Smith, 2005; Eccles & Barber, 1999). However, it is likely that these concurrent associations are the result of two processes that unfold over time. Adolescents join an activity to spend time with friends they met before the activity (e.g., Loder & Hirsch, 2003). At the same time, adolescents develop new friendships with peers they meet at an activity (Larson, Hansen, & Moneta, 2006). In other words, activities are theorized as a setting to help maintain existing friendships and form new ones.

The Association between Activities and Friendships in Middle Schools and High Schools

There are key developmental reasons to expect a stronger positive association between activity co-participation and friendships for high school students than middle school students. Scholars theorize that youth's organized activities, identity, and friendships are part of a synergistic system where the three influence one another over time (Eccles & Barber, 1999). Research also suggests there are changes in these three components throughout development. For example, identity theories maintain that adolescents develop a more well-defined sense of self as they age (Kroger, 2007). Parallel research suggests that adolescents become more specialized in their activity participation with age and that the activities they participate in correspond to their identity (e.g., Denault & Poulin, 2009b; Eccles & Barber, 1999; Mahoney et al., 2009). In other words, older adolescents have a stronger sense of who they are and what they like to do after school than younger adolescents. We propose that these developmental changes have implications for the strength of the relation relations between activities and friendships. Specifically, we expect that activities and friendships will evidence a stronger positive relation for high school

students than middle school students. This is likely because high school students may be more likely to select activities based on friendships and to develop new friendships based on co-participation compared to middle school students.

In addition to developmental differences, there are important structural differences between middle and high schools. The typically larger size of high schools is particularly germane to the questions at hand. Although larger schools often offer more activities, they have lower rates of activity participation, particularly in nonacademic activities (Crosnoe, Johnson, & Elder, 2004; Lay, 2007). This suggests that students in larger schools may be more selective in the activities they pursue, which would produce greater similarity among participants. Moreover, extracurricular activities may serve a more important sorting function for adolescents in large schools by identifying other students with similar interests. As a result, we expected friendships and activities to be positively associated in all contexts, but more strongly associated in high school compared to middle school.

The Association between Activities and Friendships across Different Activity Types

Though there is theoretical and empirical evidence suggesting that the association between friendships and activity participation varies by activity type, to our knowledge, the relation has not been empirically tested. Three main types of school-based activities include sports, performing arts, and academic clubs (e.g., Eccles, & Barber, 1999). Participation in these activities is associated with different “crowds” or peer group affiliations (Brown & Dietz, 2009). Participants in activities associated with high social status, such as sports, may receive more gestures of friendship from non-participants than participants in art or academic activities (Coleman, 1996; Brown & Dietz, 2009; Eccles & Barber, 1999). As a result, sport participants might display lower levels of friendships among co-participants because their higher status will provide them greater opportunities for friendships with non-participants. By contrast, participants in activities such as art and academic clubs that are associated with lower status crowds will be more likely to form friendships among themselves rather than across crowds. Thus, we expected the positive association between co-participation and friendship will be stronger for art and academic activities than sport activities.

Alternative Friendship Processes

Because friendship dyads are nested within larger friendship groups, assessing the contribution of activities to friendships requires disentangling it from normative friendship processes. To better understand this, we investigated the unique contribution of activity co-participation to friendships beyond the two primary contributors to friendship formation, namely dyadic homophily and network-level processes.

Homophily

One of the most important processes contributing to friendships is the preference for friends who are similar to oneself, or homophily. Activity co-participation is one example of homophily, though it is distinct in that it reflects physical co-presence in a particular setting. Other dimensions of homophily do not imply physical co-presence, but rather greater than expected similarity on characteristics and behavior. Friends tend to be more similar than non-friends in terms of their socio-demographic characteristics (e.g., gender, race, grade and SES; Brown & Larson, 2009) and behavior, including academic achievement (Kindermann, 2007), problem behaviors (e.g., Espelage, Holt, & Henkel, 2003), and physical health (e.g., Trogdon, Nonnemaker, & Pais, 2008).

Blau (1977) asserted that homophily on any behavior, such as activity participation, could be a spurious product of selection on other dimensions rather than a preference for co-participants as friends. For instance, selection on socio-economic status (SES) could produce activity homophily because friends tend to be the same SES and SES is positively related to activity participation (for a review, see Mahoney et al., 2009). Statistically controlling for individual characteristics that are strongly related to both friendships and activity participation provides greater confidence that their association is not spurious.

Network processes

The structure of the friendship network facilitates additional friendships through endogenous network processes. A key feature of social networks is triadic closure, or the tendency for friends to share mutual friends. For instance, if Amy is friends with both Beth and Cathy, it is likely that Beth and Cathy will be friends. Triadic closure appears as early as preschool (Schaefer, Light, Hanish, Martin, & Fabes, 2010), and becomes stronger as children age (Hallinan & Felmlee, 1975). Triadic closure can occur through transitivity, where current friendships provide exposure to new peers (Holland & Leinhardt, 1972). For example, if Amy spends some time with Beth and some time with Cathy, the likelihood of Beth and Cathy meeting and becoming friends increases. Failing to consider triadic closure in such a situation would lead to the erroneous conclusion that the activity brought Beth and Cathy together instead of their mutual friendship with Amy. In general, failure to control for triadic closure leads to bias in other friendship formation effects (Mouw & Entwisle 2006).

The Advantages of a Social Network Approach for Addressing Developmental Questions

We adopt a social network approach to help understand the multiple developmental and contextual processes contributing to adolescents' friendships. Specifically, we estimate an Exponential Random Graph Model (ERGM) which models a network as a function of individual, dyadic, and other structural characteristics (Robins, Pattison, Kalish, & Lusher, 2007). A key feature of the ERGM approach is that it treats the dyad as the unit of analysis. Thus, for any pair of adolescents, it estimates the likelihood that a friendship exists. In our case, we estimate how activity co-participation affects the likelihood of a friendship while controlling for homophily and triadic closure. By controlling for the interdependence of actors, this method provides an unbiased estimate of the probability that adolescents in the same activity will be friends, net of alternative relationship processes.

Study Hypotheses

In this study, we tested four hypotheses. First, we expected friendships to be more likely among activity co-participants than among adolescents who do not participate in the same activity. Second, we expected the positive associations between co-participation and friendships to be stronger in high school than middle school. Third, we expected the positive associations between co-participation and friendship to be stronger in arts and academic activities than in sports activities. Finally, we hypothesized that activity co-participants would more likely become friends in the future than adolescents who do not participate in the same activity.

Method

The National Longitudinal Study of Adolescent Health (Add Health) is a nationally representative study of 7th through 12th grade adolescents across the United States (Udry, 2003). Add Health is well-suited for network analysis because it targeted the complete student population of schools, which allows for the identification of friendship networks.

Because Add Health includes both students and their friends, it provides self-report data on all measures of interest. Our investigation includes two related samples from Wave I of Add Health: (a) a cross-sectional sample of 67,124 participants in 108 schools who completed an initial in-school questionnaire and (b) a longitudinal sample of 2,550 adolescents in 2 schools who also completed an in-home questionnaire approximately eight months later.

Participants

School information—For the initial wave of in-school data collection, 172 schools were selected. Schools that had no grade levels, were single-gender, or were special education schools were excluded from the analyses (n = 3). Because our analysis requires a relatively complete picture of the entire school network, we retained only students from schools with a response rate of at least 75% (61 schools were eliminated based on this criteria). We compared adolescents in the retained schools (n= 70,223 adolescents in 109 schools) to adolescents in schools that were excluded (n= 19,895 adolescents in 35 schools). Retained adolescents were similar to excluded adolescents in terms of gender, race, SES, activity participation, GPA, problem behavior, physical health, and depression (effect sizes: Φ's<.11 and d's <.07). Adolescents in the retained sample (mean age = 14.9 years) were slightly younger than adolescents who were excluded (mean age = 15.3 years), though the effect was small (d=.24). The final cross-sectional sample contains 108 schools: 45 middle schools, 43 high schools, and 20 schools with both middle and high school students. The majority of the schools were public (81.5%) and represented a variety in terms of size (*Mean* students per school = 649, range=25 to 2,551).

Sixteen of the Add Health schools were "saturated," meaning that all students were selected for a follow-up, in-home interview. The longitudinal sample in this investigation consisted of students from the two largest saturated high schools. We excluded four schools because they did not meet the minimum response rate (i.e., 75%). The remaining 10 saturated schools were excluded because they did not exhibit enough friendship change over time to allow estimation of the longitudinal model.[1] The most substantial difference between schools that were retained versus excluded was size: the two retained schools averaged 1,260 respondents whereas the 10 excluded schools averaged 85 respondents.[2] The two schools in the longitudinal sample represent different types of public high schools. School A (N=776), consisted of predominantly white adolescents from a rural setting in a moderately sized Midwestern city. School B (N=1,774), consisted of racially diverse adolescents from a suburban setting in the West.

Adolescents—As shown in Table 1, the 67,124 adolescents from the cross-sectional sample were about equally divided on gender, affiliated with a variety of racial groups, 14.90 years of age on average, and in grades 7-12. Parents' level of education ranged from 0= less than high school to 3= bachelor's degree or beyond. The longitudinal sample was a subset of the cross-sectional sample. As shown in Table 1, the distribution of demographic characteristics was similar to the cross-sectional sample. Both schools were about equally

[1]The rates of friendship change do not differ significantly between schools ($M_{retained}$=.165 versus $M_{excluded}$=.114, t_{10}=.84, p=.42). However, because the retained schools have more students, these schools exhibited 10 times as many friendship changes as the excluded schools ($M_{retained}$=665.5 versus $M_{excluded}$=63.5). Thus, the retained and excluded schools had equivalent rates of change, but only the retained schools contained enough observations of friendship change (e.g., a large enough sample) to reliably estimate the longitudinal network models.

[2]The adolescents in the retained sample (n=2 schools) and the excluded sample (n=10 schools) did not significantly differ in terms of gender, SES, problem behavior, or depression (Φ's<.15 and d's <.15). The retained sample had more white adolescents and fewer Hispanic and Asian American adolescents than the excluded sample (Φ=.44). Adolescents in the retained sample participated in fewer activities (mean=1.63 compared to 2.79), had slightly lower GPAs (mean=2.65 compared to 2.97), had slightly poorer health (mean=2.24 compared to 2.04), and were older (mean=15.98 compared to 14.15) than the adolescents who were excluded and effect sizes were either small or medium (d=.50, .41, .21, 1.44, respectively).

divided on gender and similar in terms of age. Parents' level of education ranged from less than high school to beyond a bachelor's degree in both schools.[3]

Measures

The data in this study came from two adolescent questionnaires. The first questionnaire was administered at school, at which time adolescents reported on their demographic characteristics, activity participation, and friendships. Adolescents completed the second questionnaire at home approximately eight months later. The in-home interview provides the second observation of the friendship network.

Friendship network—Adolescents identified their 5 closest female and 5 closest male friends (up to 10 friends total). Students were allowed to nominate any students in their school, not just those in the same classroom or grade. Hence, the networks represented by friendship nominations extended throughout the school and are, in essence, school-level phenomena. Only friendships in which nominations were reciprocated (i.e., both adolescents nominated each other as friends) were retained for the analysis. The final friendship network consisted of friendships in which both adolescents had data, attended the same school, and ties were reciprocated.

Homophily—We included four indicators of homophily on socio-demographic characteristics: gender, race, grade, and SES (measured as parents' education). For each possible dyad, we calculated whether or not the two adolescents were the same (coded 1) or different (coded 0) on each indicator. We also included four indicators of homophily based on adolescents' self-reported behavior: GPA, problem behavior, physical health, and depression. GPA was calculated by computing the average of their grades in English, Math, Social Studies, and Science in the past year (1 = D, 4 = A). Problem behavior was the average of seven items indicating how often they engaged in various behaviors during the last 12 months (e.g., "smoked cigarettes," and "skipped school without an excuse"; 0 = *never*, 6 = *nearly everyday*; alpha = .77). Physical health was based on one item ("In general, how is your health?"; 1=*excellent*, 5=*poor*). Depression was the average of five items indicating how often they felt various emotions or engaged in depression-related behaviors during the last 6 months (e.g., "had trouble eating or a poor appetite," "cried a lot"; 0 = *never*, 4 = *everyday*; alpha = .76). To make these four items comparable to sociodemographic homophily, they were rescaled to range from 0 to 1. The behavioral homophily measures were calculated as one minus the absolute difference between two adolescents' scores. This measure ranged from 0, if two adolescents were at the opposite extremes of the scale, up to 1, if two adolescents were exactly the same.

Activity co-participation—Adolescents reported which of 30 school-based clubs, organizations, or sport activities they participated in or were planning to participate in during the school year (see Table 1 for *Means*). Using these items, we constructed a dyad-level indicator of activity co-participation for each dyad of students in the school. A dyad was coded as 1 if the two adolescents participated in at least one activity together; otherwise, if two adolescents did not share participation in any of the 30 activities the dyad was coded 0.

To examine differences by activity type, we created separate dyadic indicators for each of three activity types – sports, arts, academics (Eccles & Barber, 1999; Hansen et al., 2003).

[3]Adolescents in the longitudinal and cross-sectional samples did not significantly differ in terms of gender, race, SES, GPA, problem behavior, physical health, or depression (Φ's<.17 and d's <.19). Adolescents in the longitudinal sample participated in slightly fewer activities (mean=1.63 compared to 2.21) and were older (mean=15.98 compared to 14.68 years) than the adolescents in the cross-sectional sample (d=.22, .65, respectively).

These indicators were coded 1 if two adolescents participated in at least one of the same activities within a type (e.g., the same sport activity) and 0 otherwise. Sports included the following 12 activities: cheerleading/dance team, baseball/softball, basketball, field hockey, football, ice hockey, soccer, swimming, tennis, track, volleyball, and wrestling. Arts included any of the four activities: drama club, band, chorus/choir, and orchestra. The 14 academic activities included: French club, German club, Latin club, Spanish club, book club, computer club, debate team, history club, math club, science club, honor society, newspaper, student council, and yearbook.

Network structure—Four indicators were used to control for the structure of the friendship network. First, the *friendship probability* term reflects the likelihood that any friendship exists and, thus, controls for the number of friendships in the network. Second, in social networks, most people have a small number of friends but a handful of people have many friends. Thus, the *friendship skew* term was included to control for the skewed distribution of friendships. By making additional friendships increasingly unlikely this term helps control for the cap of 10 on the number of outgoing friendship nominations. Two final terms – open triads and closed triads – were used in conjunction to estimate triadic closure and the potential for triadic closure. The *open triads* term controls for the preconditions necessary for triadic closure (e.g., Amy-Beth and Amy-Cathy friendships, which could lead to a Beth-Cathy friendship). The *closed triads* term indicates the tendency for adolescents with mutual friends to themselves be friends. This occurs when, for instance, Amy, Beth, and Cathy are all friends and the triad they form is closed on all sides. The former term is not of theoretical interest but is a necessary control that allows us to infer that the observed number of closed triads in the network is not simply due to chance (Snijders, Pattison, Robins, & Handcock, 2006).[4]

Analysis Plan

Exponential Random Graph Models (ERGMs) provide the most suitable means to predict the joint probability that friendships exist among adolescents in a network. ERGMs address complex dependencies within relational (i.e., friendship) data in order to uncover underlying structural properties. ERGMs are beneficial to answer social network questions for a multitude of reasons. First, they can determine whether certain processes (e.g., homophily) appear more often than expected by chance. Further, researchers can consider multiple processes simultaneously by estimating the effects of one process while controlling for others. For example, researchers can estimate the effect of co-participation in activities while controlling for triadic closure. Most importantly, ERGMs allow for analysis at the relational level, rather than typical statistical analyses at the individual level, which is essential for research questions such as ours. For a thorough overview of the ERGM framework see Robins et al. (2007).

It is helpful to conceptualize an ERGM as a logistic regression, where the unit of analysis is the dyad and the dependent variable is presence or absence of a friendship between two adolescents. However, ERGMs necessarily depart from logistic regression in their underlying estimation procedure. Due to the complex dependence assumptions ERGMs make, estimation follows a Markov chain, Monte Carlo method (Wasserman & Robins, 2005). Still, ERGM results can be interpreted similar to a logistic regression. Exponentiated coefficients are odds ratios that reveal how a one-unit change in the value of an indicator affects the odds of a friendship. For example, a one-unit increase in a homophily effect is the

[4]For the calculation of these terms see Hunter (2007), who defined them as: edges (friendships), geometrically weighted degree (friendship skew), geometrically weighted edgewise shared partners (closed triads), and geometrically weighted dyadwise shared partners (open triads). We use a geometric weight of .25, following Goodreau, Kitts and Morris (2009) who also examined Add Health data within an ERGM framework.

difference between dissimilarity and similarity; hence exponentiating the coefficient reveals the odds of a homophilous tie relative to a non-homophilous tie. To clarify the presentation of results we discuss effects in terms of odds ratios.

ERGMs were used to test the effects of activity co-participation, homophily, and endogenous network processes on friendship. We used the *statnet* package within R (http://www.statnetproject.org) to estimate a separate ERGM for each school and then summarized the results across schools using a meta-analysis procedure developed by Hedges and Olkin (1985). For each effect we combined the 108 estimated parameters to calculate a semi-weighted mean, where parameters were weighted inversely by their standard error (giving greater weight to more precise estimates). We used the standard errors to calculate an unbiased estimate of the population variance for each effect. Statistical significance was determined using the estimated population mean and variance to calculate a *t* value. For more detail on meta-analysis of network models see Snijders and Baerveldt (2003) and Lubbers and Snijders (2007).

Our analysis proceeded in three steps. First, we examined whether activity co-participation predicted friendship above and beyond alternative friendship processes. To do this, we first estimated a model that included all effects except co-participation; then we added co-participation to the model to test its net effect. Second, we investigated whether the relation between activity co-participation and friendship differed between middle and high schools and by activity type (i.e., sports, academic, and art activities). Third, we used the longitudinal data to test whether activities led to the formation of new friendships eight months later.

The longitudinal model used activity co-participation at Time 1 to predict ties at Time 2, while controlling for ties at Time 1. We included the same controls as in prior models. In addition, to control for the process of transitivity over time (Pattison & Robins, 2001), we included a term for each dyad that indicates whether the adolescents had a tie to a common third adolescent at Time 1 (*transitive potential*). We also included two interactions in order to distinguish tie formation from tie persistence (Krivitsky & Handcock, 2010). First, we included an interaction between activity co-participation and the Time 1 network. The main effect of activity co-participation captures the effect of co-participation on new tie formation, while the combination of the main effects and interaction captures the effect of co-participation on tie persistence. Second, an interaction between the *transitive potential* effect and friendships at Time 1 differentiates the effect of transitivity on tie formation versus tie persistence.[5]

Results

Relations between Activities and Friendships

As shown in Model 1 (Table 2), the friendship probability effect reflects the likelihood of a friendship between two adolescents if none of the other processes included in the model were present (i.e., dyads that do not produce homophily, open triads, or closed triads). As is

[5]Several approaches to the use of ERGMs to model network change have been proposed (Hanneke, Fu, & Xing, 2010; Krivitsky & Handcock, 2010; Robins & Pattison, 2001). A common alternative to ERGMs is the stochastic actor-based model, otherwise known as a “SIENA” model (Snijders 2005). A key difference between the two approaches is that the ERGM assumes that network change occurs through discrete steps, which are observed, while SIENA models network change as a continuous time process that is observed only at discrete time points (Snijders 2005). The SIENA approach thus allows for unobserved changes between observation points, which cumulate to produce the observed network. The consequence is that the SIENA model utilizes a simpler set of effects to represent the mechanisms responsible for change over time (Steglich, Snijders, & Pearson 2010). Although both approaches are appropriate for our research question, to maintain consistency with the cross-sectional analyses we use an ERGM. To gauge the sensitivity of our results to model specification, we estimated comparable models of network change in SIENA. Results of the SIENA analysis were consistent with the models shown.

often the case in ERGMs, this effect was negative, indicating that friendships were unlikely outside of the other processes included in the model. As expected, the negative friendship skew term reveals that additional ties were less likely as a student's number of ties increased.

The effects of homophily were significant and in the expected positive direction. Adolescents were more likely to be friends if they were similar in terms of demographic characteristics and behavior. However, the strength of homophily varied greatly across dimensions. Homophily was strongest on grade, where the odds of a friendship were 8.8 times higher for students in the same grade versus students in different grades. Homophily on gender, race, GPA and problem behavior was somewhat weaker. The remaining dimensions – SES, physical health, and depression – displayed the weakest homophily effects.

Effects for the network processes were statistically significant and in the anticipated direction. The significant negative effect of open triads indicates that the odds of any two students having mutual friends without themselves being friends fall below chance expectations. That means it was unlikely for Beth and Cathy to share many of the same friends (e.g., Amy, Allison, and Amanda), but not themselves be friends. The positive effect of closed triads suggests adolescents with mutual friends were more likely than chance to be friends themselves. In other words, the more friends Beth and Cathy had in common the greater their chance of being friends.

Model 2 tested the hypothesis that friendships were more likely among activity co-participants. As shown in Table 2, Model 2 added an effect for activity co-participation while maintaining the controls for homophily and network processes from Model 1. The effect of activity co-participation was significant and positive, suggesting that adolescents who participated in the same activity were more likely to be friends than adolescents who did not participate in the same activity. The odds of a friendship between two students were 2.3 times higher if the students shared the same activity.

Relations between Activities and Friendships across High Schools and Middle Schools

The next set of analyses tested the hypothesis that activities would be more strongly associated with friendships in high school than in middle school. To evaluate this hypothesis, we conducted a separate meta-analysis on the coefficients from Model 2 for high schools and middle schools. Figure 1 presents the means and 95% confidence intervals for the activity coefficients and, for comparison sake, the homophily and closed triads effects. As hypothesized, the mean activity co-participation effect was larger for high schools (M=.91, SD=.16) than middle schools (M=.75, SD=.31), a difference that was statistically significant ($t(86)=3.01$, $p<.01$). The odds of students in the same activity being friends, relative to students not in the same activity, were 2.5 times greater in high school compared to 2.1 times greater in middle school. The only other statistically significant differences between middle schools and high schools were in the effects of gender homophily ($t(86)=5.10$, $p<.001$), which was stronger in middle school, and problem behavior homophily ($t(86)=2.33$, $p<.05$), which was stronger in high school.

Relations between Activities and Friendships across Activity Types

The next analysis tested for differences by activity type. We hypothesized that the association between friendship and activities would be weaker for sports compared to art and academic activities. Instead of a single effect for activity co-participation, Model 3 included effects for co-participation in (a) sports, (b) arts, and (c) academics, and the same controls for homophily and endogenous network processes as in the prior models.

As shown in Table 3, each of the activity co-participation effects was significant and positive. To help assess differences across the types, Table 3 includes 95% confidence intervals for each effect. As hypothesized, the effect of co-participation in sports was significantly weaker than the effect of co-participation in arts. The odds of a friendship between two students were 1.8 times higher if they shared a sport compared to 2.3 times higher if the students shared an art activity. The magnitude of the academic clubs co-participation effect fell between sports and arts activities (i.e., odds ratio of 1.9), but did not significantly differ from the other activity types.

Relations between Activities and Friendships across Time

The final model evaluated whether activity co-participation predicted friendship change over time. This model estimated the effect of Time 1 co-participation on friendships at Time 2 while controlling for friendships at Time 1 (eight months earlier). Controls in Model 4 resemble the preceding models by including effects for dyadic homophily, endogenous network processes, and activity co-participation, as well as transitive potential at Time 1.

Table 4 presents the results separately for the two high schools in the longitudinal sample. Results for the control variables reveal a strong positive effect of the friendship network at Time 1 in each high school. Adolescents who were friends at Time 1 tended to be friends at Time 2, meaning that friendships were likely to persist over time. Homophily effects were evident on all sociodemographic characteristics except SES, while the effects for behavioral homophily were mainly present in school A, and in fact, negative for depression in school B. The effects of friendship probability, friendship skew, and network processes were similar to preceding models. The main effect for transitive potential indicates that friendships were more likely to form when they created closed triads. The interaction between transitive potential and Time 1 friendship was significant in both schools, but in different directions. The positive interaction in school A indicates that transitivity was more important for tie persistence than for new tie formation. However, in school B, the interaction effect is negative, indicating that transitivity was more important for tie formation than for tie persistence.

For both schools the effect of activity co-participation was significant and positive. The main effect of co-participation reveals that adolescents who participated in the same activity at Time 1 were more likely to become friends at Time 2 than students who did not participate in the same activity. The odds of friendships forming between co-participants were 1.8 times higher in school A and 2.8 times higher in school B. The interaction between co-participation and Time 1 friendship reveals the effect of co-participation on friendship persistence. This interaction was negative for both schools, meaning that co-participation had a weaker effect on friendship persistence than new friendship formation. In school A, the interaction term (i.e., −.70) cancelled out the main effect of activity co-participation (i.e., .60), which indicates that co-participation did not significantly influence friendship persistence. In other words, friends in the same activity at Time 1 were no more likely to remain friends than friends who did not share activities. In school B, the negative interaction is roughly one-third the size of the main effect of co-participation (i.e., interaction: −.30, main effect: 1.04). This pattern indicates that co-participation was associated with friendship persistence such that friends in the same activity at Time 1 were more likely to remain friends than friends who did not share an activity. However, co-participation had a smaller effect on the odds of friendships persistence (i.e., 2.10 [calculated by exponentiating (1.04-.30)]) versus friendship formation (i.e., 2.84).

Discussion

Research on adolescent development has documented numerous benefits from both participating in extracurricular activities and high quality friendships (e.g., high self-esteem, GPA; Brown & Larson, 2009; Mahoney et al., 2009). Although scholars have theorized that friendships and activity participation are related (e.g., Eccles & Barber, 1999), little research has examined these interrelations. The primary objective of this research was to explore the association between friendship ties and activity participation. This question is complicated by the presence of multiple processes that promote friendship. The literature in developmental psychology has emphasized the role of homophily in friendship formation (e.g., Brown & Larson, 2009) whereas the sociological literature has established the importance of network-level processes, such as triadic closure (Holland & Leinhardt, 1972). Thus, we first asked whether activities were associated with friendships above and beyond these common processes that contribute to friendship formation. We followed this with an investigation of differences between middle school and high school, between activity types (i.e., sports, arts, academics), and over time. To address these questions, we utilized a social network model to analyze the structure of student friendship networks in over 100 schools.

The findings of this study suggest that activity settings play a key role in adolescents' friendships by helping support existing friendships and the development of new friendships. Although a handful of qualitative studies have highlighted the importance of activity settings for supporting friendships (e.g., Fredricks et al., 2002; Loder & Hirsch, 2003), this study was the first that we know of to quantitatively examine the role of activities while accounting for dyadic homophily and network processes. Results indicate that when two adolescents participated in the same activity they were 2.3 times more likely on average to be friends than adolescents who were not activity co-participants. The strength of this association was similar in magnitude to homophily on gender, race, GPA, and problem behavior, but was stronger than homophily on SES, physical health, and depression. Of the homophily effects, only being in the same grade was a stronger predictor of friendships than activity co-participation. These findings highlight the importance of school organizational factors such as grade and activities that bring adolescents together for sustained periods of time and thereby promote friendships among them.

What is particularly unique to this study is the longitudinal analysis, which provides evidence that activity co-participation promoted friendship formation eight months later. In the two high schools examined, new friendships were from 1.8 to 2.8 times more likely to form if adolescents participated in the same activity. This supports qualitative work suggesting that activity settings are particularly poised to promote relationships (Loder & Hirsch, 2003). Our findings also highlight the importance of an individual's need to belong. Self Determination Theory advocates that adolescents will actively seek settings in which they feel a sense of belonging (Ryan & Deci, 2008). Accordingly, adolescents are more likely to join activities that their existing friends attend or to forge new friendships in these settings. Our findings denote that both processes are at work.

The Associations between Friendships and Activities in High School and Middle School

The results from this investigation indicate that activity co-participation is more highly associated with friendship in high school compared to middle school, a correspondence that can be partially attributed to developmental and school structural differences. From a developmental perspective, researchers have suggested that adolescents actively pick their niches or settings, which include friendship networks and activities (Scarr & McCartney, 1983). According to Eccles and Barber (1999), the two niches at hand, friendship networks and activities, influence each other bi-directionally across time, such that adolescents select activities based on friendships and activities shape one's friendships. One reason for the

stronger association between these two niches in high school compared to middle school is that adolescents typically gain greater autonomy in making everyday decisions in many facets of life, including friendships and activities, as they age (e.g., Smetana et al., 2005). In addition to these developmental differences, there are structural differences between these schools. High schools typically have more students and extracurricular activity offerings than middle schools. In larger schools, where there are more unfamiliar peers, adolescents may be more likely to use activities as a means to find potential friends who share similar interests and identity. In combination, these developmental and structural changes from middle school to high school produce a context where students are increasingly likely to turn to activity co-participants for friendship.

The Associations between Friendships and Activities by Activity Types

Scholars have recognized that activities are unique in terms of their content, affordance of developmental opportunities, and associated adolescent outcomes. For example, athletes report more experiences with teamwork during the activity and higher subsequent alcohol use than participants of art and academic activities (Eccles & Barber, 1999; Larson et al., 2006). The current findings suggest that whether adolescents' friends are likely to be co-participants depends on the type of activity.

We hypothesized that the popularity of the crowd affiliated with an activity was inversely related to the strength of the association between the activity and friendship – that students in less "popular" activities hung together at higher rates. As expected, the association between activities and friendship was weakest for sports (higher status, Coleman, 1996) and strongest for art activities (lower status, Brown & Larson, 2009), with academic clubs indistinguishable from either. This is not to say that sports involvement inhibits friendships; rather, it is likely that adolescents participating in sports often had friends in sports and friends who did not participate in sports whereas artists were more likely to be friends with other artists. This is all the more likely because unlike other types of activities it becomes increasingly difficult to obtain a spot on a sports team, particularly the high school varsity team (Quiroz, 2000).

Homophily and Social Network Processes

Identifying the contribution of activities to friendship above and beyond other network processes was possible only through social network analysis. The network model controlled for the complex interdependencies between students, allowing for unbiased estimates of the effect of activity co-participation on friendship. The model enables several additional inferences about adolescent friendship processes. For instance, our finding that gender homophily decreased from middle to high school confirms previous work suggesting that adolescents become less gender-segregated with age as they become more romantically involved (i.e., Connolly, Craig, Goldberg, & Pepler, 2004). Conversely, the greater importance of homophily on problem behavior in high school versus middle school highlights the association between friendships and behavior outside of the classroom. As adolescents age they spend more time with peers and rely more heavily on peers in day to day decisions, such as engaging in problem behavior (Dishion & Owen, 2002; Haynie, 2002; Larson & Richards 1991). Because both problem behavior and extracurricular activities typically occur after school has ended (Osgood, Anderson, & Shaffer, 2005), it is not surprising that they would evidence parallel increases.

Limitations and Future Directions

The measures used in this paper had several advantages over previous work. We included friends' self-reports of their activity participation, rather than proxy reports which are known to contain biases. Still, the measures of activity participation did not consider several

important aspects of activities. The Add Health survey asked about both participation and intentions to participate. Although these constructs are highly correlated (Ajzen & Driver, 1992), focusing on actual participation can reduce error in the items. Furthermore, participation was indicated as simply yes or no and items did not differentiate between multiple teams or groups within a specific activity, such as varsity versus junior varsity teams. More precise indicators of students' histories of participation, the frequency at which they currently participate, and activity specification would better capture adolescents' investment in particular activities and identify the activities that may be most influential.

This study was limited to school-based activities and friendships. By including school-based activities, the study captured where most of adolescents' activity time is spent, though it will be important for future studies to consider activities in other settings, such as community-based activities (Mahoney et al., 2009). In extending research to include non-school activities, it will be important to also consider non-school friendships. Community-based activities often include a different set of peers than found in school, which provides adolescents with greater choice in selecting friends. Including a broader set of friends and activities in future work would provide a more comprehensive understanding of how activities in different contexts promote friendship and their consequences for development.

Our finding that the relation between co-participation and friendship varied by activity type implies that these relations are not simply due to propinquity, or the tendency for people who share the same space to become friends. However, we did not examine the process by which activities promoted friendship. Add Health does not include indicators of activity quality or observations of activity experiences. Observational techniques have been used to assess social networks based on young children's playground interactions (Schaefer et al., 2010). Such an approach could be used to gain insight into friendship network dynamics within activity settings. Furthermore, some activities and activity leaders are likely more adept at promoting positive peer relations and friendships and could have important moderating effects on these processes.

The longitudinal analysis revealed a significant effect of activity co-participation on friendship formation over time. However, others have suggested that youth with positive adjustment and relationships are more likely to enroll in activities. Thus, the relationship between activities, adjustment, and friendship may include feedback effects, such that positive adjustment and friendship leads to activity participation, where they are further reinforced. Both of these processes have been suggested as explanations for the link between friendships and activities (Fredricks et al., 2002; Loder & Hirsch, 2003) but have yet to be tested. Because Add Health did not include longitudinal data on activity participation, we were unable to examine the reciprocal effect of friendship on activities. To fully address the reciprocal relations between friendships and activity participation, longitudinal data on both friendships and activity involvement is required. This remains an important and necessary endeavor in order to identify means to promote the beneficial outcomes of each.

Longitudinal data are also necessary to address whether the association between activity participation and friendships changes over development. The current findings address developmental differences between middle school and high school students, but not whether there are developmental changes in these associations over time. It will be important for future studies to address developmental changes with age, but also transition points. School transitions are important periods when some old friendships dissolve and new ones form (Bohnert, Aikins, & Edidin, 2007; Hardy, Bukowski, & Sippola, 2002). In fact, organized activities during the first year of college predicted higher friendship quality for young adults who had high feelings of loneliness (Bohnert et al., 2007). This effect is likely mediated by the opportunity for friendships that activities provide.

Our use of network analysis provides new insight to how friendship networks and activities are related. Here, we examined the most common network-level process that contributes to friendship formation, namely triadic closure. However, there are several other aspects of social network structure that warrant more research. Through social network analysis, one can determine if particular network positions, such as being more central, or particular aspects of network structure, such as hierarchy, affect adolescent behavior and development. Furthermore, activities may influence not only the number and arrangement of friendships, but also whether a friendship network becomes less hierarchical and more tightly-knit over time.

Conclusion

This study provides empirical evidence that activity co-participation promotes concurrent and new friendships. Extracurricular activity settings are foci (Feld, 1981) within schools that are uniquely poised to promote friendships as they are typically voluntary, safe settings that allow adolescents space to interact and engage with their friends (Loder & Hirsch, 2003). Although this correspondence was stronger in high school than middle school and in art than sports, co-participation in extracurricular activities was a strong predictor after accounting for other established processes of friendship formation. Because extracurricular activities may be more amenable to interventions than the larger school setting, these findings suggest it is a possible context to help adolescents with too few or poor quality friendships. This research calls for further investigation of this process, including how friendships affect activity involvement and potential moderating effects of individual, school, and activity characteristics. An understanding of the dynamic relationship between friendship and activities can enlighten our knowledge of how these processes jointly affect developmental outcomes.

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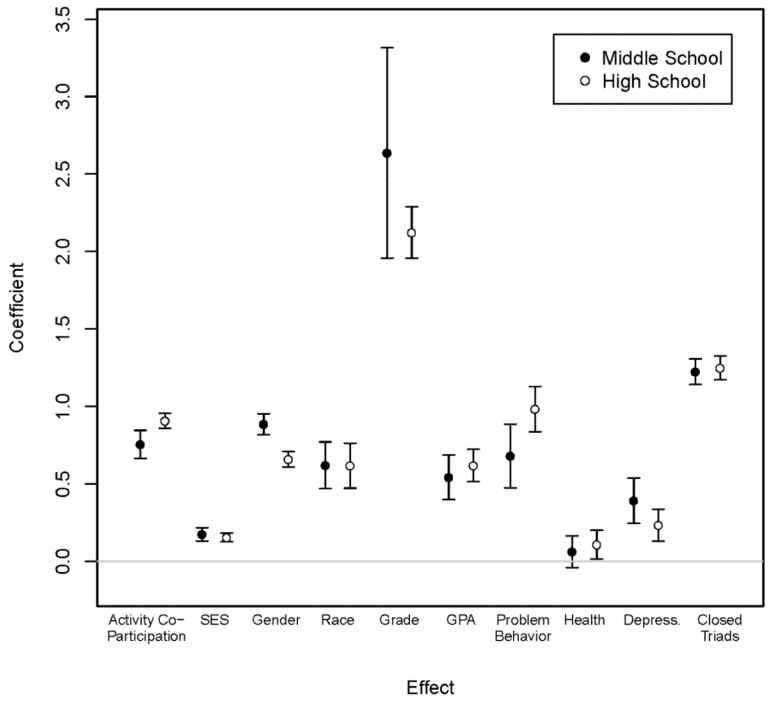

Figure 1.
Figure 1 displays the relation between all coefficients in Model 2 and school type (i.e., middle and high school). The mean coefficients and 95% confidence intervals are plotted separately for middle schools and high schools.

Table 1

Demographic Characteristics of the Participants

	Cross-sectional sample	Longitudinal sample	
Indicators	**108 Schools (n = 67,124)**	**School A (n = 757)**	**School B (n = 1,673)**
Gender (% female)	50.5	48.3	47.8
Race (%)			
White	55.4	89.2	4.2
African American	15.4	0.3	9.2
Hispanic	15.2	2.8	40.3
Asian American	5.2	0.7	29.9
Biracial	4.6	4.2	4.6
Other	2.5	2.4	1.3
Age in years *M(SE)*	14.90(1.74)	15.73(1.20)	16.09(1.04)
Parent education (%)			
Less than high school	7.5	4.0	13.5
High school graduate	26.3	36.6	18.9
Some college	15.3	20.3	15.5
College degree or higher	35.3	32.7	29.8
GPA *M(SE)*	0.64(0.27)	0.56(0.27)	0.60(0.26)
Problem Behavior *M(SE)*	0.19(0.19)	0.24(0.20)	0.18(0.18)
Physical health *M(SE)*	0.27(0.23)	0.30(0.23)	0.31(0.24)
Depression *M(SE)*	0.23(0.21)	0.25(0.23)	0.22(0.21)
Activity participation (%)			
Any activity	75.6	78.7	63.5
Sports	52.2	60.5	46.3
Arts	26.5	25.1	9.3
Academics	31.6	28.0	24.8

Table 2

Results of the Cross-Sectional Exponential Random Graph Models of Friendship at Time 1

Effect	Model 1		Model 2	
	Estimate (standard error)	Odds ratio	Estimate (standard error)	Odds ratio
Friendship probability	−5.69 (0.13)	0.003	−6.06 (0.17)	0.002
Friendship skew	−1.60 (0.04)	0.20	−1.59 (0.05)	0.20
Homophily				
Gender	0.78 (0.01)	2.18	0.77 (0.02)	2.16
Race	0.58 (0.05)	1.79	0.58 (0.05)	1.79
Grade	2.18 (0.06)	8.85	2.35 (0.15)	10.49
SES	0.18 (0.01)	1.20	0.16 (0.01)	1.17
GPA	0.66 (0.03)	1.93	0.60 (0.06)	1.82
Problem behavior	1.02 (0.06)	2.77	0.78 (0.06)	2.18
Physical health	0.36 (0.04)	1.43	0.08 (0.04)[a]	1.08
Depression	0.12 (0.02)	1.13	0.36 (0.04)	1.43
Network Structure				
Open triads	−0.34 (0.01)	0.71	−0.36 (0.02)	0.70
Closed triads	1.24 (0.03)	3.46	1.21 (0.03)	3.35
Activity co-participation	----------[b]	------[b]	0.81 (0.03)	2.25

Note. Effects are significant at $p < .001$ unless otherwise noted.

[a] Significant at $p < .01$.

[b] Effect not included in the model

Table 3

Results of the Cross-Sectional Exponential Random Graph Models of friendship at Time 1 by Activity Type

	Model 3			
		95% Confidence Interval		
Effect	**Estimate (standard error)**	**Lower bound**	**Upper bound**	**Odds ratio**
Friendship probability	−6.12 (0.17)	−6.45	−5.79	0.002
Friendship skew	−1.56 (0.04)	−1.65	−1.48	0.21
Homophily				
Gender	0.78 (0.02)	0.74	0.82	2.18
Race	0.60 (0.05)	0.50	0.69	1.82
Grade	2.37 (0.16)	2.06	2.67	10.70
SES	0.17 (0.01)	0.14	0.19	1.19
GPA	0.57 (0.03)	0.51	0.66	1.77
Problem behavior	0.78 (0.06)	0.66	0.90	2.18
Physical health	0.32 (0.04)	0.24	0.40	1.38
Depression	0.12 (0.03)	0.04	0.16	1.13
Network structure				
Open triads	−0.35 (0.01)	−0.37	−0.32	0.70
Closed triads	1.22 (0.03)	1.17	1.27	3.39
Activity type				
Sports	0.56 (0.02)	0.52	0.61	1.75
Arts	0.85 (0.04)	0.77	0.94	2.34
Academics	0.66 (0.07)	0.52	0.80	1.93

Note. All effects are significant at $p < .001$.

Table 4

Results of the Longitudinal Exponential Random Graph Models of Friendship at Time 2

	Model 4			
	School A		School B	
Effect	**Estimate (standard error)**	**Odds ratio**	**Estimate (standard error)**	**Odds ratio**
Friendship probability (Time 2)	−6.56 (0.11)***	0.00	−8.14 (0.10)***	0.00
Friendship skew (Time 2)	−1.50 (0.02)***	0.22	−2.20 (0.02)***	0.11
Friendship (Time 1)	4.75 (0.18)***	115.49	5.77 (0.13)***	321.98
Homophily				
Gender	−0.03 (0.16)	0.97	−0.08 (0.06)	0.92
Race	0.95 (0.03)***	2.57	0.48 (0.03)***	1.61
Grade	0.12 (0.02)***	1.13	1.88 (0.03)***	6.57
SES	1.51 (0.02)***	4.51	1.53 (0.03)***	4.62
GPA	0.28 (0.07)***	1.32	−0.12 (0.08)	0.89
Problem behavior	2.25 (0.13)***	9.50	1.04 (0.14)***	2.83
Physical health	0.69 (0.08)***	1.99	−0.04 (0.09)	0.96
Depression	0.40 (0.08)***	1.49	−0.36 (0.09)***	0.70
Network structure				
Open triads (Time 2)	−0.28 (0.01)***	0.76	−0.47 (0.01)***	0.62
Closed triads (Time 2)	1.00 (0.03)***	2.71	0.60 (0.03)***	1.82
Transitive potential (Time 1)	0.63 (0.17)***	1.88	0.49 (0.04)***	1.64
Transitive potential (Time 1) × Friendship (Time 1)	0.43 (0.06)***	1.54	−0.40 (0.09)***	0.67
Activity co-participation	0.60 (0.14)***	1.82	1.04 (0.15)***	2.84
Activity co-participation × Friendship (Time 1)	−0.70 (0.05)***	0.49	−0.30 (0.06)***	0.74

Note.

*** $p<.001$.