

CHILDREN'S FRIENDSHIP NETWORKS AND GENDER

by

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(Under the Direction of A. Michele Lease and Dawn T. Robinson)

ABSTRACT

Study1: This study examined how gender and perceived rough and non-rough sports competency shape friendship networks among 459 fourth- and fifth-grade students across 26 classrooms. Using Exponential Random Graph Models, the study found strong gender homophily in friendships. Contrary to expectations, sports competency did not predict more friendship ties. However, homophily in sports competency significantly predicted the formation of friendship. For boys, friendships were associated with homophily in rough sports competency, whereas for girls, with shared non-rough sports competency.

Study2: This study investigated the characteristics of cross-gender friendship (CGF) groups among 468 students in 26 classrooms. Using community detection technique, 88 friendship groups were identified. CGF groups were less frequent but larger than same-gender friendship (SGF) groups and demonstrated lower density, reciprocity, and transitivity. CGF groups differed from SGF groups in perceived rough and non-rough sports competency, while they exhibited similar levels of academic competency and social status.

INDEX WORDS: Gender, Sports competency, Friendship networks

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CHAPTER 1

INTRODUCTION

Friendship networks have been studied to explore complex social interactions among children. From early observations studies to contemporary social network analyses, researchers have sought to understand how children form and maintain friendships. This paper included two primary lines of inquiry across two separate studies: (1) how gender and perceived sports competency were associated with children's friendship networks and (2) what characteristics and network structures distinguished cross-gender friendship groups from same-gender friendship groups. Together, these studies provided a nuanced and comprehensive understanding of children's friendship networks within school settings.

Study 1 revisited foundational theories on gendered social networks among children. Prior research suggested that boys' friendship networks were larger and more diffuse, whereas girls' networks were more intimate and cohesive (Lever, 1976; Maccoby & Jacklin, 1974). These patterns have been partially attributed to the nature of gendered play, with boys more often engaging in physical activities and girls favoring verbal interactions (Maccoby, 1998; Pellegrini, 2005; Thorne, 1993). However, since the enactment of Title IX in 1972, girls' participation in sports activities has markedly increased (Cooky & LaVoi, 2012; Messner, 1988). This societal shift might change how children develop friendships in school settings. Using Exponential Random Graph Models (ERGMs), this study investigated how gender and two types of perceived sports competency (i.e., rough and non-rough sports) shaped friendship networks within classrooms.

Study 2 focused on cross-gender friendship (CGF) groups, which were less frequent yet offering distinct social, emotional, and developmental advantages. Previous research indicated CGFs can enhance self-esteem, reduce gender stereotyping, and promoted more sophisticated social skills (McMillan et al., 2023; Pettigrew et al., 2011). These relationships were found to serve as social bridges across segregated networks (Bleske & Buss, 2000). Once children form friendship groups, the influence of these groups tend to grow over time, reinforcing members' behaviors, attitudes, and interactions. Despite their importance, CGF groups remain understudied, particularly during late childhood, a transitional period characterized by heightened peer influence and the emergence of romantic interests (Mehta & Strough, 2009). This study filled this gap by identifying CGF groups within friendship networks and comparing them to SGF groups in network structure, descriptive characteristics, and behavioral traits.

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CHAPTER 2
GENDER, SPORTS, AND FRIENDSHIP NETWORKS¹

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Abstract

The current study examines the school-based friendship networks of elementary-age children in the post-Title IX educational era, a period marked by increased gender equity in sports participation. The study investigates how gender and two types of perceived sports competency (i.e., rough and non-rough sports) are associated with school-based friendship networks. The study includes 459 students in the fourth and fifth grades, nested in 26 elementary school classrooms. Using Exponential Random Graph Models (ERGMs), we incorporate individual characteristics (i.e., sports competency, gender, racial status), dyadic effects (i.e., homophily) and structural configurations (i.e., density, reciprocity, and transitivity) to predict friendship network ties. Strong and consistent patterns of gender homophily effects within children's friendship networks were observed. Interestingly, higher rough or non-rough sports competency perceived by peers did not predict more friendship ties, and these associations did not differ by gender. However, homophily in both perceived rough and non-rough sports competency significantly predicted the presence of a friendship tie. Specifically, shared levels of skills in rough sports were more pivotal in boys' friendship ties than girls, whereas girls' friendship ties demonstrated a greater sensitivity to homophily for perceived non-rough sports competency. This study highlights the significant role of gender and sports competency in children's friendship networks. Implications are discussed.

INDEX WORDS: Gender, Sports competency, Friendship networks, ERGMs

Introduction

Historical perspectives on gendered networks are that boys have larger and more loosely connected networks, whereas girls' networks are smaller and more densely interconnected (Lever, 1976; Maccoby & Jacklin, 1974). Some studies suggest that these differences might arise from the distinct activities in which boys and girls take part (Martin et al, 2013), with boys engaging in physically active games and girls preferring activities that allow for ongoing conversation (Maccoby, 1998; Pellegrini, 2005). In ethnographic studies conducted in elementary schools, Thorne (1993) reported that boys generally spread out and use larger area of the playground for activities such as soccer, basketball, or football, whereas girls form small clusters and engage in activities, such as jumping rope or hanging on the 'monkey bars,' which require less physical area. These distinct activity preferences likely influence and shape social network structures, suggesting a potential link between the types of activities in which children engage and the way their social networks develop.

Since the seminal studies on children's gendered play and friendship networks were first conducted (Lever, 1976; Maccoby & Jacklin, 1974), the societal backdrop of youth sport has drastically changed. Traditionally, sports reinforced gender roles through which physical activities often symbolize masculinity and participation for girls had been limited (Messner, 1988). However, Title IX from the Education Amendments of 1972, 20 U.S.C. §1681 et seq. prohibited discrimination based on sex in any educational program receiving federal funding. This federal civil rights law led to a substantial increase in the number of girls participating in sports and changes in perception about the appropriateness of sports for girls (Lindstrom & Lease, 2005). Title IX also helped to challenge traditional gender norms around athleticism and competition (Cooky & Lavoie, 2012). Girls' increased participation in athletic activities has

possibly influenced the structure of friendship networks and gendered socialization processes for school-aged children (Davis, 2003; Ramachandran, 2009).

The current study aimed to re-examine school-based friendship networks of elementary-age children in a post-Title IX educational context, focusing on the role of gender and sports competency. Considering children's networks are influenced by both individual traits and group characteristics (Gradassi et al., 2023; LaFontana & Cillessen, 2002), we used Exponential Random Graph Models (ERGMs), a state-of-the-art social network analysis tool. This approach enabled us to examine the role of gender and sports competency in friendship networks, through examination of individual characteristics (i.e., gender and sports competency) and dyadic effects (e.g., homophily in sports competency) while accounting for structural network characteristics (e.g., density, reciprocity, and transitivity).

Theoretical Framework: Role of Homophily, Behavioral Compatibility, and Social Synchrony in Children's Friendship Networks

Farmer and Farmer (1996) suggested that similarity among individuals results from two distinct processes – social homophily and social synchrony. Closely related to social synchrony is the concept of behavioral compatibility, which specifically focuses on shared behavioral patterns. Thus, our study adopted three theoretical frameworks—social homophily, social synchrony, and behavioral compatibility—to understand the process of selecting and forming children's friendship networks.

First, social homophily refers to a phenomenon that people tend to naturally gravitate towards others who share common characteristics in terms of demographics, behaviors, and personal characteristics (Farmer & Farmer, 1996; Kandel, 1978). Research indicates that sociodemographic factors, such as gender, race, religion, and social class, are particularly strong

drivers of homophily in social networks (McPherson et al., 2001). In homophilous relationships, it takes less effort to communicate, trust is more readily established, and the relationship is perceived as more rewarding and less conflictual (Veenstra et al., 2018). Relationships between dissimilar individuals are less stable and durable (McPherson et al., 2001).

Extensive studies have demonstrated that gender homophily is one of the strongest predictors of friendship formation across diverse cultures and age groups. During the 1970s and 1980s, developmental psychologists observed that, from a young age, children tend to naturally segregate by gender during play (Lever, 1976; Maccoby & Jacklin, 1974). Studies have consistently demonstrated that children, from preschool age to adolescence, exhibit a preference for same-gender playmates and friends. For example, Martin and colleagues (2011) observed that among children aged three to six years, 89% of peer interactions occurred with those of the same gender. Lee and colleagues (2007) reported that only 11% of children in the first to sixth grade had cross-gender friendships. These patterns are not limited to specific cultural contexts, as research on African American and Latinx children in the US (Halim et al., 2013) and children in Tasmania and Australia (Smith et al., 2001) has revealed similar trends of gender segregation. A recent, longitudinal study examining the friendship networks of 280 fourth grade students reported that gender homophily influenced the formation and stability of friendships over a school year (Garrote et al., 2023).

Gender segregation among children often leads to the formation of two separate social groups, aligning with the concept of the “Two World Theory” (Maccoby, 1998). Gender norms and peer pressure play a significant role in shaping and maintaining these two separate worlds (Witt, 2000). Children develop their own set of rules and norms that friendships should be with same-gender peers and those who violate these rules are often teased, bullied, and accused of

having cross-gender friendships (Thorne, 1993; Monsour, 2002). A cross-cultural, comparative study conducted by Mehta and Smith (2022) highlighted that children in various cultures commonly reinforce gender boundaries during playtime.

Distinct interaction patterns, consistent with the concept of “two worlds,” have been observed in various contexts of children’s friendships. Research suggests girls primarily engage in conversation and in sports viewed as feminine with their friends, whereas boys more often participate in traditionally masculine sports (Al-Attar et al., 2017; Klomsten et al., 2005). Such findings suggest that gender norms inform the types of activities in which children engage with friends. Furthermore, boys and girls geographically separate their spaces during play. For example, playground observations in Kenya revealed that girls chose to play in the corner, away from boys, to avoid having their play interrupted by boys (Edwards & Whiting, 2004). Regarding how boys and girls define friendship, girls emphasize emotional aspects in friendships, valuing peers who protect their feelings, keep secrets, and offer emotional support, while boys prioritize shared interests, mutual relationships, and having common friends (Buckley et al., 2010; Kitts & Leal, 2021). Even though studies collectively suggested distinct norms and interaction patterns among two gender groups, few studies have used a social network analysis approach to explore the moderating effect of gender on children’s dyadic peer interactions.

Next, behavioral compatibility refers to the tendency to connect with people who display similar interests, interaction styles, and behaviors (Martin et al, 2013). This concept stems from observations that children are drawn to others with whom they share behavioral patterns (La Freniere et al., 1984). Similar to the effect of homophily, individuals with similar behavioral patterns can easily communicate and build trust (Veenstra et al., 2018). In addition to the lens of

homophily, behavioral compatibility allows us to understand the peer relationship based on the role of shared activities and behaviors.

Compatible behaviors often align with gender, given the distinct interests and activities typically pursued by boys and girls (Farmer & Farmer, 1996; Maccoby, 1990; Mehta & Smith, 2022). Research conducted by Martin and colleagues (2013) indicates that children prefer peers who engage in similar levels of gender-typed activities. Additionally, gender-typed behaviors are more helpful when socializing with same-gender peers than with mixed-gender groups (Martin & Fabes, 2001). In research conducted with first grade children, girls reported they do not want to play with boys because they believe boys are rough, physically vigorous, and care only for sports (Corsaro et al., 2003). Similarly, adolescent girls reported a preference for spending time with girls because they assume they will be more listened to and supported by girls than boys (Mehta & Strough, 2009).

Last, social synchrony refers to the increase in similarity of individuals' behaviors, emotions, and activities, as the social interactions between affiliative partners endure (Farmer & Hollowell, 1994; Kandel, 1978). Social synchrony involves two types of social interchanges (Farmer & Farmer, 1996). First, reciprocal interchanges involve peer partners responding similarly to each other, enhancing similarity in viewpoints, values, and behaviors. Second, complementary interchanges occur when partners support each other's distinct behaviors in ways that are mutually beneficial. As individuals increasingly mirror (i.e., reciprocal interchange) and support (i.e., complementary interchange) each other's behaviors and attitudes, they are likely to grow more similar to each other (Brown & Larson, 2009).

The social synchrony framework enhances our understanding of friendship networks by covering not just their formation and selection but also their maintenance. As social interactions

are dynamic and active interchanges between individuals, it is crucial to understand the evolving nature of these interactions in analyzing friendship networks. Maccoby (1990) noted that gender differences in children's behaviors are less salient when observed individually. As children find same-gender peers more similar and compatible, they segregate themselves into same-sex groups, and these social bonds, in turn, are likely to result in distinctive norms among two gender groups (Farmer & Hollowell, 1994). Over a six-month observation period, results from one study revealed that the more both boys and girls engaged with same-gender partners the more their behavior exhibited gender distinctions (Martin & Fabes, 2001). Although the current study did not examine longitudinal data, it is important to acknowledge that existing friendship networks are the outcomes of ongoing social interactions.

In conclusion, homophily and social synchrony are not mutually exclusive processes (Kandel, 1978; Farmer & Farmer, 1996). Sharing similarity and having compatible behaviors are essential for initiating and forming friendships, and the continuous process of synchronizing is important for maintaining and solidifying friendships. In the following section, we turn our attention to how gender and sports shape children's friendship.

Gender, Sports, and Social Interaction

Historically, sports have been male-dominated, valuing traits of masculinity such as physical strength and aggression. These values led to a gendered division in sports activities, with men engaging in competitive, physically demanding sports, such as football and basketball, while women were directed toward activities considered more feminine, such as gymnastics (Bruce, 2016). This segregation reflects and perpetuates societal gender norms, influencing sports preferences from a young age and restricting physical activities deemed acceptable for each gender (Mehta & Smith, 2022; Messner, 1988; Witt, 2000). Institutional policies and

cultural norms historically limited female participation in sports, reinforcing traditional gender roles (Acosta & Carpenter, 2014; Taylor & Wells, 2017).

Gendered group norms are one of several factors associated with how boys and girls differently value and interpret athletic abilities. Among boy's social interaction, sports competency and athletic ability are often strongly related with popularity and social status (Fisette, 2011; Klomsten et al., 2005). Research indicates that boys make clearer distinctions between popular and unpopular peers based on athletic prowess (LaFontana & Cillessen, 2002). Additionally, participation in prestigious activities, such as highly-regarded athletic team or cheerleading, typically place students at the top of the social hierarchy (Lease et al., 2002). Social status among peers can even influence play patterns, where popular boys might coerce peers into activities not of their choice (Adler & Adler, 1998). Although athleticism in girls is related to popularity, their athletic achievements often need to be balanced with traditional gender norms and societal expectations of femininity (Fisette, 2011; Klomsten et al., 2005). Unlike boys, girls perceived as popular by peers are often seen as attractive, prosocial, and intelligent; sports competency has been a less strong predictor of popularity among girls (Lease et al., 2002). However, the weaker correlation between sports competency and popularity among girls might indicate limited opportunities for sports participation or girls' lower interest in sports (Deaner et al., 2016).

The enactment of Title IX in 1972 revolutionized educational and athletic opportunities for women and girls (Lindstrom & Lease, 2005). In 1970, before Title IX was enacted in 1972, the average school had only 2.5 girls' sports teams. By the 1977-1978 academic year, this number had increased to 5.61 teams per school. By 2012, the number of girls' teams per school reached a record high of 8.73 (Acosta & Carpenter, 2014). Title IX legislation has not only

increased female representation in sports but also challenged gender norms around athleticism and competition (Cooky & Lavoie, 2012). Gender equity education further supported this change by promoting inclusive sports practices, by dismantling stereotypes that categorized sports as inherently male or female, and by influencing school curricula (Davis, 2003). These societal shifts have broadened opportunities for female athletes. The growing achievements of women in various sports, that have been widely publicized, have empowered subsequent generations of women and girls to engage in athletic pursuits free from the constraints of historical stereotypes (Bruce, 2016; Cooky & Lavoie, 2012).

Even though studies have explored a wide range of gendered norms and their influences on children's social interaction, gaps in our understanding and in the literature still exist. Although the association between boys' sports competency and social acceptance is well-documented, it might be influenced by underlying bias in measurement methodologies. For example, common paraphrasing in peer nomination studies, such as “Who is good at sports?” might inadvertently evoke images of male-dominated sports (e.g., football). This question can lead children to nominate boys and result in an underrepresentation of the association between sports competency and social status among girls. Additionally, since the 1970s, educational policies and societal views on gender norms have continuously changed. These shifts have potentially altered the socialization processes of children. All of these factors, necessitate a reexamination of the association of gender, sports activities, and friendship networks within school settings.

Current Study

Our study aimed to provide a nuanced understanding of the interplay between gender and sports within the context of friendship networks. To address existing research gaps, we employed

an advanced, modern technique used to examine social networks – Exponential Random Graph Models (ERGMs). Social relationships of students are shaped by an interplay of both individual characteristics and social structures of the classroom (Farmer & Farmer, 1996). Utilizing ERGMs enabled us to analyze complex friendship networks by considering both individual attributes and relationship (dyadic) factors while accounting for aspects of network structures. Another unique feature of the current research was our assessment of athletic competence. To better capture the types of athletic activity in which children might engage, we assessed peer-perceived sports competency in two types of sports that children are able to engage in at school (e.g., recess, PE class) – those that include the likelihood of physical contact (e.g., soccer) and those that do not (e.g., volleyball). Research questions are as follows.

RQ1: *How does gender homophily influence children's friendship networks?*

RQ2: *How does sports competency influence children's friendship networks, and how is this relationship moderated by gender?*

RQ3: *How does sports competency homophily influence children's friendship networks, and how is this relationship moderated by gender?*

Method

Participants

The study included 459 students in the fourth and fifth grades, nested within 26 elementary school classrooms. The data were collected from six elementary schools located in rural counties in the southeastern United States. Table 2.1 describes the demographic characteristics of the participants. Of the sample, 52.3% were girls ($n = 240$) and 54.9% of students identified as White ($n = 252$), 42.4% as Black ($n = 195$), and 2.7% as another ethnicity ($n = 12$). The schools involved in the study predominantly served either Black or White student

populations, with 80.3% of the students ($n = 369$) belonging to the majority race of their respective school. The grade distribution within the sample was 37.9% in the fourth grade ($n = 174$) and 62.1% in the fifth grade ($n = 285$).

Procedure

The university's Institutional Review Board (IRB) approved all measures and procedures involved in the study. Active consent for participation was obtained from parents and classroom teachers after permission had been obtained from school superintendents and building principals. Each student provided assent before the administration of questionnaires. Across classrooms, parental consent was obtained for 89% of students, with student participation rates ranging from 83% to 100%.

Measures

Friendship Network

Our study used peer nominations, referred to as sociometric assessments, to assess children's social relationships in the context of their peer groups (Cillessen & Marks, 2017). To identify the friendship networks, we asked "Please tell us who your three closest friends in your classroom are." Participants were allowed to list up to three friends. We gathered data across all peer reporters from each classroom unit and created a directed friendship matrix for each classroom.

Sports Competency

A peer nomination procedure to assess sports competency allowed us to understand sports ability not only as a physical attribute but also reflecting children's sociometric perceptions (Cillessen & Marks, 2017). We specified perceived sports competency in two categories: rough sports and non-rough sports. Participants were asked to nominate up to three

peers for each category based on the questions, “Who is good at sports that are rough, like soccer, basketball, and football?” and “Who is good at sports that aren’t rough, like volleyball and gymnastics?” Due to class size variations, the number of nominations received from peers were divided by the number of participants (i.e., nominators) in each class size to calculate participants’ sports competency.

Overview of Analysis

Our data analysis involved two stages; 1) preliminary analysis and 2) ERGM analysis. We used the *ergm* package in R version 4.3.1 (Hunter, Hancock, et al., 2008) in all processes. In the first stage, descriptive statistics were calculated and presented by the two gender subgroups. Next, we combined the friendship networks within the 26 classrooms into a single block-diagonal network, keeping structural zeros to represent the absence of connections between classrooms (Krivitsky et al., 2023). This strategy allows for precise statistical estimations, while preserving the unique network characteristics of each classroom (Krivitsky, 2024). We excluded a friendship network of one classroom from our analysis because the model including that classroom did not converge, even after attempting recommended practices for enhancing convergence (Estévez et al., 2022; Windzio & Heiberger, 2022). Thus, our final block-diagonal friendship network consisted of the data from 25 classrooms.

In the second stage, we specified the ERGMs and analyzed the result. The ERGMs predict the likelihood of a relationship between any two children in a network by evaluating the presence of specific patterns within the network (Hancock, et al., 2023). In our study, this approach enabled us to incorporate both individual characteristics (e.g., gender, racial status, sports competency) and collective group structure (e.g., reciprocity and transitivity) into a

statistical model to explore the complex patterns in the friendship networks (Borgatti et al., 2022).

The model specification procedure followed the approach of Goodreau (2007). We started with a null model that included only an edge term, which functions similarly to an intercept in regression analysis and captures the overall density of the network. We progressively incorporated terms of structural effects (e.g., reciprocity and transitivity) and individual effects (e.g., gender, sports competency). Shrum and colleagues (1988) suggested that the influence of racial homophily on friendship increases from elementary to middle school, and, after middle school, the role of racial homophily remains constant. Given the significant patterns of racial homophily in friendship networks noted in prior research (McPherson et al., 2001), we included the homophily of racial status (i.e., majority or minority race in the classroom) as a covariate in all models. We compared the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) scores to identify the most parsimonious models. Goodness-of-fit statistics were also used to evaluate model fit (Goodreau, 2007; Hunter et al., 2008).

According to research questions and the model specification procedure, we identified four statistical models. All four models included the homophily effects of gender and racial status. In the first two models, we examined the interaction effects between gender and individual level of perceived rough sports competency (model 1.1) and perceived non-rough sports competency (model 1.2). In the following two models, we tested interaction effects between gender and (dyadic) homophily for perceived sports competency (model 2.1) and for perceived non-rough sports competency model 2.2). All four models demonstrated acceptable convergence and good fit.

Results

Descriptive Statistics

The descriptive analyses, presented in Table 2.2, reveal distinct patterns among boys and girls in the two types of perceived sports competency. Boys were perceived as having a higher degree of rough sports competency compared to girls (boys = 0.223, girls = 0.070). The distribution for perceptions of boys' rough sports competency was moderately left skewed and flatter than for girls', while the girls' scores exhibited a sharper peak and were more left-skewed than for boys (boys; kurtosis = 0.488, skewness = 1.088, girls; kurtosis = 1.982, skewness = 1.401). In contrast, girls were perceived as having higher degree of non-rough sports competency than boys (girls = 0.145, boys = 0.085). Both boys and girls demonstrated strong left-skewness in the distributions of perceived non-rough sports competency, more pronounced in boys (skewness = 1.567) than in girls (skewness = 1.390). The kurtosis values indicated high-peaked distributions for both groups (boys = 2.939, girls = 2.781). These results suggested gender differences in who was perceived to have the two types of sports competency, with boys being seen as having greater prowess in rough sports and girls being seen as excelling in non-rough sports. For both sports types, most participants, regardless of gender, scored in the low range, while a few participants achieved high sports competency.

Dyadic and Structural Features of Friendship Networks

Across all tested models (presented in Table 2.3, 2.4), our results indicate significant effects of homophily on the friendship network. Gender homophily was consistently significant across models (estimate; model 1.1 = 1.15, model 1.2 = 1.19, model 2.1 = 1.23, model 2.2 = 0.96), indicating a preference for same-gender friendships. Racial status homophily (i.e., majority or minority) also revealed a positive effect (estimate; model 1.1 = 0.19, model 1.2 =

0.20, model 2.1 = 0.19, model 2.2 = 0.19), reflecting the association of racial status homophily with friendship ties.

In terms of structural characteristics, consistent patterns in density, reciprocity, and transitivity (measured by GWESP metric) were observed across all four models (see Table 2.3, 2.4). This consistency suggests that the underlying social structure of children's friendships remains similar regardless of group conditions. A negative significant coefficient for edges (estimate; model 1.1 = -7.35, model 1.2 = -7.27, model 2.1 = -7.27, model 2.2 = -6.73) indicates fewer friendship ties than expected across all networks. This could be related to the use of a limited nomination procedure (i.e., “up to three peers”). Positive significant coefficients for reciprocity terms (estimate; model 1.1 = 4.04, model 1.2 = 4.01, model 2.1 = 4.04, model 2.2 = 4.56) demonstrated strong tendencies for mutual tie formation. Positive significant coefficients for transitivity terms represented a tendency toward triad closure (estimate; model 1.1 = 1.82, model 1.2 = 1.86, model 2.1 = 1.83, model 2.2 = 1.31).

The Effects of Sports Competency Moderated by Gender on Friendship Networks

Our study explored the interaction effects between gender and perceptions of the two types of sports competencies in model 1.1 and 1.2 (presented in Table 2.3). Model 1.1 examined the interaction effect between gender and perceived rough sports competency, and individual level variable, in shaping friendship ties within peer networks. We did not find evidence that gender ($p = .438$), perceived rough sports competency ($p = .410$), or the interaction term between gender and perceived rough sports competency ($p = .167$) are significantly associated with friendship networks.

Model 1.2 examined the interaction between gender and perceived non-rough sports competency. The results were similar to those regarding perceived rough sports competency. We

found no evidence that gender ($p = .880$) or perceived non-rough sports competency ($p = .963$) significantly impacted the likelihood of ties within friendship networks. Additionally, the interaction between gender and perceived non-rough sports competency did not suggest any significant impact on children's friendship networks ($p = .245$).

In sum, the results in Table 2.3 tell us that, consistent with previous research, children in our study were more likely to be friends with children of the same race, children of the same gender, with people who name them as friends, and with friends of their friends. We find no significant evidence that (a) girls or boys are chosen as friends at higher rates, (b) being perceived as good at rough or non-rough sports predicts friendship, or (c) girls and boys differently value perceived sports competencies when choosing friends overall.

The Effects of Sports Competency Homophily Moderated by Gender on Friendship Networks

Now we turn to the consideration of whether perceived sports competencies organize friendships via homophily. In particular, we examine (a) whether children choose friends who are similar in perceived sports competency to themselves and (b) whether this tendency varies by gender.

We further explored the interaction effects between gender and sports competency homophily in model 2.1 and 2.2 (presented in Table 2.4). In model 2.1, homophily in perceived rough sports competency was a positive predictor of friendship ties (estimate = 0.58). For each unit increase in shared rough sports competency, the probability of forming a friendship increased 78.7% (odds ratio = 1.787). The coefficient for gender is negative but not statistically significant ($p = .179$), indicating that gender alone does not predict the formation of friendship ties in this model. Moreover, the negative and significant interaction effect suggested that the

impact of rough sports competency homophily on friendship formation is less pronounced for girls than for boys (estimate = -0.44). This result demonstrated that girls are less likely to form friendships based on shared rough sports competency compared to boys. Specifically, for girls, each unit increase in rough sports competency homophily lowered the likelihood of forming friendship ties by 35.4% compared to boys (odds ratio = 0.646).

In model 2.2, homophily in perceived non-rough sports competency was a positive and significant predictor of friendship formation (estimate = 0.35). For each unit increase in shared non-rough sports competency, the probability of forming a friendship increased 42.1% (odds ratio = 1.421). Again, gender was not a significant predictor ($p = .366$). The positive interaction term (estimate = 0.41) suggested that the influence of shared non-rough sports skills was stronger among girls than boys in the friendship networks. Specifically, one unit increase in non-rough sports competency homophily was associated with 50.5% higher likelihood of forming friendship ties among girls than among boys (odds ratio = 1.505).

In sum, children tend to form friendships based on shared sports competency perceived by peers. The type of sport, however, matters by gender—boys are more sensitive to having similar levels of perceived rough sports competency, while girls are more influenced by those of non-rough sports.

Discussion

Our study investigates how gender and two types of perceived sports competency (i.e., rough and non-rough sports) relate to the pattern of ties within children's friendship networks. Through the use of ERGMs, we were able to comprehensively take into account individual characteristics (i.e., sports competency, gender, racial status), dyadic effects (i.e., homophily) and structural configurations (i.e., density, reciprocity, and transitivity) across 26 classrooms.

Gender Homophily Effects on Children's Friendship Network

Regarding the first research questions, we observed strong and consistent patterns of gender homophily effect within children's friendship network across all statistical models. Prior research has suggested that the tendency towards forming friendships with peers of the same gender is prevalent across various social settings from early childhood to adulthood (Mehta & Smith, 2022). Our finding confirms that gender homophily is related to the presence (or absence) of children's friendship ties, whether due to children naturally gravitating to same gender peers (McPherson et al., 2001) or learning to conform to the same gender group operated through reinforcement, modeling, and peer pressure (Witt, 2000). Specifically, at this developmental stage (i.e., fourth and fifth grade students), our findings indicate that forming same-gender friendships remains a dominant pattern.

Higher Sports Competency Does Not Predict the Presence of Friendship Ties

Regarding the second research question, our study finds that higher rough or non-rough sports competency perceived by peers does not predict more friendship ties, and these associations do not differ by gender. These results imply that the level of an individual's athletic skills might not be a primary factor for children to select their friends. Interestingly, this finding contrasts with previous research that athletic competence positively predicts friendship ties (Zhang et al., 2023), and especially among boys, it is associated with popularity and higher status (LaFontana & Cillessen, 2002; Lease et al., 2002). However, in a departure from prior research, our ERGM models examined the effect of individual levels of sports competency after accounting for the structural effects of the networks.

One possible explanation for this unexpected finding could be that perceptions of friendship are not necessarily identical with popularity, as the concept of friendship is nuanced

and influenced by various factors. As Kitts and Leal (2021) suggest, friendship networks are multidimensional, shaped by sentiments (i.e., liking and trust), interaction patterns (i.e., frequency and quality of interactions), and expected social roles. Moreover, they insist that friendship should be differentiated from directed liking and directed interaction. LaFontana and Cillessen (2002) also suggest that athletic ability is more strongly associated with perceived popularity than with liking. Thus, our finding implies that the status and social dominance of children with high sports competency might come from hierarchical relationships within their groups, regardless of the number of direct friendship ties they have.

Second, from the perspective of friendship goals, choosing athletic children to befriend might not necessarily align with children's friendship goals. Even though being a friend with a highly athletic peer can confer some benefits in the context of friendship, such as having higher dominance or more chances to engage in influential interactions (Adler & Adler, 1998), for some children, friendship goals lean more toward emotional support, individual interactions, and a communal orientation. Choosing friends with high athletic skills might lower the probability of satisfying dyadic interactions, because high popularity can create imbalances in dyadic relationships. Therefore, sports competency might influence some children's choice of friends, but the current results indicate sports competency does not universally underlie friendship selection for all children.

Higher Sports Competency Homophily Shapes Gendered Friendship Networks

In terms of the third research question, our results revealed that homophily in both perceived rough and non-rough sports competencies significantly predicts the likelihood of a friendship tie. This outcome is consistent with previous findings that shared athletic abilities are a crucial medium for shaping social ties (Fujimoto et al., 2018; Martin et al, 2013). Our study

supports that communal relationships, such as mutual support and enjoyment of shared activities, are important aspects of children's friendship networks. Our findings align with three theoretical frameworks we have previously discussed: As people are drawn to others who have shared sociodemographic and behavioral characteristics (i.e., social homophily and behavioral compatibility), having similar levels of sports competency might be a good reason for children to choose friends. This interaction between peers of shared sports competencies can further increase the likelihood of eliciting and sustaining similar behaviors and viewpoints (i.e., social synchrony).

Our study reveals that homophily for two types of sports competencies shape children's friendship formation in a distinct way by gender. Shared skills in rough sports are more pivotal in boys' friendship, demonstrating greater sensitivity compared to girls. It might be because, in our sample, boys were seen as having greater proficiency in rough sports than girls. Higher proficiency facilitates their participation in and enjoyment of rough sports, reflecting traditional gender roles where physical contact sports are usually male-dominated (Martin et al., 2013; Pellegrini, 2005). Interestingly, although perceived rough sports competency is typically low among girls, a few girls exhibited high proficiency, which makes them discrepant from the other girls in our sample. This might present several challenges for these girls. Girls might struggle to find same gender peers with similar interests in rough sports. It potentially leads to social isolation or a pressure to conform to more traditional female activities, which could eventually suppress their sports abilities or alter their interests to better fit those of their peer group. Alternatively, these girls with high sports skills might seek friendships outside their gender group, which might necessitate adaptation to different social norms underscored by the "Two World Theory."

Homophily with regard to perceived non-rough sports competency also had different effects on the friendship networks of boys and girls. Our results indicated that girls demonstrate a greater sensitivity to homophily in perceived non-rough sports competency when selecting friends than boys. Given girls are seen as having higher non-rough sports competency than boys, it reflects girls are more likely to enjoy participating in less physically aggressive activities, which is consistent with the traditional gender norm in child's play (Al-Attar et al., 2017). Such preference suggests that non-rough sports activities can be a medium of facilitating social connections among girls through shared activity skills and compatible behaviors. Conversely, boys place less emphasis on sharing non-rough sports competency in their friendships. Similar to girls with high rough sports competency, boys with high non-rough sports skills might encounter difficulties finding same-gender friends with similar interests.

Implications and Future Directions

Overall, our findings have several implications. First, sport is an important medium for the friendship formation of both boys and girls. A large shift in societal and educational backgrounds has been progressively made on gender equity in sports participation. Although the data for this study were collected in 2004, they reflect the post–Title IX era in which sports were becoming increasingly important for girls. We observed growing participation among girls, though often within traditionally feminine or non-contact sports. Since then, cultural shifts have continued, with more girls and women engaging in sports traditionally viewed as masculine. Additionally, the emergence of the "cool sports girl," a figure who combines athletic prowess with traditional femininity (Henry, 2023), highlights a cultural shift that challenges traditional gender roles in sports. Following those changes, sports have become crucial aspects of children's

social interaction, regardless of gender, serving as a means to find common interests and facilitate their socialization.

Second, as of 2004, traditional gender norms continue to influence gendered socialization among children. Boys and girls exhibit distinct preferences for different types of physical activities, consistent with gender norms, such as boys favoring rough sports and girls favoring non-rough sports. In the recent day, despite increased participation of girls and women in a wider range of sports, women athletes continue to be underrepresented in sports leadership roles (Taylor & Wells, 2017) and receive less media attention compared to male athletes (Cooky & Lavoie, 2012). Providing opportunities for children to participate in a variety of sports at school is crucial for diminishing gender-stereotypical perceptions of sports.

Last, the differences in how boys and girls respond to sports competencies highlight unique socialization processes associated with different types of sports. Our study offers insights into the question of why boys tend to have larger, more loosely connected social networks than girls. Specifically, boys often exhibit a greater sensitivity to rough sports that require large teams and expansive play areas, explaining their larger, less dense networks. Conversely, girls demonstrate an enhanced sensitivity to non-rough sports, which generally involve smaller teams and less physically demanding activities. This leads to denser, more tightly-knit networks among girls. Such divergent sports preferences of boys and girls underscore the need to consider how participating in different physical activities distinctly shapes their social networks, in turn influencing broader patterns of peer relationships and social interaction.

However, our sample primarily centered on a rural southeastern U.S. demographic, leaving concerns about the generalizability of our findings. To address these concerns, future research should expand upon our findings across a broader geographical and cultural contexts.

Moreover, our sociometric measure allowed children to nominate up to three peers. This approach might not fully capture their friendship networks. Researchers could employ an unlimited nomination method that provides deeper insights into friendship networks. Given the continued shifts in gender norms and the growing participation of girls and women in traditionally male-dominated sports, future research should investigate whether these patterns persist in more recent educational settings. Last, the cross-sectional design of this study captures only a snapshot of the social dynamics. Longitudinal research would significantly enrich our understanding of how friendship networks evolve from the developmental stage of preadolescence to adolescence.

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Table 2.1*Demographic Information*

Variable	Boys (N)	Girls (N)	Total (N)
Race			
White	111	141	252
Black	101	94	195
Other	7	5	12
Racial Status			
In Majority	175	194	369
In Minority	44	46	90
Grade			
Fourth	89	85	174
Fifth	130	155	285
Total	219	240	459

Table 2.2*Descriptive statistics*

	Mean	SD	Min, Max	Kurtosis	Skewness
Rough sports competency					
Boys	0.223	0.205	0, 0.882	0.488	1.088
Girls	0.070	0.080	0, 0.407	1.982	1.401
Total	0.143	0.008	0, 0.882	3.150	1.787
Non-rough sports competency					
Boys	0.085	0.088	0, 0.476	2.939	1.567
Girls	0.145	0.117	0, 0.737	2.781	1.390
Total	0.117	0.005	0, 0.737	3.238	1.522

Table 2.3*Result of ERGM Predicting Friendship Network with Sports Competency Interaction Effects*

	Model 1.1		Model 1.2	
	Estimate (Std.Error)	Odds Ratio	Estimate (Std.Error)	Odds Ratio
Structural effect				
Edges	-7.35***(0.21)	0.001	-7.27***(0.12)	0.001
Reciprocity	4.04***(0.20)	57.038	4.01***(0.15)	55.288
Transitivity	1.82***(0.09)	6.193	1.86***(0.08)	6.400
Individual factor				
Gender_girls	0.10(0.12)	1.106	-0.08(0.05)	0.925
Gender_H	1.15***(0.17)	3.174	1.19***(0.10)	3.283
Racial status_H	0.19*(0.10)	1.207	0.20***(0.06)	1.225
RSC	0.67(0.40)	1.952		
NRSC			0.44(0.36)	1.557
Gender_girls*RSC	0.07(0.48)	1.075		
Gender_girls*NRSC			0.13(0.36)	1.135
AIC	10,040		10,073	
BIC	10,122		10,155	

Note: Presented results were estimate (log odds) and standard error; Odds ratio values were additionally reported for detailed explanation; *** $p < .001$, ** $p < .01$, * $p < .05$; RSC = Rough Sports Competency, NRSC = Non-Rough Sports Competency, H = Homophily.

Table 2.4*Result of ERGM Predicting Friendship Network with Homophily Interaction Effects*

	Model 2.1		Model 2.2	
	Estimate (Std.Error)	Odds Ratio	Estimate (Std.Error)	Odds Ratio
Structural effect				
Edges	-7.27***(0.09)	0.001	-6.73***(0.09)	0.001
Reciprocity	4.04***(0.13)	57.072	4.56***(0.13)	95.737
Transitivity	1.83***(0.06)	6.222	1.31***(0.06)	3.706
Individual factor				
Gender_girls	-0.03(0.02)	0.973	-0.03(0.03)	0.974
Gender_H	1.23***(0.09)	3.438	0.96***(0.06)	2.610
Racial status_H	0.19***(0.04)	1.204	0.19***(0.05)	1.204
RSC_H	0.58***(0.07)	1.787		
NRSC_H			0.35***(0.07)	1.421
Gender_girls*RSC_H	-0.44***(0.08)	0.646		
Gender_girls*NRSC_H			0.41***(0.12)	1.505
AIC	10,013		10,043	
BIC	10,095		10,125	

Note: Presented results were estimate (log odds) and standard error; Odds ratio values were additionally reported for detailed explanation; *** $p < .001$, ** $p < .01$, * $p < .05$; RSC = Rough Sports Competency, NRSC = Non-Rough Sports Competency, H = Homophily.

CHAPTER 3
FEATURES OF CROSS-GENDER FRIENDSHIP GROUPS²

² Kim, M., Lease, A. M., and Robinson, D. T. To be submitted to a peer-reviewed journal.

Abstract

This social network study explored the characteristics and network structures of children's cross-gender friendship (CGF) groups by analyzing friendship networks within 26 classrooms. We used a series of analyses to comprehensively describe CGF groups and compare them to same-gender groups (SGF). We (a) identified friendship groups and conducted descriptive analysis to compare those groups, (b) analyzed network structural features (i.e., density, reciprocity, and transitivity) of friendship groups, and (c) compared behavioral characteristics of CGF and SGF groups. This study involved 473 fourth- and fifth-grade elementary-school students (mean age = 10.6 years). Eighty-eight friendship groups (71 SGF and 17 CGF groups) were formed across classrooms using community detection techniques. Descriptive analysis revealed that CGF groups had unique characteristics, compared to SGF groups, in terms of their frequency, number of groups, group size, and prevalence by gender and grade level. Network structure comparisons revealed that SGF groups had significantly higher density, reciprocity, and transitivity than CGF groups, indicating stronger group cohesion. CGF groups demonstrated significant differences from SGF groups in perceived rough and non-rough sports competency, but not in the academic competency and social status, of their group members.

INDEX WORDS: Cross-gender friendship groups, Community detection techniques, Friendship networks

Introduction

Friendship matters to children. In school settings, friendships are closely tied to both positive and negative developmental outcomes. For example, high-quality friendships have been linked to greater happiness, life satisfaction, self-esteem (Holder & Coleman, 2015), increased intimacy and support (Berndt, 2004) as well as higher academic engagement, motivation, and better school adjustment (Hamm & Faircloth, 2005). In contrast, friendship with low levels of mutual support and trust are associated with increased problematic behaviors (Berndt, 2004) and a higher risk of school disengagement and emotional distress (Rubin et al., 2006).

Once children form friendship groups, the interactions within these groups tend to become more influential. A meta-analytic review of 25 studies by Newcomb and Bagwell (1995) found that reciprocated relationships within groups were associated with more intense social activity, more frequent conflict resolution, and more effective task performance compared to interactions among non-friends. Similarly, a systematic review of 65 studies examining programs that promote group-based peer relationships among students aged 8 to 14 revealed that positive peer interactions increased social-emotional skills and reduced problematic behaviors (Pollak et al., 2023). In this way, friendship groups function not only as sources of support but also as engines of socialization (Brown, 2004).

Gender boundaries are widely recognized as one of the most powerful forces shaping friendships. From an early age, children tend to gravitate toward same-gender peers, a phenomenon that has been consistently observed across cultures and settings (Lever, 1976; Maccoby & Jacklin, 1974; Thorne, 1993). Although gender segregation into same-gender friendship (SGF) groups is most commonly observed, cross-gender friendship (CGF) groups are also consistently observed in social worlds (Mehta et al., 2014).

Solano (1986) posited that friendships generally fulfill three fundamental functions: addressing material needs through practical support, providing emotional support, and fostering personal growth and validation. CGFs specifically offer unique advantages beyond those of same-gender friendships. These benefits include enhanced social skills, higher self-esteem (McMillan et al., 2023), exposure to diverse perspectives, and reduced prejudice and stereotyping (Pettigrew et al., 2011). CGFs also play distinct developmental roles that function as early precursors to romantic relationships (Mehta & Strough 2009). From a network perspective, CGFs might serve as bridging roles and help reduce intergroup bias (Bleske & Buss, 2000). Thus, understanding children's CGFs is essential not only for capturing a fuller picture of their friendships but also for understanding how children navigate gender boundaries and build their social identities.

Over the past few decades, there has been growing interest in CGFs (Halatsis & Christakis, 2009; Mehta et al., 2014). However, most CGF research has focused on early childhood (Maccoby, 1988; Serbin et al., 1993), adolescence (Laursen & Veenstra, 2021; McMillan et al., 2023), or young adulthood (e.g., the role of CGF; Reeder, 2017, preference for CGFs; Baumgarte & Nelson, 2009), particularly within literatures examining romantic relationships (Bleske & Buss, 2000; Fuhrman et al., 2009), workplace dynamics (Sias & Bartoo, 2007), communication styles (Guerrero & Chavez, 2005; Leaper, 2019), and psychological well-being (Lenton & Webber, 2006; Zhou & Wang, 2022). However, CGFs during late childhood remain underexplored, despite it being a transitional period marked by increased peer influence and the onset of romantic relationships. Moreover, much of the existing literature is based on individual-level analyses, such as personal factors associated with having CGFs (Lenton & Webber, 2006), and lacks understanding of CGFs at the group level. Few studies have described

how CGF groups are structurally or behaviorally characterized within friendship networks, especially within school settings. Addressing these gaps is essential for understanding how participation in CGF groups shapes children's social experience.

The current study aimed to broaden our understanding of children's CGF groups in late childhood. Friendship groups were identified from 26 classroom-based friendship networks using community detection techniques, a type of social network analysis (SNA) tool. The identified CGF and SFG groups were compared on their descriptive characteristics, network structural features (i.e., density, reciprocity, and transitivity), and behavioral characteristics (i.e., academic competency, sports competency, and social status).

Gender Expectations and Friendships

Role theory posits that individuals conform to societal expectations through meeting the role expected of each individual (Biddle, 1986). As a subset of Role theory, Social Role Theory specifically views sex differences and similarities in social behavior as a product of social roles rather than inherent biological differences (Eagly et al., 2012). This framework posits that gender stereotypes are built upon expected social roles that lead people to assume, for example, that men are dominant and independent whereas women are communal and cooperative. These stereotypes are continued and reinforced within the social settings, such as family life and work places. The societal expectations about men's and women's behavior, in turn, foster psychological and behavioral differences that strengthen gender roles over time in the society.

From an early age, friendships are significantly influenced by gender. Prolific research suggests that children naturally gravitate to same-gender peers (Farmer & Farmer, 1996; Kandel, 1978; McPherson et al., 2001). Shared sociodemographic characteristics (e.g., gender, race, religion, or social class) allow people to build more stable relationships with less effort. This

phenomenon has been observed across all age groups, including young children (Lever, 1976; Maccoby & Jacklin, 1974), school-aged children (Lee et al., 2007; Martin et al., 2013), and adults (Mehta & Strough, 2009), and across diverse cultural settings (Garrote et al., 2023; Halim et al., 2013; Smith et al., 2001).

Even though the dominant form of friendship is between same-gender individuals, CGFs are still consistently observed across all age groups. CGFs become increasingly common as children transition into adolescence. For example, adolescents typically include a higher proportion of cross-gender peers in their friendship networks compared to children and preadolescents (Poulin & Pedersen, 2007; Strough & Covatto, 2002). By twelfth grade, the majority of adolescents report having at least one cross-gender friend (McDougall & Hymel, 2007). These friendships become integrated into their broader social relationships as they transition into emerging adulthood (Mehta & Strough, 2009). Additionally, cross-gender friendships are particularly common among young adults and college students, because college environments are typically less influenced by traditional gender-role expectations (Monsour, 2002). However, research suggests that people avoid initiating and maintaining CGFs after marriage because of societal and personal taboos (Werking, 1997). As people enter early adulthood, their friendship networks tend to become more gender-segregated (McMillan et al., 2023). Overall, these patterns underscore the evolving trajectories of cross-gender relationships across different life stages.

Another important consideration when exploring CGFs is understanding the association between romantic relationships and CGFs. Romantic relationships and CGFs are often intertwined, which make it hard for researchers to discretely measure these two concepts in different ways. The motives behind CGFs are also often ambiguous, particularly because

romantic interests frequently emerge within these relationships, leading to potential confusion and misinterpretation. Once people acquire a romantic partner, their tendency to engage in CGFs decreases. O'Meara (1994) reported that 30% of study participants considered involvement in romantic relationships as a significant barrier to forming or maintaining CGFs. Similarly, married individuals have traditionally maintained fewer CSFs compared to single individuals (Booth & Hess, 1974).

There are gender differences observed for CGFs. Buhrke and Fuqua (1987) reported that men are more likely to pursue cross-sex friendships than women, viewing these relationships as potential gateways to romantic or sexual involvement. Moreover, some suggest that men might benefit more than women from cross-sex friendships due to this potential romantic or sexual component (Bleske & Buss, 2000). In contrast, other studies suggest women might be more inclined than men to establish cross-sex friendships, given their tendency to initiate and maintain these relationships platonically (Buhrke & Fuqua, 1987). Supporting the latter, some research indicates that women report having more cross-sex friendships than men do (Parker & DeVries, 1993). Particularly during adolescence, growing interest in romantic relationships contribute to increased interactions with cross-gender peers (Bukowski et al., 1999; Mehta & Strough, 2009; Poulin & Pedersen, 2007). Given adolescents' and emerging adults' heightened interest in forming romantic relationships, CGFs might be particularly influential during these transitional developmental periods.

Most studies of CGFs involve samples of adults, college students, and adolescents, with children's CGFs receiving less attention. However, considering preadolescence is the developmental stage right before or during the emerging stage of romantic relationships, their CGFs are worth studying. Children's CGFs are also unique because they mainly occur in

structured environments such as classrooms, which are environmentally and socially different from the more autonomous settings in which adolescents and adults have such friendships (Mehta & Strough, 2009).

Network Structural Characteristics of Friendship Groups

Social Network Analysis (SNA) refers to a robust set of statistical tools which can be used to uncover the patterning of ties and interactions within a given network (International Network for Social Network Analysis [INSNA], n.d.). Understanding the structural characteristics underlying children's friendship networks provides valuable insight into how their friendship connections are formed within a group. To understand the overall cohesion and structure of CGF groups, as compared to SGF groups, we focused: density, reciprocity, and transitivity. *Density* refers to the proportion of actual ties relative to the number of all possible ties within a group, taken to indicate the overall cohesion of the group. *Reciprocity*, calculated as the ratio of the number of mutual ties to the total number of ties in the network, indicates the degree of mutual friendship ties. Finally, *transitivity* represents a tendency toward triad closure in a network. For example, higher transitivity in a group indicates a friend of one's friend is also considered a friend.

Extensive research has focused on gender differences in the structural characteristics of boys and girls SGF networks. For example, girls are generally found to have more reciprocal friendship ties than boys (Haynie et al., 2014; Markovic & Bowker, 2015). In contrast, boys are more likely to include both friends and non-friends in their playgroups or social interactions (Baines & Blatchford, 2009), and their friendship networks tend to have lower reciprocity (Escribano et al., 2023). However, relatively few network studies have examined CGFs compared to the larger body of research focused on SGFs.

It is widely agreed that SGFs tend to be more stable than CGFs (Lee et al., 2007; Wei et al., 2025). A longitudinal study by Garrote and colleagues (2023) examined the friendship networks of 280 fourth-grade students (aged 9–11) across 15 classrooms. They found that CGFs were less stable over the school year and exhibited lower density and transitivity compared to SGFs. Despite valuable insights, these studies still focused on dyadic relationships between cross-gender friends and adopted binary categorization (i.e., SGFs and CGFs) to compare the relationships. To our knowledge, no research has directly compared the structural characteristics of SGF and CGF groups at the group or network level and further investigated the association between network structures and gender composition (i.e., predominance of one gender or the other) of CGF groups.

Behavioral Characteristics of Friendship Groups

Behavioral characteristics are important considerations when comparing children's friendship groups. Interesting in their own right, they also are associated with group cohesion and shape the pattern of interaction within the group. For example, in a study of 115 children ages six to nine years old, results indicated that those with similar behavioral traits were more likely to form tightly connected friendship groups with strong internal cohesion (Rabaglietti et al., 2012). In this study, we examined peer perceptions of four types of behavioral descriptors characterizing the membership of CGF and SGF groups: (a) academic competency, (b) rough and non-rough sports competency perceived by peers, (c) social status. These factors are developmentally salient in late childhood and possibly relevant to forming CGF friendship groups within the school setting.

First, academic competency has been linked to children's friendships. A network study by Shin (2022) involving 542 children (mean age = 11.46) found that students with similar levels

of academic engagement were more likely to become friends, and those peers with high academic engagement positively predicted academic engagement of other members in the friendship group over time. A study including 631 fifth graders found that a social-emotional learning intervention promoting peer interactions increased peer influence within friendship groups and enhanced writing and math performance of friendship group members (DeLay et al., 2016). However, to our knowledge, no study has examined the association between membership in CGF groups and student's academic performance.

Second, children's friendships are significantly associated with shared behavioral characteristics (McPherson et al., 2001). Specifically, in a study of 459 fourth and fifth-graders, Kim and colleagues (2025) found that having a similar level of competence in rough sports is more pivotal for boys' friendships, showing greater sensitivity to this source of homophily compared to girls. In contrast, girls demonstrate a greater sensitivity to homophily in perceived non-rough sports competency in their friendships than do boys. These results for friendship at the dyadic level might extend to the group level. That is, girls' SGF groups, as well as predominantly female CGF group, might be characterized by higher levels of non-rough sports competency, whereas boys' SGF groups, and CGF groups primarily comprised of boys, might be characterized by higher levels of rough sports competency. Thus, we included both types of perceived sports competency in our investigation.

Last, social status is a strong predictor of children's group positioning, friendship stability, and friend influence (Laursen et al., 2023). For example, a study involving 613 fifth graders found that children tended to select their friends based on similarity in popularity more than similarity in aggression or prosociality (Logis et al., 2013). However, prior research on these behavioral characteristics has primarily focused on how individual behaviors relate to their

friendship selection, formation, or maintenance. Few studies have examined how individuals' behaviors, collectively, differentiate CGF from SGF groups.

Current Study

This study aimed to explore the characteristics and structural features of children's CGF groups by analyzing classroom-based friendship networks. Specifically, the study sought to (a) identify friendship groups and conduct descriptive analysis to compare those groups, (b) analyze network structural features (i.e., density, reciprocity, and transitivity) of friendship groups, and (c) compare behavioral characteristics of friendship groups.

Our study bridges gaps in the existing literature and provides unique information about children's CGF groups in three key ways. Given prior studies on CGFs have been targeted mainly at young children, adolescents, or young adults, this study focuses on fourth- and fifth-grade children's friendship networks, who are in the developmental stage prior to or during the emergence of romantic relationships. These accounts broaden our understanding regarding how preadolescents form CGF groups and, perhaps, begin to engage in those types of social interactions. Second, we categorized friendship groups into two types of CGF groups -- those predominantly comprised of boys and those comprised of mostly girls -- and two types of SGF groups (i.e., boys' and girls' SGF groups), moving beyond the binary classification of CGF and SGF groups mostly used in prior studies to provide a more nuanced understanding of children's friendship groups. These four types of groups were compared on their descriptive patterns, network structures, and behavioral characteristics. Third, we used peer nomination procedures to construct directed friendship networks and adopted a community detection algorithm to identify the friendship groups within those networks. Using this computational technique in Social Network Analysis (SNA) helped uncover social interactions that were not obvious from surface-

level. Visualizations of representative classrooms were used to further illustrate this patterning within classroom-based social networks. Together, these approaches provide a comprehensive examination of the prevalence, characteristics, and network structural features of CGF groups as compared to SGF groups. The specific research questions are as follows:

RQ1: *What are the descriptive features (prevalence, group size) of children's friendship groups?*

RQ2: *Do network structural features, including density, reciprocity, and transitivity, differ across types of friendship groups?*

RQ3: *Do behavioral characteristics vary across different types of friendship groups?*

Method

Participants

The study involved 473 fourth- and fifth-grade students (mean age = 10.6 years). Participants were recruited from 26 classrooms located in six elementary schools in rural southeastern U.S. counties. Of the participants, 52.2% were girls ($n = 247$) and 47.8% of the sample were boys ($n = 226$). The grade distribution included 37.8% fourth graders ($n = 174$) and 62.2% fifth graders ($n = 299$). Regarding ethnicity, 54.1% identified as White ($n = 256$), 42.9% as Black ($n = 203$), and 3.0% as Asian, Hispanic/Latino, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, or biracial ($n = 14$). Two of the schools were majority-White and four schools were majority-Black. 79.9% of participants were of the majority race within their school. We were not allowed to collect socioeconomic data for participants, but schools were located in counties with median household income (US\$28,574) and well below the United States median family income (US\$59,600; U. S. Census Bureau, 2006).

Data Collection

The data analyzed in this study were collected as part of a larger study on children's peer relationships in May 2004. Data collection occurred over two separate sessions, each lasting about one hour.

Peer nomination procedures were utilized to collect the data in this study. A fixed-choice nomination procedure was implemented to minimize respondent burden, which limited participants to nominating up to three peers. To lessen the pressure of children to select individuals who did not align with a specific descriptor, they were permitted to nominate fewer than three peers. While fixed-choice nomination might limit children's ability to name all of their peers (Adams, 2020), research has shown that when children are allowed unlimited nominations of friends and of behaviors similar to those in the current study the average number of nominations is quite close to three (McKirahan, 2022).

The university's Institutional Review Board (IRB) approved all measures and procedures involved in the study. Active consent for participation was obtained from parents and teachers after permission had been obtained from school superintendents and building principals. Each student provided assent before the administration of questionnaires. Across classrooms, parental consent was obtained for 89% of students, with student participation rates ranging from 79.0% to 100%.

Measures

Friendship Networks

To examine the friendship networks within each classroom, students were asked to nominate their three closest friends within their classroom (Bukowski et al., 1993). All peer reporters' responses were used to create a directed friendship matrix for each of the 26

classrooms. Columns and rows corresponded to students, with each cell indicating the absence (coded as 0) or presence (coded as 1) of a friendship nomination.

Academic Competency

Participants' academic competency scores were built from two peer-nomination items: (1) "This is a person who tries hard to do good schoolwork," and (2) "This person makes good grades, is smart, and usually knows the right answer." For each nomination item, a proportion score was calculated by dividing the number of nominations received by the total number of participants in the classroom. The final academic competency score was then calculated as the mean score of the two proportions scores. The internal consistency of the academic competency measure demonstrated high reliability ($r = .78$).

Sports Competency

Two types of sports competency were measured with two peer nomination items: (1) Rough sports competency: "This child is good at rough sports, such as soccer, basketball, and football," and (2) Non-rough sports competency: "This child is good at non-rough sports, such as volleyball and gymnastics." Each participant could nominate up to three peers in their classroom for each item. For both types of sports competency scores, the proportion score was calculated by dividing the number of nominations each child received by the number of participants in the classroom.

Social Status

Participants' social status was assessed using three peer nomination items: (1) "This person is really cool. Just about everybody in school knows this person," (2) "This person has a lot of control—they decide who gets to be in the popular group," and (3) "This classmate is the most popular at school." For each nomination item, the proportion score was calculated by

dividing the number of nominations received by the number of participants in the classroom. The final social status score was calculated as the average of the three proportions scores. Cronbach's alpha for the scale was .86, indicating sound internal consistency. An EFA result supported one factor solution ($KMO = .71$), showing good item loadings (item 1 = .81, item 2 = .74, and item 3 = .93).

Overview of Analysis

Data analysis proceeded in four main stages, each aligned with the study's research questions: (1) construct directed friendship networks and identify friendship groups, (2) conduct descriptive analysis to compare friendship groups, (3) analyze network structural characteristics (i.e., density, reciprocity, and transitivity) of friendship groups, and (4) compare behavioral characteristics of friendship groups. All analyses were performed using R Statistical Software v4.4.2 (R Core Team 2021) and IBM SPSS Statistics v29.0.1.0 (171) (IBM Corp., 2023). The specific software packages and statistical tests used in each analysis were listed below.

Stage 1

We constructed 26 classroom-based directed friendship networks using peer nomination data collected from 26 classrooms. Each student was allowed to nominate up to three classmates whom they considered their "close friends." Adjacency matrices for each classroom were created, where rows represented nominators and columns represented nominees. Each nomination was considered the presence of a directed friendship (coded as 1).

To identify friendship groups within each classroom, we applied a community detection algorithm using the Walktrap package (Pons & Latapy, 2005) and igraph package (Csardi & Nepusz, 2006) in R. This method detects cohesive subgroups within directed networks by reflecting the density of connections within groups. The Walktrap algorithm was selected

because it is suitable for small to moderately sized groups (e.g., 20-40 nodes) and empirically validated for detecting educational and developmental social networks (Pons & Latapy, 2005). Five students (1.06% of the sample; one fourth grade boy, one fourth grade girl, and three fifth grade boys) who were not assigned to any subgroup were classified as social isolates and excluded from group comparison analyses.

Across the 26 classrooms, a total of 88 friendship groups were identified with 468 students in the sample assigned to a friendship group. Following the identification of groups, we classified groups as either an SGF group ($n = 71$), in which all members were of the same gender, or as a CGF group ($n = 17$), where included both boys and girls.

Stage 2

To compare CGF and SGF groups, we conducted a series of descriptive analyses, including the group size and distribution of friendship groups across classrooms. To reflect gender composition within the groups, we further categorized friendship groups into four subtypes: (a) CGF-Boys (CGF group with more boys than girls), (b) CGF-Girls (CGF group with more girls than boys), (c) SGF-Boys (SGF group with all boys), (d) SGF-Girls (SGF group with all girls). Following this specification, we also reported the number of groups and group size by group types and grade levels. We also included the visualization of classroom-based friendship networks using the *igraph* package (Csardi & Nepusz, 2006) in R, which represented the patterns of friendship groupings observed across the 26 classroom networks. All descriptive analyses were performed in SPSS (Version 29.0.1.0).

Stage 3

To analyze three key structural characteristics of children's friendship groups, we examined the structural features within each of the 88 friendship groups. Each of the network

structural characteristics (i.e., density, reciprocity, and transitivity) was calculated from 88 friendship groups, using the igraph package (Csardi & Nepusz, 2006) in R. Five groups with fewer than three members were excluded when calculating transitivity, as triad relationships are structurally impossible.

To compare network structural characteristics across four types of friendship groups, we assessed the normality of each variable within each group type using Shapiro-Wilk tests (Shapiro & Wilk, 1965). As normality assumptions were violated for at least one group in all three variables, we used the Kruskal-Wallis H test (Kruskal & Wallis, 1952), which is appropriate when comparing more than two independent groups with non-normally distributed data.

Stage 4

We examined how behavioral characteristics differed across friendship groups. We included four behavioral characteristics (i.e., academic competency, perceived rough sports competency, perceived non-rough sports competency, and social status) based on peer nomination data. We checked the normality of each variable within each group type using Shapiro-Wilk tests (Shapiro & Wilk, 1965). To compare group differences for the four behavioral characteristics, we conducted one-way ANOVAs (Field, 2013) for normally distributed variables (i.e., academic competency and social status) or the Kruskal-Wallis H test (Kruskal & Wallis, 1952) for non-normally distributed variables (i.e., perceived rough and non-rough sports competency).

Results

Identification and Description of Friendship Groups

Descriptive Characteristics of CGF and SGF Groups

In this section, we present our results aligning each of the research questions. First, using community detection techniques, we identified and described the friendship groups within each of the 26 classroom-based friendship networks, addressing the following questions: How many distinct friendship groups are identified? How does group size differ between CGF and SGF friendship groups? What is the distribution of SGF versus CGF groups across classrooms?

We identified 88 distinct groups across 26 classrooms. Of these, 17 were CGF groups and 71 were SGF groups. Children were only assigned to one group within their classroom. The average group size was 6.12 (SD = 0.44) for CGF groups and 5.13 (SD = 0.23) for SGF groups, indicating that CGF groups are significantly larger than SGF groups ($U = 14484.0$, $Z = -3.72$, $p < .001$). Classrooms had between two and five friendship groups, with an average of 3.38 groups per classroom (SD = 0.17). Thirteen classrooms had only SGF groups and the other 13 classrooms included at least one CGF group. Additionally, five students (one fourth-grade boy, one fourth-grade girl, and three fifth-grade boys) were identified as socially isolated, as they did not belong to any friendship group. These students were excluded from the group comparison analysis, as they were not affiliated with either a CGF or SGF group.

Number of Groups and Group Size by Group Type and Grade Level

Given that gender composition can shape distinct cultural norms within the group, we categorized the sample into four group types: (a) CGF-Boys—CGF groups with more boys than girls, (b) CGF-Girls—CGF groups with more girls than boys, (c) SGF-Boys—SGF groups consisting only of boys, and (d) SGF-Girls—SGF groups consisting only of girls. We then explored how the number of groups and group sizes varied by group type and grade level. Due to the small number of groups in some categories (e.g., only three CGF-Boys groups in fourth

grade), statistical comparisons were not conducted. Nevertheless, descriptive results revealed notable patterns across group types and grades (see Table 3.1).

SGF-Girls and SGF-Boys groups made up the majority of the sample. SGF-Girls groups were the most prevalent, accounting for 16 of 35 groups in the fourth grade classrooms (45.71%) and 25 of 53 groups in fifth grade (47.16%). CGF groups were relatively uncommon; only three CGF-Boys groups (8.57%) and three CGF-Girls groups (8.57%) were identified in fourth grade. In fifth grade, the proportion of CGF groups slightly increased, with six CGF-Boys groups (11.32%) and five CGF-Girls groups (9.43%) identified.

With regard to size, fifth grade CGF-Boys groups were the largest group ($M = 6.67$, $SD = 1.37$), followed by both fourth grade CGF-Boys ($M = 6.33$, $SD = 1.53$) and CGF-Girls ($M = 6.33$, $SD = 1.53$) groups. SGF-Girls groups were the smallest, particularly in fourth grade ($M = 4.06$, $SD = 1.57$), although their size increased in fifth grade ($M = 5.24$, $SD = 2.19$).

Overall, these findings highlighted developmental and gender-based differences in group formation. CGF groups were less common, but tended to be larger, especially among boys. The number increase in SGF-Girls groups between fourth and fifth grade may reflect reinforced gender homophily over time. In contrast, the consistently large CGF-Boys groups suggest more stable cross-gender interactions among boys across grade levels.

Visualizations of Classroom-Based Friendship Networks

Visualizations of four classroom friendship networks illustrate the distinct characteristics observed in CGF and SGF friendship groups, particularly with regard to group size, cohesion, and pattern of connections (see Figure 3.1). The first friendship network of a fourth-grade classroom (see Figure 3.1A) displayed five clearly segregated SGF groups. The boys' SGF groups exhibited multiple transitive ties and tended to be larger and less reciprocated than girls'

SGF groups. However, the girls' SGF groups appeared more tightly knit and ties were commonly reciprocal. Although there were two cross-gender connections bridging boys' and girls' groups, these children remained part of their respective SGF groups.

The second friendship network (see Figure 3.1B) revealed more diverse friendship groupings, including one girls' SGF group, three CGF groups (one boy-dominant CGF group and two girl-dominant CGF groups), and one isolated boy. This class had active interactions not only within the groups but also between the groups. Again, most CGF groups were larger than the SGF group. The girls' SGF group exhibited strong mutual ties, suggesting cohesive interactions. One isolated boy did not nominate anyone as a friend nor receive any nominations.

The third friendship network, from a fifth-grade classroom (see Figure 3.1C), illustrated the most common classroom structure—one CGF group positioned at the center among several SGF groups. The CGF group served a bridging role between SGF groups, which might enhance the social interactions across the classroom network.

Last, the friendship network of a fourth-grade classroom (see Figure 3.1D) had two large CGF groups and a small SGF group. A notable characteristic of this classroom was the gender imbalance (i.e., three girls and 12 boys), which might have resulted in the higher prevalence of CGF groups. With fewer opportunities to form SGF groups, girls in this classroom were more likely to be part of CGF groups.

Network Structural Characteristics of Friendship Groups

In this section, we compare how friendship groups differ in key network structures. Three network structural characteristics were explored: (a) *Density* provides insight into the overall connectivity among group members, (b) *Reciprocity* reflects the degree to which friendship

nominations are mutual, and (c) *Transitivity* refers to the tendency for forming triads (e.g., a friend of one's friend is also considered a friend).

The unit of analysis was the friendship groups, with a total of 88 groups (nine CGF-Boys, eight CGF-Girls, 30 SGF-Boys, and 41 SGF-Girls groups). To test the normality of network characteristics (i.e., density, reciprocity, and transitivity) within each group type, we conducted Shapiro-Wilk normality tests (Shapiro & Wilk, 1965). Results indicated that normality was violated in at least one group for all three variables. Specifically, density violated the normality assumption in CGF-Girls ($p = .025$), SGF-Boys ($p = .005$) and SGF-Girls ($p = .002$) groups but not in CGF-Boys groups ($p = .861$). Reciprocity was non-normally distributed in SGF-Boys ($p = .004$) and SGF-Girls ($p = .038$) groups but not in CGF-Boys ($p = .427$) and CGF-Girls ($p = .177$) groups. Transitivity violated the normality assumption in CGF-Girls ($p = .034$), SGF-Boys ($p = .002$), SGF-Girls ($p = .001$) but not in CGF-Boys ($p = .805$). Thus, we conducted Kruskal-Wallis H tests (Kruskal & Wallis, 1952), which are non-parametric tests, to compare group differences in the three network characteristics (see Table 3.2).

Density

The result revealed significant differences in density across the four types of groups ($\chi^2(3) = 14.57, p = .002$). Post-hoc pairwise comparisons using Dunn's test with Bonferroni correction indicated that SGF-Girls groups ($M = 0.65, SD = 0.23$) had significantly higher density than did CGF-Boys ($M = 0.41, SD = 0.06, p = .004$) and CGF-Girls groups ($M = 0.45, SD = 0.16, p = .047$). No other group differences were statistically significant. It suggested that both types of CGF groups were less densely connected than SGF-Girls groups.

Reciprocity

The result of the Kruskal-Wallis H test revealed that reciprocity was significantly different across the four types of groups ($\chi^2(3) = 9.63, p = .022$). The SGF-Girls groups ($M = 0.72, SD = 0.19$) had the highest reciprocity, which was significantly higher than CGF-Boys groups ($M = 0.52, SD = 0.14; Z = -2.91, p = .011$). This suggests that mutual friendship ties are most prevalent in SGF-Girls groups and least common in CGF-Boys groups. No other group differences were significant.

Transitivity

This result demonstrated significant differences in transitivity across the four types of groups ($\chi^2(3) = 15.28, p = .002$). Dunn's post-hoc tests with Bonferroni correction revealed that SGF-Girls had significantly higher transitivity ($M = 0.74, SD = 0.25$) than both CGF-Girls ($M = 0.30, SD = 0.34, Z = -3.24, p = .003$) and SGF-Boys ($M = 0.53, SD = 0.25, Z = -2.78, p = .016$) groups. No other group comparisons were statistically significant. The results indicate that triadic relationships (i.e., friends of friends are also friends) are less prevalent in CGF-Girls groups than in SGF-Girls groups.

Behavioral Characteristics of Friendship Groups

To provide a more complete picture of the four types of friendship groups, we report the mean score of four behavioral characteristics: (a) academic competency, (b) perceived rough sports competency, (c) perceived non-rough sports competency, and (d) social status. These four variables were selected to represent key, observable aspects of children's behavior and characteristics that are easily recognized by peers within classroom and school settings.

The unit of analysis was, again, the friendship group, with a total of 88 groups (nine CGF-Boys, eight CGF-Girls, 30 SGF-Boys, and 41 SGF-Girls groups). To test the normality of

behavioral characteristics within each group type, we conducted Shapiro-Wilk normality tests (Shapiro & Wilk, 1965). Academic competency met the normality assumption in all groups: CGF-Boys ($p = .200$), CGF-Girls ($p = .452$), SGF-Boys ($p = .357$), and SGF-Girls ($p = .131$). Perceived rough sports competency was non-normally distributed in SGF-Girls groups ($p = .038$), but not in CGF-Boys ($p = .802$), CGF-Girls ($p = .666$) and in SGF-Boys ($p = .170$) groups. Perceived non-rough sports competency violated the normality assumption in CGF-Boys ($p = .115$), CGF-Girls ($p = .735$), and SGF-Girls ($p = .215$) groups but not in SGF-Boys ($p = .019$) groups. Social status met the normality assumption in all groups: CGF-Boys ($p = .357$), CGF-Girls ($p = .242$), SGF-Boys ($p = .713$), and SGF-Girls ($p = .154$). Next, we conducted one-way ANOVAs (Field, 2013) for normally distributed variables (i.e., academic competency and social status) or Kruskal-Wallis H tests (Kruskal & Wallis, 1952) for non-normally distributed variables (i.e., perceived rough and non-rough sports competency) to compare group differences for the four behavioral characteristics (see Table 3.3).

Academic Competency

One-way ANOVA results indicate no significant differences in academic competency across the four group types ($F(3) = 1.70$, $p = .17$). All groups reported similar mean levels of academic competency: CGF-Boys ($M = 0.15$, $SD = 0.08$), CGF-Girls ($M = 0.15$, $SD = 0.07$), SGF-Boys ($M = 0.12$, $SD = 0.06$), and SGF-Girls ($M = 0.16$, $SD = 0.09$). This result suggests that academic competency is relatively consistent across different friendship group types.

Sports Competency

In terms of perceived rough sports competency, Kruskal-Wallis H tests indicate a significant difference among at least one pair of the four groups ($\chi^2 = 33.34$, $df = 3$, $p < .001$). Groupwise comparison showed that CGF-Boys groups ($M = 0.20$, $SD = 0.09$) had significantly

higher perceived rough sports competency than SGF-Girls ($M = 0.07$, $SD = 0.05$; $Z = 3.62$, $p = .001$) and CGF-Girls ($M = 0.08$, $SD = 0.06$; $Z = 2.41$, $p = .04$) groups. SGF-Boys groups ($M = 0.22$, $SD = 0.13$) also exhibited significantly higher perceived rough sports competency than SGF-Girls ($Z = 5.16$, $p < .001$) and CGF-Girls ($Z = 2.71$, $p = .02$) groups. However, CGF-Boys groups did not differ from SGF-Boys groups ($Z = 0.24$, $p = 1.00$) nor did CGF-Girls and SGF-Girls groups ($Z = 0.41$, $p = 1.00$) differ significantly in perceived rough sports competency. These results indicate that, within CGF groups, perceived rough sports competency is largely related to the dominant gender, potentially shaping the group's cultural norms and play activities.

Regarding perceived non-rough sports competency, the Kruskal-Wallis H test indicated a significant difference between at least one pair of the four groups ($\chi^2 = 14.65$, $df = 3$, $p = .002$). Dunn's Post-Hoc test results indicate SGF-Boys groups ($M = 0.09$, $SD = 0.04$) have significantly lower perceived non-rough sports competency than SGF-Girls groups ($M = 0.15$, $SD = 0.08$; $Z = -3.75$, $p < .001$). Except for this pair, all other group comparisons were non-significant. While SGF-Boys and SGF-Girls groups revealed significant differences in perceived non-rough sports competency, both CGF groups displayed intermediate level competency, falling between the two SGF groups.

Social Status

Results of the ANOVA indicate no significant differences in social status across the four group types ($F(3) = 1.05$, $p = .37$). All groups reported similar mean levels of social status: CGF-Boys ($M = 0.16$, $SD = 0.07$), CGF-Girls ($M = 0.11$, $SD = 0.07$), SGF-Boys ($M = 0.12$, $SD = 0.06$), and SGF-Girls ($M = 0.13$, $SD = 0.08$).

Discussion

The current study reports on the characteristics and structural features of CGF groups, as compared to SGF groups, in 26 classroom-based children's friendship networks. Using a community detection technique, we identified 88 friendship groups and categorized them into four types (i.e., CGF-Boys, CGF-Girls, SGF-Boys, and SGF-Girls). Specifically, the study offers (a) descriptive comparisons, (b) analysis of network structural features (i.e., density, reciprocity, and transitivity), and (c) comparison of behavioral characteristics across friendship groups. These findings comprehensively illustrate the prevalence and unique characteristics of children's CGF groups.

Descriptive Differences

Of the 88 total identified groups, only 17 were CGF groups. Although SGF groups are dominant, CGF groups exhibit distinctive characteristics. Across the classrooms, half of them had only SGF groups, while the other half included at least one CGF group, suggesting variability in friendship groupings across classroom contexts. There were more SGF-Girls groups than any other type of group, accounting for 16 of 35 groups in 4th grade (45.71%) and 25 of 53 groups in 5th grade (47.16%), but they were also smaller, aligning with previous findings that girls' friendship groups tend to be smaller than that of boys' (Mehta & Strough, 2010; Rubin et al., 2006). Supporting a widely observed pattern of grade level difference in CGFs (Conway et al., 2011; Molloy et al., 2014), the proportion of CGF groups slightly increased by grade. This pattern was more salient for CGF-Boys groups (fourth = 8.57%, fifth = 11.32%) than for CGF-Girls groups (fourth = 8.57%, fifth = 9.43%), indicating a potential developmental shift in openness to CGF groups.

In terms of group size, CGF groups were significantly larger than SGF groups. Notably, fifth-grade CGF-Boys groups reported the largest group size. Both fourth-and fifth-grade CGF-Boys groups maintained comparable group size, indicating less developmental shifts. These findings might reflect CGF groups have higher degree of openness to diverse ties.

Diverging from the previous finding that boys' friendship networks are generally larger than girls' (Rubin et al., 2006, p. 575), our results found that in fourth grade, CGF-Girls groups ($M = 6.33$) were larger than SGF-Boys groups ($M = 5.31$). However, this pattern reversed in fifth grade, with SGF-Boys groups ($M = 5.76$) becoming larger than CGF-Girls groups ($M = 5.00$). These results suggest that even within girl-dominant CGF groups, the inclusion of different gender members might influence interaction patterns, potentially leading to larger group sizes than fourth-grade SGF-Boys groups. However, given the relatively small number of CGF groups in our data, this finding should be interpreted with caution.

Furthermore, visualizations of the classroom friendship networks suggested that CGF groups might function as bridging ties between gender-segregated groups. These bridging roles of CGFs might facilitate intergroup communication and mitigate the effects of gender segregation commonly observed in childhood peer networks (Mehta et al., 2014). This pattern supports previous findings that CGFs can promote social integration and cohesion (Kindermann, 2007; Thorne, 1993).

In classrooms with pronounced gender imbalances, such as one with only three girls and 12 boys, contextual constraints appeared to increase the likelihood of CGF group formation. When opportunities to form SGF groups are limited, children might be inclined to engage in CGF groups out of necessity. This observation diverges from earlier ethnographic research, emphasizing strong gender homophily even in imbalanced settings (Lever, 1976; Maccoby,

1998). Whereas prior studies have often framed CGFs as developmental precursors to romantic relationships (Bleske & Buss, 2000), our results suggest that CGF groups can also reflect adaptive strategies in response to the classroom environment.

Network Structural Differences

In general, SGF groups indicated higher levels of density, reciprocity, and transitivity compared to CGF groups. SGF-Girls groups exhibited the highest level of density, reciprocity, and transitivity, consistent with prior research that girls often prioritize mutual, closely connected relationships (Haynie et al, 2014; Markovic & Bowker, 2015). The lower cohesion observed in CGF groups suggests that they might function more as bridges between SGF groups within the classroom rather than as tightly bonded subgroups. However, CGF-Boys groups did not significantly differ from SGF-Boys on any of the three network structures. Furthermore, CGF-Boys groups had significantly lower density and reciprocity, but not transitivity, compared to SGF-Girls groups. This result suggests that, despite the inclusion of girls in CGF-Boy groups, CGF-Boys groups maintain a network structure that is more similar to SGF-Boys groups. In other words, the dominant presence of boys seems to shape the group's overall structural characteristics and preserve typical patterns of boys' friendship networks.

In contrast, CGF-Girls groups diverged more from SGF-Girls groups in their network structure compared to the divergence of CGF-Boy from SGF-Boy groups. CGF-Girls groups exhibited significantly lower density and transitivity, but not reciprocity, than SGF-Girls groups. This finding suggests that although mutual relationships were still present, CGF-Girls groups exhibited lower levels of cohesion and interconnectedness. This pattern might reflect the structural complexity introduced by CGFs—possibly due to different interaction styles, gender-based social norms—which can make it more difficult to form fully integrated groups.

Behavioral Differences

Although prior study have found that having CGFs enhance individuals' social capital (Bukowski et al., 1999), no previous research has specifically examined how CGF groups are differ from SGF groups in terms of academic competency and social status. Our findings uniquely suggest that CGF and SGF groups did not differ on either academic competency or social status. However, this result should be interpreted with caution, because individual variation within groups might be masked when data were aggregated at the group level. Thus, it is hard to conclude CGF and SGF groups are identical in academic competency and social status, given that individual differences were not directly examined.

We did find, however, substantial differences in perceived rough sports competency across different types of friendship groups. Both CGF-Boys and SGF-Boys groups evidenced higher levels of perceived rough sports competency than CGF-Girls and SGF-Girls groups, supporting previous findings that boys are more likely to engage in physically active plays (Mathur & Berndt, 2006; McGuire & Leaper, 2016). Interestingly, there were no significant differences between CGF-Boys and SGF-Boys, or between CGF-Girls and SGF-Girls. It indicates that perceived rough sports competency was more aligned with the dominant gender composition of the group than with its cross-gender status. This pattern highlights how gender continues to influence behavioral traits within groups, particularly in contexts that involve traditional gender norms. Regarding non-rough sports competency, as perceived by peers, SGF-Girls significantly outperformed SGF-Boys, with CGF-Boys and CGF-Girls groups at intermediate levels. This suggests that CGF groups may balance different preferences for non-rough sports engagement and allow a wider range of activity patterns. Such findings are

consistent with prior research that CGF groups can foster more flexible behavioral norms compared to SGF groups (Bukowski et al., 1993).

Overall, these results highlight the enduring influence of gender composition on some group behavioral characteristics, especially those relating to sports competency, which carry strong gendered associations.

Implications

The findings of the current study have important implications for both research and educational practice. Our use of community detection analysis enabled us to identify children's friendship groups based on collective peer-report, rather than a sole reliance on children's self-reports, allowing us to capture a more complete picture of the natural topography of friendship groupings embedded in the classroom-based network.

For educators, the findings add to prior work that CGF might play an inclusive role and reduce social segregation and gender stereotyping, especially in late childhood (Aboud, 2003; Eisenberg et al., 2005). Research indicates children with more exposure to same-gender peers demonstrate more socialization from same-gender peers than children with more cross-gender interactions (Martin & Fabes, 2001). Children who believe same-gender play is socially preferred by others are more likely to engage in it (Martin et al., 1999). Teachers can play a critical role in supporting CGF formation and interaction. Supporting cross-gender collaboration in classroom settings through mixed-gender seating, group projects, or cooperative games might help maintain the social and academic benefits observed in CGFs.

In summary, while CGFs are less common than SGFs, they serve distinct and developmentally significant functions. Their unique composition, structural features, and

behavioral characteristics suggest that CGFs may play a meaningful role in helping children explore identity, build social skills, and navigate gendered expectations.

Limitation and Future Directions

This study offers novel insights into the descriptive, structural, and behavioral characteristics of CGF groups in childhood. However, there are limitations to consider. First, the fixed-choice peer nomination method allowed participants to naming up to three peers, which could limit our capacity to examine children's friendship networks. Peer nominations within the same classroom might also limit the ability to capture cross-classroom level friendships. Second, although the study included a substantial number of friendship groups in total, the number of CGF groups was relatively small compared to SGF groups. Even though it reflects the common pattern that children are more likely to engage in SGF groups, this imbalance might have reduced the statistical power to detect more nuanced differences. Third, calculating the group mean to determine the behavioral character of a group, such as the group's social status, has limitations. Within a group, the distribution of social status can vary, depending on the degree to which the group has a hierarchical structure. The spread and distribution of social status, rather than the average for the group, might be a more accurate characterization of the friendship group. Last, future research could involve teacher-reported friendship groups to validate student-reported friendship nominations. This approach might help address potential biases or limitations inherent in self-reported friendship networks.

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Table 3.1

Descriptive Characteristics of Friendship Groups by Group Type and Grade Level

Group Types	Grade	Number of Groups	Average Group Size (M, SD)
CGF-Boys	4th	3	6.33 (1.53)
	5th	6	6.67 (1.37)
CGF-Girls	4th	3	6.33 (1.53)
	5th	5	5.00 (2.56)
SGF-Boys	4th	13	5.31 (1.70)
	5th	17	5.76 (1.89)
SGF-Girls	4th	16	4.06 (1.57)
	5th	25	5.24 (2.19)

Note: CGF-Boys—CGF groups with more boys than girls, (b) CGF-Girls—CGF groups with more girls than boys, (c) SGF-Boys—SGF groups consisting only of boys, and (d) SGF-Girls—SGF groups consisting only of girls. ‘CGF-Boys’ represents CGF groups with more boys than girls and ‘CGF-Girls’ represents CGF groups with more girls than boys. ‘SGF-Boys’ refers to SGF groups consisting only of boys, and ‘SGF-Girls’ represents SGF groups consisting only of girls.

Table 3.2*Network Characteristics by Friendship Group Type*

Variable	Group Types	Mean	SD	$\chi^2(df)$	Pairwise Comparison (Z)			
					1	2	3	4
Density	1.CGF-Boys	0.41	0.06	14.57 (3)**	-	-	-	-
	2.CGF-Girls	0.45	0.16		-0.50	-	-	-
	3.SGF-Boys	0.51	0.14		-1.77	-1.08	-	-
	4.SGF-Girls	0.65	0.23		-3.20**	2.42*	-2.11	-
Reciprocity	1.CGF-Boys	0.52	0.14	9.63 (3)*	-	-	-	-
	2.CGF-Girls	0.64	0.24		-1.10	-	-	-
	3.SGF-Boys	0.66	0.17		-1.84	-0.41	-	-
	4.SGF-Girls	0.72	0.19		-2.91*	-1.39	-1.55	-
Transitivity	1.CGF-Boys	0.57	0.12	15.28 (3)**	-	-	-	-
	2.CGF-Girls	0.30	0.34		1.05	-	-	-
	3.SGF-Boys	0.53	0.25		-0.16	-1.44	-	-
	4.SGF-Girls	0.74	0.25		-2.02	-3.24**	-2.78*	-

Note: The total number of groups is 88 (CGF-Boys = 9, CGF-Girls = 8, SGF-Boys = 30, SGF-Girls = 41). For transitivity, five groups were excluded due to the insufficient group size (fewer than three members). $\chi^2(df)$ values were from Kruskal-Wallis rank sum tests assessing group differences in network characteristics. Pairwise comparisons were conducted using Dunn’s test with Bonferroni correction. Z-values are reported for each pairwise comparison. * $p < .05$. ** $p < .01$.

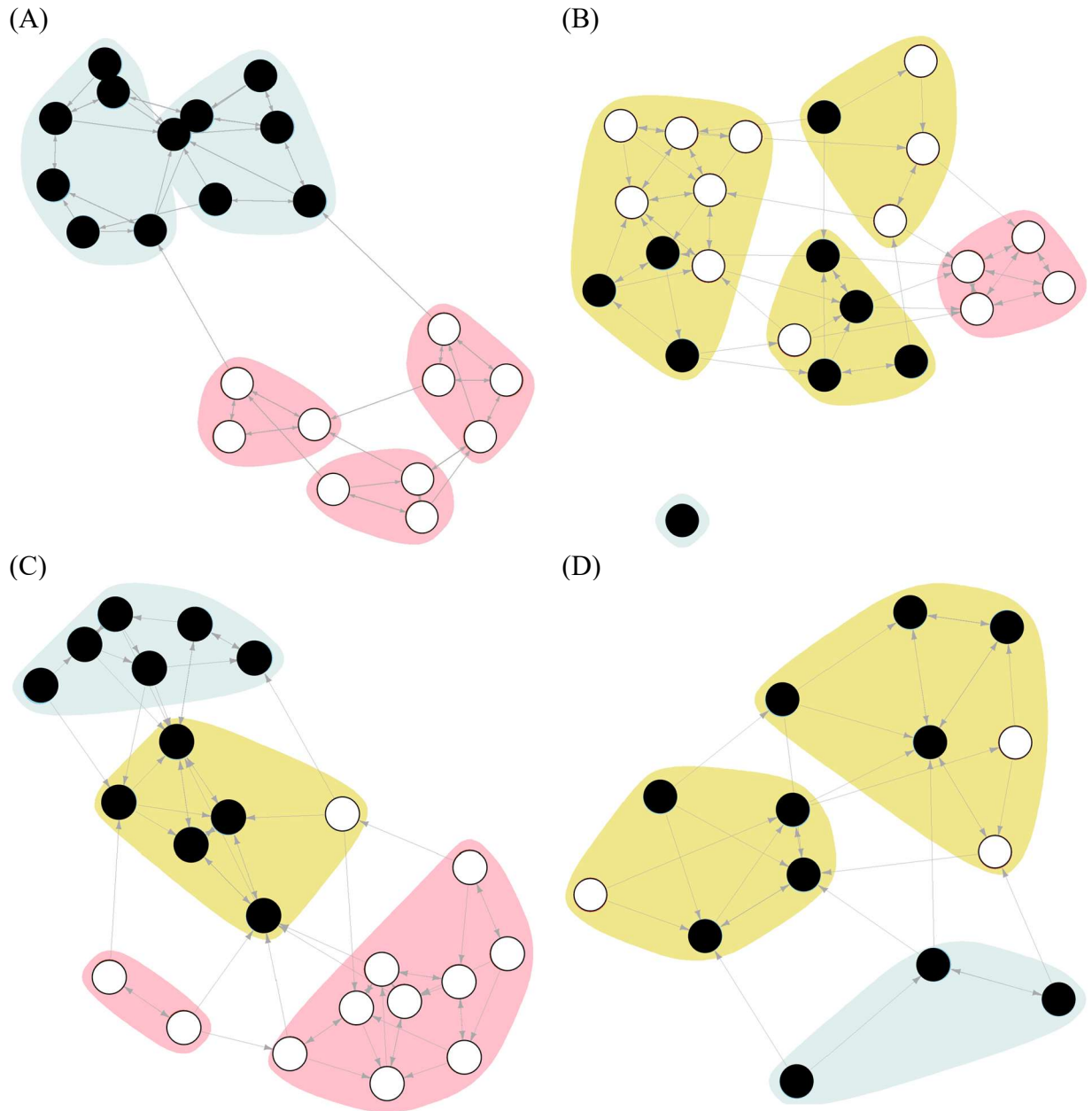
Table 3.3*Behavioral Characteristics by Friendship Group Type*

Variable	Group Types	Mean	SD	Statistic	Pairwise Comparison (Z)			
					1	2	3	4
Academic Competency	1.CGF-Boys	0.15	0.08	F(3) = 1.70	-			
	2.CGF-Girls	0.15	0.07			-		
	3.SGF-Boys	0.12	0.06				-	
	4.SGF-Girls	0.16	0.09					-
Rough Sports Competency	1.CGF-Boys	0.20	0.09	$\chi^2(3) = 33.34^{***}$	-			
	2.CGF-Girls	0.08	0.06		2.41*	-		
	3.SGF-Boys	0.22	0.13		0.24	2.71*	-	
	4.SGF-Girls	0.07	0.05		3.62**	0.41	5.16***	-
Non-rough Sports Competency	1.CGF-Boys	0.12	0.09	$\chi^2(3) = 14.65^{**}$	-			
	2.CGF-Girls	0.10	0.04		0.12	-		
	3.SGF-Boys	0.09	0.04		0.91	0.73	-	
	4.SGF-Girls	0.15	0.08		-1.51	-1.58	-3.75***	-
Social Status	1.CGF-Boys	0.16	0.07	F(3) = 1.05	-			
	2.CGF-Girls	0.11	0.07			-		
	3.SGF-Boys	0.12	0.06				-	
	4.SGF-Girls	0.13	0.08					-

Note: The total number of groups is 88 (CGF-Boys = 9, CGF-Girls = 8, SGF-Boys = 30, SGF-Girls = 41). F(df) values were from one-way ANOVA test results, and $\chi^2(df)$ values were from Kruskal-Wallis rank sum tests to assess group differences in behavioral characteristics. Pairwise comparisons were conducted only for perceived rough and non-rough sports competency variables, using Dunn's test with Bonferroni correction. Z-values are reported for each pairwise comparison. * $p < .05$. ** $p < .01$. *** $p < .001$

Figure 3.1

Visualization of Friendship Networks in Four Classrooms



Note: The background area represents a group where participants belong to the same friendship group. Boys are shown as black dots, and girls as hollow dots. Classroom (A) and (D) are fourth grade-level, and classroom (B) and (C) are fifth grade-level.

CHAPTER 4

CONCLUSION

Together, the two studies presented in this paper deepen our understanding of fourth- and fifth-grade children's friendships in multifaceted ways. Using social network analysis techniques and grounded in sound theoretical frameworks, these investigations reveal how both individual attributes and group-level interaction characterize friendship relationships.

The first study demonstrates that gender homophily remains a dominant force in shaping children's friendships, aligning with prior research (McPherson et al., 2001; Mehta & Smith, 2022; Witt, 2000). Our finding reaffirms that, despite societal changes such as Title IX, traditional gender boundaries persist within children's peer networks.

Contrary to expectations, individual levels of perceived sports competency—whether in rough or non-rough sports—did not significantly predict the number of friendship ties individuals received (i.e., incoming nominations). This challenges earlier findings suggesting that athletic ability, especially in boys, often translates into higher peer status and popularity (LaFontana & Cillessen, 2002; Lease et al., 2002; Zhang et al., 2023). However, friendship is shaped by more nuanced and emotionally complex goals, such as trust, mutual support, and opportunities for dyadic interaction (Kitts & Leal, 2021). While athletic skills appear to elevate social visibility or dominance, they do not necessarily foster close, reciprocal friendships.

On the other hand, we find that sports competency homophily—especially in rough sports for boys and non-rough sports for girls—plays a key role in friendship selection. This supports prior research that children are drawn to peers who share similar interests and

capabilities (Fujimoto et al., 2018; Martin et al., 2013). The findings also reflect broader gender norms around sports participation, at least when these data were collected in 2004: Boys demonstrated greater sensitivity to homophily in perceived rough sports competency, whereas girls displayed stronger sensitivity to perceived non-rough sports competency (Al-Attar et al., 2017; Pellegrini, 2005). These patterns might help explain why boys typically have larger, less cohesive networks, while girls tend to form smaller, tightly-knit groups—a finding that aligns with classic gender network literature (Lever, 1976; Maccoby & Jacklin, 1974). It would be interesting to explore whether these patterns regarding sports competency and friendship network still hold, given the rise of the “cool sports girl” and the increasing inclusion of girls and women in traditionally male-dominated sports.

The second study switches the lens toward cross-gender friendship (CGF) groups. Our results indicate that CGF groups are less prevalent than same-gender friendship (SGF) groups, and they exhibit distinct characteristics in terms of group size, network structures, and some behaviors. Specifically, CGF groups tend to be larger, and visualization of these groups within the friendship networks in which they appeared suggest that they serve as bridges between SGF groups, supporting theories that such groups facilitate social integration and mitigate gender-based stereotypes (Kindermann, 2007; Thorne, 1993).

Interestingly, CGF-Boys groups maintain a network structure that is more similar to SGF-Boys groups, implying the dominant presence of boys seems to shape the overall group structure. However, CGF-Girls groups diverged more from SGF-Girls groups, exhibiting significantly lower interconnectedness. This pattern suggests that the complexity introduced by CGFs makes it more challenging for girls in these groups to maintain the same patterns of friendship interaction typically observed in SGF-Girls groups

CGF groups exhibited no significant difference from SGF groups in academic competency and social status, which challenges previous assumptions that engaging in CGF groups might increase the access to social capital (Bukowski et al., 1999; DeLay et al., 2016). In terms of perceived rough sports competency, there were no significant differences between CGF-Boys and SGF-Boys, or between CGF-Girls and SGF-Girls groups, indicating perceived rough sports competency was more aligned with the dominant gender composition of the group than with its cross-gender status. However, both types of CGF groups scored in the mid-range of non-rough sports competency, suggesting that CGF groups may balance different preferences for non-rough sports engagement among group members.

In conclusion, these two studies collectively illuminate the complex nature of children's friendship networks. They reveal how gender and sports competency interact to shape friendship selections, and how CGF groups serve unique roles within classrooms. Understanding these patterns is essential for fostering inclusive peer environments that support healthy development and enhance social belonging for all children.

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