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How Context and the Perception of Peers' Behaviors Shape Relationships in Adolescence

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How Context and the Perception of Peers' Behaviors Shape Relationships in Adolescence

A Multiplex Social Network Perspective

Diego Palacios

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How Context and the Perception of Peers' Behaviors Shape Relationships in Adolescence

A Multiplex Social Network Perspective

PhD thesis

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 University of Groningen
 on the authority of the
 Rector Magnificus Prof. C. Wijmenga
 and in accordance with
 the decision by the College of Deans.

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CHAPTER 1

Introduction

1.1 Adolescents' peer relations in schools

Social relationships play a crucial role in adolescents' development. Peer relationships become more frequent and prominent during adolescence (Giordano, 2003; Johnson et al., 2011). In this developmental phase, peers become an important point of social reference as adolescents spend a large part of their time interacting and socializing with peers (Card & Schwartz, 2009) and increasingly attend to the expectations and opinions of peers. During adolescence, it becomes increasingly important to fit in with a group, to be accepted and well regarded by peers, as well as to gain a position within the peer group. For instance, when forming peer relationships such as friendships or help, adolescents grow more sensitive to their implications for their status within the broader peer system. Moreover, frequent contact, common activities, and intimate relationships among peers provide extensive opportunities for adolescents to learn from others as well as to obtain social support to cope with emotional stress and adjustment difficulties (Hartup, 1992; Rubin et al., 1998). These features make adolescence an especially crucial and interesting period to study peer relationships.

The rise of peer relationships in adolescence confers to this period specific characteristics. First, *peer relationships are complex and intertwined*. Social relationships among adolescents are not only positive, such as friendship and helping relations, but also negative, such as victimization and disliking. Moreover, different types of relationships tend to be interdependent. For instance, the association between friendships and helping relationships is bidirectional, that is, not only friendships may give rise to help, but also help may contribute to the establishment of friendships (Van Rijsewijk et al., 2016, 2019; Wentzel & Erdley, 1993). Altogether, this raises the question: How are different types of peer relationships interrelated?

Second, *peer relationships emerge in a larger peer context*. The classroom environment arguably provides the most immediate and relevant context defining adolescent's behaviors and peer relationships. The classroom is a relevant social context for studying different types of peer relationships because students, as members of a particular classroom, spend most of their school time with their classmates, playing, talking, and working together. Classrooms are likely to affect the way behaviors and relationships are evaluated and appreciated (Dijkstra & Gest, 2015). Features of classrooms such as their composition (e.g., students' ability composition) and social norms can shape peer relationships by fostering and limiting the social comparisons and interactions among classmates (Marsh et al., 2008), and, by promoting positive relationships, respectively (Schacter & Juvonen, 2018). This dissertation focuses on the question: How do peer context shape peer relationships?

Third, *status becomes a crucial element of adolescent peer relationships*. Hierarchies emerge within the peer system with certain individuals and groups having more status than others in dimensions such as popularity and likeability (Brown et al., 2008; Cillessen & Rose, 2005). As adolescents consider relationships with specific peers or peer groups, they are sensitive to status differentiations. Even within friendships or help, which tend to be reciprocal relationships, one partner often appears to have more status than the other (Updegraff et al., 2004). As peer opinion is of considerable importance in adolescent behavior, the following question arises: Does the perception of peers' behavior affect peer relationships?

These three overarching questions guide the Chapters of the dissertation. Thus, this dissertation focus on the role of interdependence, peer context, and perceptions of peers' behavior on shaping different types of peer relationships. To this purpose, I adopted a social network approach.

1.2 A social network perspective for examining peer relationships

The analysis of social networks focuses on how social life is structured, the mechanisms that drive the change and maintenance in the social connections, and how individuals' actions and cognitions are affected by those connections. Social network analysis defines a set of actors (e.g., students) and relationships (e.g., friendships, helping) that connect the individuals within a social structure (e.g., classroom, school). Social network models model the interdependence of individuals and their relationships. Characteristics of networks, individuals, pairs of individuals, and the structural position of individuals within networks affect the evolution of the network.

There are several benefits of using a social network perspective to investigate peer relationships. First, social network analyses provide information about the potential mechanisms that affect the formation or maintenance of relationships while controlling for multiple social mechanisms that influence the formation of such ties (e.g., reciprocity, transitivity). Second, it allows examining the influence effects, that is, the extent to which participants change their behavior in accordance with the peers they affiliate with (e.g., friends, academic partners). Third, it allows treating how actors perceived peers' behaviors (e.g., *who of your classmates starts fights?*) or characteristics (e.g., *who are the most popular and visible students in your class?*) as network variables instead of individual attributes. This reflects the idea that adolescents' perceptions of peers' behavior have a dyadic character, and therefore could be described as directed relationships. Finally, social network analyses also bring the possibility of examining the interplay of two or more relationships simultaneously.

In this dissertation, I apply longitudinal social network analyses in different school contexts to cover the three presented research topics. I advance the peer relationships literature by incorporating the effect of the perception of other peers' behavior and attributes on peer relationships as well as by including information about multiple types of relationships in all chapters. Moreover, as most research on peer relationships has been conducted in the US or Europe, this study extends this literature by using data from Chilean schools.

1.3 Chilean educational system

The school system in Chile is organized in three sequential stages: pre-primary education (children up to 6 years old), primary education (divided in 8 years with ages 6 to 13), and upper secondary education (divided in 4 years with ages 14 to 17). Since 2003, both primary and upper secondary education are mandatory for children up to 18 years old (12 years of compulsory schooling). In 2015, the greatest portion of students attended private-subsidized schools (53.4%), while 38.8% of students attended public schools and 7.7% private schools (OECD, 2017). The Chilean educational system reproduces a highly segregated society in terms of income and educational level. Whereas public schools tend to concentrate low-class students, the middle-low and middle class attend private-subsidized schools, and the upper-class students go to private schools (García-Huidobro, 2007; Valenzuela et al., 2014). Classrooms have an average of about 30 students, where students remain together with the same classmates for at least their whole primary education (grades 1 to 8), and commonly also through their upper secondary education (grades 9 to 12). Therefore, classrooms constitute highly stable social contexts. Despite these particularities, studies on adolescent peer relationships with Chilean samples have shown similar patterns similar to those found in the US and European youth for several interpersonal processes such as the peer influence effects in the development of aggression (e.g., Dijkstra et al., 2011), the interplay of friendships and antipathies (e.g., Berger & Dijkstra, 2013; Rambaran et al., 2015) or the protective effects of friends

for adolescents who experience victimization (Cuadros & Berger, 2016; Hodges et al., 1997; Hodges & Perry, 1999).

1.4 Overview of the Dissertation

Table 1.1 provides an overview of the research topics, data and samples used, as well as the analytical strategies and main variables of the different studies that are included in this dissertation. The studies in Chapters 2 to 5 were written for peer-reviewed journals and may be read as separate research articles. In Chapter 6, I discuss the main findings of all studies and their scientific and practical implications, as well as the directions for future research.

In the following sections, I present the background and aims of each study as well as the three datasets used. In the first two chapters of the dissertation, I investigate academic relationships. First, by examining whether the interplay of academic and friendship networks and its association with academic performance and school misconduct differ when comparing three types of classroom ability composition (i.e., high-, low-, and mixed-ability classes; Chapter 2). Second, by examining whether adolescents' selection of preferred academic partners is driven by peers' academic performance, prosocial behavior, and friendships (Chapter 3). In the second part, I focus on how the perception of peers' behavior (prosociality, aggression) and characteristics (victimization, popularity) affects friendship and antipathies networks. I examine whether being perceived as prosocial/aggressor/popular by an individual peer (dyadic perception) or by many classmates (reputational perception) is differently associated with being befriended (Chapter 4). I also examine whether adolescents befriend or dislike peers whom they consider an aggressor or a victim differ in classrooms that received an intervention to promote prosocial behavior compared to classrooms without this intervention (Chapter 5).

1.4.1 Classroom Ability Composition and Network Dynamics

Chapter 2 was set up to investigate the relationship between classroom ability grouping strategies and academic (*with whom do you study at school?*) and friendship networks. Ability grouping mechanisms assign students into different classes based on their abilities, educational career goals, or curriculum standards (Belfi et al., 2012). By assigning students to different classes, ability grouping defines the social group present in classes, not only by generating homogeneous educational environments but also by fostering and limiting the possible academic comparisons and social interactions among classmates (Marsh et al., 2008). In this chapter, I examine whether the interplay of academic and friendship networks and their association with academic performance and school misconduct differed when comparing three types of ability classroom composition (i.e., high-, low-, and mixed-ability classes). In this way, this study takes into account both the importance of the peer context and the interdependence of networks.

1.4.2 Adolescents' Preferred Studying Partners

In Chapter 3, I examine which characteristics drive to choosing preferred academic partners (*with whom would you like to study at school?*). There can be several motivations for selecting study partners. First, adolescents can focus on improving their academic success by selecting study partners whose help they think will be useful (Sullivan et al., 2002). Second, adolescents might prefer to study with more approachable and friendly classmates (i.e., prosocial peers and friends) because asking for academic help may pose a threat to one's self-image by being refused by peers and by showing one's weaknesses. Moreover, as high-achieving students might play an important role in academic

settings, I analyze whether they are more likely to prefer to study with similar high-achieving peers and friends. Thus, this study zooms in on multiplexity and takes into account dyadic perspective and reputation.

1.4.3 Dyadic versus Reputational Perceptions

Chapter 4 was set up to examine whether friendship selection differs when adolescents evaluate diverse sources of information, that is, the individual perception of peers' behavior (*dyadic perception*) and the reputation of those peers (*reputational perception*). As friendships play an important role in satisfying the fundamental goals of affection and status (Giordano, 2003; Johnson et al., 2011), adolescents might evaluate the behaviors and characteristics of others based on whether they will contribute to their goal fulfillment. Whereas peers' prosocial and aggressive behavior may give adolescents information about the potential quality of intimate relationships, peers' popularity may offer information on peers' social position, visibility, and social dominance. In this chapter, I analyze whether being perceived as prosocial, aggressor, and popular by an individual peer (dyadic perception) or by many classmates (reputational perception) is differently associated with being befriended. By doing so, this study incorporates and examines the importance of perceptions of peers' behaviors on peer relationships.

1.4.4 The Role of Context in the Perception of Peers' Behavior and Peer Relationships

In Chapter 5, I focus on how classrooms might differ in the way behaviors are evaluated and appreciated (Dijkstra & Gest, 2015), and, therefore, differ in the extent to which they promote and nurture positive relationships, such as friendships or, by contrast, foster negative relationships, such as antipathies. A way to promote more positive peer environments is by modifying the environment (e.g., social norms) and, in turn, the evaluation of certain behaviors and characteristics such as aggression and victimization. Specifically, in this chapter, I analyze the extent to which adolescents befriend or dislike peers whom they consider as aggressors or victims, and whether this selection differs between classrooms that received an intervention to promote prosocial behavior and classrooms without the intervention. This study takes into account both the peer context and the interdependence of networks by comparing intervention and control classrooms, and by examining the interplay of aggression and victimization with friendships and antipathies networks, respectively.

1.5 Datasets

1.5.1 Ability Grouping Project data

The data in Chapter 2 were part of a broader research project that aims to examine and understand the grouping processes carried out by effective-inclusive Chilean schools by describing their institutional arrangements and pedagogies (project FONDECYT 1150261; other publications related to this research project are Treviño et al., 2016, 2018). Participants were 1474 seventh, eighth, and ninth graders from 35 classrooms from nine schools in four regions in Chile. In those schools, the first grade of education offered was seventh, eighth, or ninth grade. The participating schools were selected according to their trajectories of school effectiveness and educational inclusion between 2010 and 2015. Regarding school effectiveness, schools were selected when 1) the progress of the majority of the students in the Chilean national standardized tests (SIMCE) in Mathematics and Language was better than expected given the socioeconomic conditions of the

families (Hopkins & Reynolds, 2001; Mitchell et al., 2002), and when 2) the schools did not apply selection processes for enrolling students and exhibited lower rates of repetition and dropout. Educational inclusion was conceived as schools' ability to close learning gaps, measuring by schools' decrease in their variance in both SIMCE standardized tests (Mathematics and Language) and Grade Point Average (GPA) throughout the secondary education cycle (from 9th to 12th grade in Chile).

1.5.2 ProCiviCo data

The data in Chapter 3 and 5 were part of a larger project aimed at developing, implementing, and evaluating a school-based intervention to promote prosocial behavior and civic engagement in Chilean schools (project FONDECYT 1160151; other publications related to this research project are Luengo Kanacri & Jiménez-Moya, 2017; Luengo Kanacri et al., 2019). This research project was adapted from the Italian project CEPIDEA (“Promoting Prosocial and Emotional Skills to Counteract Externalizing Problems in Adolescence”; (Caprara et al., 2015). The intervention was implemented between April and November 2017. In total, eight schools participated (16 classrooms), of which four were intervention (9 classrooms). From April 2017 onwards, students completed paper-and-pencil questionnaires twice per school year (April and November 2017 and 2018). The ProCiviCo intervention, through workshops and lessons for students and teachers, included the training in five components: (a) prosocial responding in the peer context, (b) empathic skills, (c) emotion regulation, (d) prejudice reduction, and (e) civic participation towards the school community. The workshops were led by the research team and in collaboration with teachers, consisted of weekly group discussions, role-playing, and interviews. The lessons were led by teachers and consisted of integrating civic issues in regular classwork across subjects.

1.5.3 Chilean peer relationships data

The data in Chapter 4 was part of a longitudinal study on peer relationships that followed fourth, fifth, and sixth graders in Santiago, Chile. The project focused on peer relationships and the developmental trajectories of aggression and prosociality in Chilean adolescents (project FONDECYT 1150201 other publications related to this research project are Berger et al., 2015, 2019). Data collection started in 2012 with four schools and 30 classrooms. Five waves were collected (April and October during the year 2012 and 2013, and April in the year 2014). Data includes students' socio-demographic characteristics, behaviors, and social networks assessed through paper-and-pencil questionnaires. Participating schools were private but received a public subsidy; this is representative of most Chilean schools. All schools were average in terms of family income, and they were located in low-to-middle socioeconomic status neighborhoods.

Table 1.1 Overview of the dissertation

Chapter	Research topic	Data source	Sample	Analytical strategy	Main variables
2	<ul style="list-style-type: none"> The effects of academic performance and school misconduct on academic and friendship networks in three types of classrooms ability composition The interplay of academic and friendship networks in three types of classrooms ability composition 	Ability Grouping Project wave 1 to 2	<ul style="list-style-type: none"> 528 students (12 classes) 7th to 9th grade; 14 years old 	Longitudinal social network analysis (RSiena) Multiple networks model	<ul style="list-style-type: none"> Academic: “With whom do you study at school?” (<i>unlimited network nominations</i>) Friendship: “With whom do you hang out at school?” (<i>unlimited network nominations</i>) Academic performance: General grade point average (<i>individual covariate</i>) School misconduct: number of school misconduct behaviors that they have been involved in at the end of the school year of the first assessment (<i>individual covariate</i>)
	<ul style="list-style-type: none"> The effects of academic performance, prosociality, and friendship on academic preference networks The interaction of academic performance and friendships on academic preference networks 	ProCiviCo wave 1 to 3	<ul style="list-style-type: none"> 537 students (13 classes) 7th grade; 12 years old 	Longitudinal social network analysis (RSiena)	<ul style="list-style-type: none"> Academic preference: “With whom would you like to study at school?” (<i>up to three network nominations</i>) Friendship: “With whom do you hang out at school during recess?” (<i>dyadic covariate</i>) Academic performance: General grade point average (<i>individual covariate</i>) Prosocial behavior: “Who helps those students in need” (from 1 = almost never to 5 = almost always) (<i>individual covariate</i>)
3	<ul style="list-style-type: none"> The effects of the dyadic and reputational perceptions on prosociality, aggression, and popularity on friendships 	Chilean Peer relationships wave 1 to 2	<ul style="list-style-type: none"> 694 students (16 classes) 4th to 6th grade; 11 years old 	Longitudinal social network analysis (RSiena)	<ul style="list-style-type: none"> Friendship: “Who are your best friends?” (<i>unlimited network nominations</i>) Prosociality: “Who cooperates? They help and share with others” (<i>dyadic covariate</i>) Aggression: “Who starts fights? They hit, kick, or punch others” (<i>dyadic covariate</i>) Popularity: “Who are the most popular and visible students in your class?” (<i>dyadic covariate</i>)
	<ul style="list-style-type: none"> The effects of the dyadic and reputational perceptions on prosociality, aggression, and popularity on friendships 	Chilean Peer relationships wave 1 to 2	<ul style="list-style-type: none"> 694 students (16 classes) 4th to 6th grade; 11 years old 	Longitudinal social network analysis (RSiena)	<ul style="list-style-type: none"> Friendship: “Who are your best friends?” (<i>unlimited network nominations</i>) Prosociality: “Who cooperates? They help and share with others” (<i>dyadic covariate</i>) Aggression: “Who starts fights? They hit, kick, or punch others” (<i>dyadic covariate</i>) Popularity: “Who are the most popular and visible students in your class?” (<i>dyadic covariate</i>)

Table 1.1 Overview of the dissertation (Continued)

Chapter	Research topic	Data source	Sample	Analytical strategy	Main variables
5	<ul style="list-style-type: none"> • Whether adolescents befriend or dislike peers whom they consider as aggressors or victims • Whether the selection of friends and antipathies differs in intervention and control classrooms 	ProCiviCo wave 1 to 3	<ul style="list-style-type: none"> • 530 students (13 classes) • 7th grade; 12 years old 	<p>Longitudinal social network analysis (RSiena)</p> <p>Multiple networks model</p>	<ul style="list-style-type: none"> • Friendship: “With whom do you hang out at school?” (<i>up to three network nominations</i>) • Antipathy: “With whom would you not like to hang out at school?” (<i>up to three network nominations</i>) • Aggression: “They behave aggressively or make fun of others” (<i>up to three network nominations</i>) • Victimization: “They are victimized, or kids make fun of them” (<i>up to three network nominations</i>)



Classroom ability composition and the role of academic performance and school misconduct in the formation of academic and friendship networks

This chapter is based on:

Palacios, D., Dijkstra, J. K., Villalobos, C., Treviño, E., Berger, C., Huisman, M., & Veenstra, R. (2019). Classroom ability composition and the role of academic performance and school misconduct in the formation of academic and friendship networks. *Journal of School Psychology, 74*, 58–73. <https://doi.org/10.1016/J.JSP.2019.05.006>

2.1 Introduction

There is a large variability in the academic performance of high school students. Whereas some students work diligently and get good grades, others seem to be less involved in school, resulting in underachievement or even school misconduct (Bissell-Havran & Loken, 2009; Demanet & Van Houtte, 2012). Educational systems have responded in different ways to students' academic heterogeneity. One strategy that has received considerable attention is ability grouping (also known as tracking), the practice of assigning students into different classes based on their abilities, educational career goals, or curriculum standards (Belfi et al., 2012). Ability grouping seems to be a widely used practice around the world, being implemented in some form in most countries of the Organisation for Economic Co-operation and Development (OECD, 2010). In secondary education, ability grouping usually takes the form of placing higher achieving students into advanced academic classes and lower achievers in general or vocational classes.

Research has suggested that ability grouping has considerable effects on academic and socio-emotional outcomes of students, but little is known about its effects on academic and friendship relationships, referring to who studies with whom and who is best friends with whom, respectively. These two peer relations are rooted in learning environments as adolescents spend a considerable amount of time with each other doing academic tasks or hanging out in schools (Altermatt & Pomerantz, 2003).

By assigning students to different classes, ability grouping defines the social group present in classes, not only generating more homogeneous educational environments than in mixed-ability classrooms but also fostering and limiting the possible academic comparisons and social interactions among classmates (Marsh et al., 2008). Moreover, ability grouping tends to produce a process of differentiation and polarization in academically-oriented norms (Hargreaves, 1967; Lacey, 1970) with students in high-ability classrooms (or higher tracks) developing pro-school attitudes and students in low-ability classrooms displaying anti-school attitudes (Berends, 1995; Van Houtte, 2006).

We examined the link between friendship and academic networks, as well as their association with adolescents' academic performance and school misconduct, comparing classrooms with different ability composition (high-, low-, and mixed-ability classrooms). A novel contribution of this study is that the association between classroom ability composition and academic and friendship networks was examined, thus adding to the understanding of the link between school practices and adolescents' social dynamics. This paper sheds light on how academic performance and school misconduct are differently related to academic and friendship networks depending on ability grouping. Examining this topic is relevant because ability grouping tends to influence academic and friendship relationships, which, in turn, are likely to impact not only students' social development but also future educational careers.

2.1.1 Ability grouping generating distinctive educational environments

According to the differentiation-polarization theory (Hargreaves, 1967; Lacey, 1970), a process of differentiation based on an academically-oriented norm is associated with a polarization between high-track students developing pro-school attitudes, and low-track students exhibiting anti-school attitudes (Berends, 1995; Hargreaves, 1967; Van Houtte, 2006). High-track students usually have a positive school experience finding greater meaning in schoolwork, being more motivated, putting forth more effort, and holding higher expectations for themselves compared to low track students (Gamoran, 1992).

On the contrary, low-track students experience a loss of status and sense of failure because their lack of ability in terms of academic performance pushes them into lower tracks (Byrne, 1988; Ireson et al., 2001). These students will react against the tracking system and its values (e.g., academic performance and hard work). Consequently, they will reject academically-oriented norms as a frame of reference (Hargreaves, 1967; Van Houtte, 2006) and search for alternative paths to reach status, most prominently via deviant behavior (Catsambis et al., 1999; Gamoran et al., 1995; Oakes, 1985; Van Houtte, 2006). Peer interactions in lower tracks, compared with higher tracks, are often characterized by higher levels of anti-academic behaviors (e.g., school misconduct, dropping out) (Carbonaro, 2005; Gamoran & Berends, 1987; Junger-Tas et al., 2010) as well as smaller friendship networks among students (Fisher & Shogren, 2016).

2.1.2 Effects of ability grouping on school settings

Research on ability grouping has primarily focused on assessing its impact on academic and socio-emotional outcomes, such as academic performance, academic self-esteem, and academic self-efficacy (Belfi et al., 2012; Holm et al., 2013; Ireson et al., 2001; Steenbergen-Hu et al., 2016). Overall, there is evidence that ability grouping is beneficial for high-ability students in terms of their academic achievement (Hattie, 2002; Rogers, 2007; Shields, 2002) and academic attitudes (Neihart, 2007). However, ability grouping tends to be detrimental for low-ability students in areas such as general and academic self-esteem (Agirdag et al., 2013; Ireson et al., 2001; Tereshchenko et al., 2018), academic self-concept (Boaler et al., 2000; MacIntyre & Ireson, 2002), educational expectations (Walsemann & Bell, 2010), and psychological adjustment (Dupriez, 2010; Müller & Hofmann, 2016).

The effects of ability grouping on academic functioning can occur in three domains: instructional, social, and institutional (Pallas et al., 1994). First, ability grouping is associated with different learning environments by influencing the quantity, quality, and pace of instruction and learning (Oakes, 1985; Pallas et al., 1994). Learning contexts tend to be richer for high-track students, and poorer for low-track students. High-track students tend to learn more by covering a significant proportion of the curriculum, learning at a faster pace, and being taught by more qualified teachers (Gamoran et al., 1995), whereas low-track students are typically provided with inferior educational experiences and support (Darling-Hammond, 2000; Hattie, 2009), spending, for example, less time on homework (Oakes, 1985).

Second, ability grouping stratifies peer contexts, which influences students' expectations of their performance and their self-concepts. Ability grouping defines the social group that students use to compare their abilities and to develop their academic identities (Marsh et al., 2008). Moreover, ability grouping and curricular differentiation foster interaction among students with comparable levels of academic performance and engagement. For instance, lower tracks structure and promote friendships among students who are similarly alienated from school and are more likely to be involved in deviant behaviors, such as school misconduct, leading to the increase of other students' engagement in those behaviors (Crosnoe, 2002; Dishion et al., 2001). Similarly, students in low-ability classrooms are likely to have fewer learning opportunities and experience a lack of positive stimulation from other classmates (Van Houtte, 2004).

Third, ability grouping influences the expectations and perceptions of teachers and parents about student's competences, independent of their actual skills. Teachers not only tend to reduce their expectations for low-ability students (Boaler et al., 2000), but also implement less challenging instructional strategies which promote low complexity skills, such as repetition and memorization

(Clotfelter et al., 2005; Toledo Román & Valenzuela, 2015). Moreover, some teachers might consider that low-ability students have more behavioral problems than other students (Haskins et al., 1983; Van Houtte, 2006). Conversely, teachers consider teaching more prestigious in high-track classrooms (Finley, 1984).

Together, the literature stresses the importance of ability grouping in generating diverse educational settings that are associated with different school experiences. From this evidence, we expected that academic performance and school misconduct would be oppositely valued in high- and low-ability classrooms, thus, affecting the formation and maintenance of academic and friendship relationships with peers differently.

2.1.3 Academic and friendship networks in school settings

Peers in school, particularly friends, play an important role in adolescents' academic behaviors (Altermatt & Pomerantz, 2003). On the one hand, peers can influence their classmates' academic functioning by promoting or discouraging academic behaviors including school engagement, academic achievement, homework activity, paying attention in class, academic mastery goals, and truancy (Flashman, 2012; Geven, Weesie, & van Tubergen, 2013; Gremmen, Dijkstra, Steglich, & Veenstra, 2017; Lomi, Snijders, Steglich, & Torló, 2011; Rambaran et al., 2017; Shin & Ryan, 2014b). On the other hand, attraction to peers is partially driven by academic performance with high-achieving students receiving more friendships nominations over time than low achievers (Gremmen et al., 2017; Palacios & Berger, 2016; Shin & Ryan, 2014a; Stark, Leszczensky, & Pink, 2017).

Previous studies in school settings have, however, focused almost exclusively on understanding the role of friendship, typically ignoring more specific academic relationships. Only a few studies have examined comparable positive networks, such as helping or advice relationships. For example, one study examined friendship and advice relationships (i.e., peers to whom university students recurrently referred for information and advice on course-related matters) showing that both friendship and advice networks positively influenced each other and that academic performance was positively related to being nominated as advisor (Snijders et al., 2013). Another study examined prosocial relationships in secondary education, showing that adolescents are likely to reciprocate helping relationships as well as cooperate with peers with whom they already established a friendship (Van Rijsewijk et al., 2016).

Finally, there is evidence that academic networks (with whom do you study at the school?), like friendship networks, are shaped by reciprocity and transitivity mechanisms in high school students (Palacios & Villalobos, 2016).

2.1.4 Present study

This paper investigated the association between academic and friendship networks with academic performance and school misconduct comparing different classrooms in terms of ability composition¹. Three types of classrooms were investigated: high-ability classrooms, low-ability classrooms, and mixed-ability classrooms. We included the latter group of classrooms to compare how academic and friendship relationships unfold in contexts without clear ability grouping

¹ Although grouping might not be actually based on ability but on academic performance, the underlying assumption for this grouping is that students have different abilities which are expressed in their achievement. Because the term ability grouping is commonly used (Dupriez, 2010), we decided to keep this nomenclature.

strategies. In the current study, we focused on permanent route ability grouping (which also has been called streaming, tracking, or program differentiation), in which students are assigned to classes according to their academic abilities as measured using a prior evaluation or test.

In the permanent route, students remain in the same ability group for all of the classes during secondary education (Treviño et al., 2018). We expected that each type of classroom signals and promotes distinct educational environments: pro-school norms in high-ability classrooms; anti-school norms in low-ability classrooms; and moderate pro-school norms in mixed-ability classrooms. As a result, the importance and prominence of academic performance and school misconduct on the formation and maintenance of academic and friendship networks are expected to differ in each type of classroom.

High-ability classrooms would signal academically-oriented environments, resulting in the prominence of academic performance (Oakes, 1986) and the rejection of school misconduct. We hypothesized that compared to low-ability classrooms, in high-ability classrooms students with higher academic performance are more likely to attract academic nominations from their peers (*hypothesis 1*). Also, students who engage in school misconduct are expected to be unattractive as academic partners. Consequently, we hypothesized that compared to low-ability classrooms, in high-ability classrooms students with higher levels of school misconduct are less likely to attract academic nominations (*hypothesis 2*).

High-track students exhibit positive attitudes toward homework (Van de Gaer, Pustjens, Van Damme, & De Munter, 2006), and are also expected to spend a considerable amount of class time doing academics tasks, such as homework (Ireson & Hallam, 2001; Oakes, 1986). As a consequence, high-track students dedicate more time to academic duties and, therefore, to more academic interactions with other students, increasing opportunities for academic partners to become friends. Hence, we expected that, compared to low-ability classrooms, in high-ability classrooms, the existence of academic relationships is likely to promote the creation or maintenance of friendship relationships (*hypothesis 3a*).

Conversely, because friends tend to be a source of support in other positive relationships such as advice and helping networks (Snijders et al., 2013; Van Rijsewijk et al., 2016), we expected that the same occurs for academic networks. Hence, we hypothesized that the existence of friendships was likely to promote the creation or maintenance of academic relationships in both types of classrooms (*hypothesis 3b*).

Regarding low-ability tracks, these classrooms seem to generate anti-academic oriented settings, with students exhibiting poorer attitudes toward school as well as experiencing feelings of incompetence, dropping out of school, and displaying problem behaviors (Oakes, 1985; Page, 1991). This might also affect how peer relations are formed, specifically the prominence of school misconduct for friendship selection. Hence, we expected that, compared to high-ability classrooms, in low-ability classrooms, students with higher levels of school misconduct are likely to attract more friendship nominations (*hypothesis 4*).

Regarding the mixed-ability classrooms, we expected a moderate academically-oriented environment in which academic performance would play an important role in influencing both academic and friendship networks. Mixed-ability classrooms seem to foster higher self-esteem and positive attitudes toward school among students (Ireson et al., 2001). Moreover, these classrooms usually present a wider variability of students' academic engagement compared to high- and low-ability classrooms. For that reason, these classrooms could be more polarized in terms of academic engagement, leading to similarity selection effects for both academic performance and school

misconduct. Therefore, we hypothesized that in mixed-ability classrooms, students with similar academic performance and school misconduct are likely to be academic partners (*hypothesis 5a*) and friends (*hypothesis 5b*).

To test these hypotheses, we used longitudinal social network models, specifically the stochastic actor oriented-models (SAOM) implemented in RSiena (Ripley et al., 2018). In the analyses, we also controlled for two demographic variables: sex and socioeconomic status as both seem to be important factors in the formation of academic and friendship relationships. Friendship and academic relationships are commonly formed between same-sex peers (Palacios & Villalobos, 2016; Shin, 2017; Sijtsema, Ojanen, et al., 2010; Simpkins et al., 2013). Studies have also shown sex differences in several academic dimensions, such as academic performance, motivation, and self-esteem (e.g., Bugler, McGeown, & St Clair-Thompson, 2015; Diseth, Meland, & Breidablik, 2014; Voyer & Voyer, 2014). Socioeconomic status plays a crucial role in Chilean schools because it is related to academic outcomes and trajectories of students from different social backgrounds (Mizala & Torche, 2012).

2.2 Method

Participants were 1,474 seventh to ninth graders from 35 classrooms from nine schools in four regions in Chile. According to the Chilean national socioeconomic classification, schools come from middle to low socioeconomic backgrounds (see Table 2.A in Appendix 2.A). These schools offered education from 7th, 8th grade (last years of primary education) or 9th (first year of secondary education) throughout 12th grade (see Table 2.1). We studied the first grade of education offered in each selected school. The case of Chilean schools is relevant because ability grouping is a fairly common practice, especially in the beginning of secondary education, being applied by around 80% of the schools with two or more classrooms per grade level (Trevisño et al., 2018).

The participating schools are part of a broader Chilean research project that aims to examine and understand the grouping processes carried out by effective-inclusive Chilean schools by describing their institutional arrangements and pedagogies (see Appendix 2B for additional information on the sample). These types of schools are characterized by shared commitment, high educational expectations, shared values and beliefs, clear school-wide goals, high-quality instruction in all classrooms, and learner-centered professional development (Hehir & Katzman, 2012; Intxausti et al., 2017; McLeskey et al., 2014). All classrooms in these nine schools were eligible for the present study.

2.2.1 Sample selection

We analyzed the first two waves of a 3-wave study, with six months as a period between the first two waves. This interval seems to be adequate to assess potential changes in the friendship networks (see suggestions by Ripley et al., 2018; Snijders, van de Bunt, & Steglich, 2010), whereas the interval between the second and third waves was considerably larger (approximately a year). As a consequence, we removed six classrooms that only participated in the second and third waves. Additionally, we excluded one classroom that left the study before the second wave as well as a notably small classroom with only seven students. Our sample contained 27 classrooms.

In view of the requirements for longitudinal social networks analysis (referring to model convergence), the final sample of classrooms was selected based on networks' stability and the proportion of missing data. We excluded fifteen classrooms with low levels of stability (a Jaccard

Table 2.1 Descriptive information about the selected classroom networks for time 1 and 2

Class	Grade	Type	Size	Girls %	SES	Acad		Miss t1	Miss t2	Dist		Jac AC	Jac FR	AvD		AvD AC t1	AvD AC t2	AvD FR t1	AvD FR t2	Jn	Lv
						Perf	Misc			FR	AC			FR	AC						
1	7 ^o	M	49	71.4	2.81	6.34	1.67	.13	.05	200	264	.05	.33	3.02	2.95	7.63	10.27	4	5		
2	7 ^o	M	48	51.2	3.03	6.04	2.58	.15	.14	84	186	.31	.32	2.93	3.51	8.19	10.21	8	2		
3	8 ^o	M	73	62.2	3.84	5.68	3.03	.05	.05	64	89	.07	.03	2.07	2.11	5.14	7.46	28	26		
4	9 ^o	M	52	95.3	3.37	5.31	4.32	.19	.04	100	167	.30	.27	3.67	2.84	6.67	3.84	3	11		
5	9 ^o	H	41	62.8	2.71	6.43	0.16	.10	.08	142	201	.26	.42	3.71	6.10	11.30	10.80	5	5		
6	9 ^o	H	43	40.0	2.31	6.03	0.58	.32	.05	65	80	.09	.19	2.08	3.38	5.09	5.96	7	10		
7	9 ^o	H	41	61.5	3.08	6.21	0.74	.18	.09	76	145	.38	.36	2.94	4.11	9.07	7.44	3	2		
8	9 ^o	H	40	60.0	2.77	5.79	1.80	.25	.07	108	133	.31	.44	3.85	4.09	6.26	8.15	3	2		
9	9 ^o	L	44	62.8	2.20	5.42	0.93	.31	.11	88	137	.21	.33	3.17	4.07	9.55	11.85	6	7		
10	9 ^o	L	44	50.0	2.60	5.06	4.48	.15	.07	49	125	.36	.37	2.07	3.02	11.34	7.65	6	7		
11	9 ^o	L	23	88.2	1.82	5.41	3.90	.20	.10	22	29	.31	.39	1.57	2.27	3.81	3.82	5	5		
12	9 ^o	L	30	70.8	1.87	5.46	3.79	.22	.11	59	116	.12	.30	2.06	2.06	5.72	5.88	1	5		
Av/Tot	-	-	528	71.4	2.70	5.77	2.33	.19	.08	88.1	139.3	.23	.31	2.76	3.38	7.48	2.76	79	87		

Notes. Type: Type of class (M: Mixed-ability classes; H: High-ability classes; L: Low-ability classes); SES: Average of socio-economic background; Acad Perf: Academic performance; Acad Misc: Academic misconduct; Miss: % of missing data; Dist.: Hamming distance; Jac: Jaccard index; AvD: Average degree; Jn: Number of students who joined the study between assessments; Lv: Number of students who left the study between assessments

index lower than .20, see Table 2.C in Appendix 2.C) or high levels of missing data (referring to 20% or higher), which are too high for estimating SAOM, as simulations on which estimations are based become unstable (Ripley et al., 2018). The excluded classrooms were low- and mixed-ability classrooms. Compared to students from excluded classrooms, students from the included low- and mixed-ability classrooms showed higher academic performance ($t(225) = -3.62, p < .001$; $t(605) = -5.83, p < .001$) and lower school misconduct ($t(121) = 3.65, p < .001$; $t(332.32) = 4.22, p < .001$). The final sample consisted of 528 seventh to ninth graders ($N_{t1} = 449, N_{t2} = 441; M_{age\ t1} = 15; 64.1\%$ girls) from 12 classrooms (four in each category of ability grouping) from 5 schools (see Table 2.1).

2.2.2 Missing data and classrooms' composition change

For academic and friendships nominations, ordinary missing data were handled through the RSiena default missing data procedure (Ripley et al., 2018). For each missing tie variable, the preceding non-missing value (if any) was imputed; if the previous values were missing as well, the value 0 (referring to no friendship tie) was assigned. Whenever imputed values were used, parameter estimate updates were based on the non-imputed parts of the data. This approach tries to minimize the impact of imputations on the results (Huisman & Steglich, 2008; Ripley et al., 2018).

In the case of students who joined ($n=79$) and left ($n=89$) the study between the two assessments, we used the method of joiners and leavers (see Huisman & Snijders, 2003). In this procedure, it is possible to indicate the intervals during which joiners and leavers were present in the study. In this way, joiners and leavers only participate in the simulations at the observation moments in which they were present. Compared to the students who remained in the study over the two assessments, students who left the study before the second assessment exhibited lower academic performance in low- and mixed-ability classrooms ($t(127) = -2.03, p = .04$; $t(156) = -3.97, p < .001$). Also, participants who left the study presented higher levels of school misconduct in mixed-ability classrooms ($t(138) = 2.05, p = .04$).

2.2.3 Measures

Academic networks (T1-T2). Participants were asked to identify their classmates with whom they study at the school. Adjacency matrices were created for each classroom on each assessment representing the academic network, where nominations were coded 1 and non-nominations were code 0. On average, the number of academic partners (outdegree) was 2.76 ($SD = 0.77$) for the first wave and 3.37 ($SD = 1.13$) for the second wave.

Friendship networks (T1-T2). Participants were asked to identify their classmates with whom they hang out at school (Espelage & Swearer, 2003; Schacter et al., 2014). Adjacency matrices were created for each classroom on each assessment representing the friendship network with, friendship nominations coded as 1 and non-nominations coded as 0. On average, the number of friends (outdegree) was 7.48 ($SD = 2.46$) for the first wave and 7.77 ($SD = 2.63$) for the second wave.

Classroom grouping strategy. A widespread school practice in Chilean schools is that school principals group students at the beginning of secondary education (Treviño et al., 2018). Based on a principals' report, we categorized classrooms as high-, low-, or mixed-ability classrooms. Additionally, we performed statistical comparisons (Mann-Whitney-Wilcoxon Tests) on standardized tests and GPA officially reported by schools to the Ministry of Education before students started high school to confirm differences in academic outcomes for these types of

classrooms. Results showed that the academic distribution was different among the three categories (see Appendix 2.D for more information on the distribution of each group of classrooms).

Academic performance (T1). General grade point average (GPA) was provided by the Chilean national assessment system (SIMCE) at the end of the first academic year. GPA as a measure of academic performance has been widely used in the literature about peer selection and influence processes (e.g., Flashman, 2012; Rambaran et al., 2017; Shin & Ryan, 2014). The Chilean grading scale ranges from 1 (*poor*) to 7 (*excellent*). On average, the academic performance of the students for the first wave was 5.7 ($SD = 0.59$).

School misconduct (T1). Students reported the number of school misconduct behaviors that they have been involved in at the end of the school year of the first assessment. School misconduct refers to the behaviors that disrupt the class or engenders punishment, such as cheating on tests, skipping lessons, and arriving late at school (Demagnet & Van Houtte, 2011; Van Houtte & Stevens, 2008). The original range was between 0 and 28, with an average of 4.19 ($SD = 4.92$). We recoded the original variable, maintaining the values from 0 to 8, and adding a last category representing all the values greater or equal to 9 ($M = 3.42$, $SD = 3.17$). The distribution was the following: 1 (28.2%), 2 (31.1%), 3 (12.6%), 4 (8.7%), 5 (5.1%), 6 (2.9%), 7 (2.5%), 8 (1.6%), 9 or more (6.8%).

Socioeconomic status (T1). The socioeconomic status index was obtained from the Chilean national learning assessment system (SIMCE). This index was calculated by equally weighting information of parents' educational background and incomes with a vulnerability index associated with students' schools. The socioeconomic status index has five categories: low (20.3%), low-middle (21.5%), middle (24.5%), upper-middle (23.0%), and upper socioeconomic status (10.5%). The participating schools belong to a small group of Chilean schools that have students from different socioeconomic groups. Overall, whereas public schools usually concentrate the most socially disadvantaged students, the middle-low and middle-class students attend private-subsidized schools, and the high-class students go to private schools (García-Huidobro, 2007).

Sex. Participants were asked about their sex, which was coded 0 for girls and 1 for boys.

2.2.4 Procedure

The data used were collected in October–November 2015 (Wave 1) and May 2016 (Wave 2). At each wave, the questionnaires were applied in one day in all the participating classrooms of a school. The total period of data collection in each wave lasted, on average, two weeks. The Institutional Review Board of the local university approved all instruments and procedures to meet ethical research standards (e.g., confidentiality, parental and participants' consent, data storage). Participants were assured that their answers would be kept confidential and that they could stop participating at any time. Trained research assistants with professional degrees (education, psychology, or sociology) applied the questionnaires during regular school hours.

To facilitate academic and friendship nominations, a roster with students' names was available on the blackboard of each classroom. Once the information was collected, the questionnaires were coded in the database and anonymized, to guarantee the confidentiality of the students' answers.

2.2.5 Analytical Strategy

Analyses were conducted using longitudinal multiplex social network models implemented in RSiena ("Simulation Investigation for Empirical Network Analysis"), which allowed unraveling the development of friendship and academic networks over time (Ripley et al., 2018) while taking into account students' individual covariates (sex, socioeconomic status, academic performance, and

school misconduct). RSiena models are actor-based models (Snijders et al., 2010), which assume that actors (e.g., students) modify their relationships (e.g., friendships and academics relationships) between assessments based on their individual preferences (Snijders et al., 2010). For instance, friendships may change (referring to creating a new friendship or dropping an existing one) in response to the current network structure as well as to the structure of the academic network, reflecting a dynamic process controlling for changes in structural (e.g., reciprocity, transitivity) and individual effects (actor attributes).

We estimated the model for each type of classroom separately using the Methods of Moments estimator and specifying 10,000 iterations in phase 3 for calculating standard errors. Specifically, classrooms of each type were combined and analyzed simultaneously using the multi-group approach, which assumes that parameters are identical across classroom networks. This approach yields more statistical power compared to analyzing classrooms separately (Ripley et al., 2018). All models reached convergence, showing a good convergence of the algorithm (with overall maximum convergence ratios smaller than .15 for each model), and overall satisfactory goodness of fit (for more details see Appendix 2.E). Our model includes three sets of parameters: structural effects, individual covariates, and cross-network effects.

2.2.6 Model specification

Structural network effects. These effects were included to capture the basic tendencies of actors to form and maintain relationships within the two types of networks. *Density* describes the tendency of actors to establish relationships. *Reciprocity* is the tendency toward reciprocation of relationships (referring to mutual ties). *Transitivity* (transitive triplets) refers to the transitive closure of individuals ('friends of friends become friends'). Moreover, we included the interaction between *transitivity* and *reciprocity* (transitive reciprocated triplets), representing the tendency toward reciprocation of nominations within triads (Block, 2015). Additionally, we included two degree-related effects to differentiate between actors who received or sent many (or few) nominations in friendship and academic networks. The *indegree-popularity* effect reflects the tendency of actors who receive many nominations to attract more nominations over time, whereas the *outdegree-activity* effect reflects the tendency of actors who send many nominations to send more nominations over time. To improve the goodness of fit of the models, we included the interaction between the reciprocated degree and the *indegree-popularity* (*reciprocal degree-related popularity* effect), indicating that students with a large number of reciprocated ties will receive more additional nominations over time.

Covariates. The effect of academic performance and school misconduct on friendship and academic relationships were included, assessing whether participants, who, for instance, score higher on academic performance are more likely to send (*ego* effect) and/or receive (*alter* effect) friendships or academic nominations. We also included the similarity effect for these two covariates, indicating whether friendship nominations and academic nominations are more likely to occur between participants with similar levels of academic performance and school misconduct. Additionally, we included the effect of sharing the *same sex* and *socioeconomic status similarity* in the formation and maintenance of academic and friendship networks.

Cross-network effects. These effects were included to analyze the effect of one type of network on another type of network. For our purpose, we examined whether friendship nominations lead to academic nominations and vice versa.

2.3 Results

2.3.1 Descriptive analysis

Table 2.2 provides descriptive information about the changes in academic and friendship networks from Wave 1 to Wave 2. Regarding the academic networks, high- and low-ability classrooms shared a comparable pattern, in which the number of created ties was the largest, followed by the number of maintained ties, and the number of dissolved ties was smallest. In the case of mixed-ability classrooms, the number of dissolved ties was the largest, followed by created and maintained ties. High- and low-ability classrooms shared a comparable pattern in the friendships network dynamics. The number of maintained ties was the largest, followed by the number of created ties, and the number of dissolved ties was smallest. In the case of mixed-ability classrooms, the number of created ties was the largest, followed by maintained and dissolved ties.

Students in high-ability classrooms exhibited higher academic performance ($t(251) = 13.60, p < .001$) and socioeconomic status ($t(248) = 3.39, p < .001$) and a lower level of school misconduct ($t(94) = -6.46, p < .001$) compared to students in low-ability classrooms (see Table 2.2). Moreover, students in high-ability classrooms showed higher academic performance ($t(312.31) = 5.26, p < .001$) as well as lower school misconduct ($t(223.09) = -7.81, p < .001$) and socioeconomic status ($t(274.42) = -4.01, p < .001$) than students in mixed-ability classrooms.

Students in low-ability classrooms had lower academic performance ($t(289) = -8.24, p < .001$) and socioeconomic status ($t(268) = -7.73, p < .001$) in comparison to students in mixed-ability classrooms. In addition, there was a significant negative correlation between academic performance and school misconduct in high-ability ($r(92) = -0.33, p = .001$), low-ability ($r(72) = -0.36, p = .001$), and mixed-ability classrooms ($r(138) = -0.55, p < .001$).

Table 2.2 Variables Distribution and Changes across the two observations by each type of classroom composition

	High-ability classrooms		Low-ability classrooms		Mixed-ability classrooms	
	T1	T2	T1	T2	T1	T2
N students by wave	147	146	123	117	179	178
N students total	165		141		222	
Academic networks						
Density	.08	.11	.07	.08	.06	.06
Average degree	3.15	4.42	2.22	2.86	2.92	2.85
	T1 → T2		T1 → T2		T1 → T2	
Average number of academic changes	97.75		41.25		112	
Jaccard index (stability)	.27		.24		.18	
Academics emerged	381		288		386	
Academics dissolved	170		93		395	
Academics maintained	201		106		153	
	T1	T2	T1	T2	T1	T2
Friendship networks						
Density	.20	.20	.21	.21	.14	.15
Average degree	7.93	8.09	7.61	7.30	6.91	7.95

Table 2.2 Variables Distribution and Changes across the two observations by each type of classroom composition (continued)

	High-ability classrooms	Low-ability classrooms	Mixed-ability classrooms
	T1 → T2	T1 → T2	T1 → T2
Average number of academic changes	139.75	101.75	176.50
Jaccard index (stability)	.36	.35	.26
Friendships emerged	505	421	885
Friendships dissolved	429	395	770
Friendships maintained	545	436	547
	T1	T1	T1
<i>Covariates</i>			
Academic performance	6.12 (0.46)	5.30 (0.49)	5.82 (0.54)
School misconduct	0.84 (1.40)	3.45 (3.25)	2.89 (2.59)
Socioeconomic background (SES)	2.74 (1.29)	2.20 (1.20)	3.31 (1.12)
Sex (% girls)	56%	64%	70%

Notes. Standard errors in parentheses

2.3.2 Longitudinal social networks analysis

Results of the RSiena analyses for the different types of classrooms are presented in Table 2.3. To facilitate the interpretation of the effects, we calculated the odds ratios representing the odds that an outcome will occur given a particular situation, compared with the odds of the outcome occurring in the absence of that situation. For instance, the odds of 3 for the friends' similarity effect means that a student was three times as likely to nominate a similar peer as a friend than not to, all else being equal.

Structural network effects. Across the three type of classrooms, we found that students were likely to reciprocate academics relationships (*reciprocity* Est. _{high} = 2.35, $p_{\text{high}} < .001$, OR = 10.46; Est. _{low} = 2.13, $p_{\text{low}} < .001$, OR = 8.43; Est. _{mixed} = 2.70, $p_{\text{mixed}} < .001$, OR = 14.81). Also, participants nominated academic partners of academic partners as academic partners (*transitivity* Est. _{high} = 0.50, $p_{\text{high}} < .001$, OR = 1.65; Est. _{low} = 0.73, $p_{\text{low}} < .001$, OR = 2.08; Est. _{mixed} = 0.89, $p_{\text{mixed}} < .001$, OR = 2.44), but academic relationships within triadic structures were not reciprocated (*transitivity × reciprocity* Est. _{high} = -0.78; $p_{\text{high}} < .001$, OR = 0.46; Est. _{low} = -0.45, $p_{\text{low}} = .01$, OR = 0.64; Est. _{mixed} = -0.63, $p_{\text{mixed}} < .001$, OR = 0.53).

Participants who had many academic relationships in low-ability classrooms were less likely to attract new academic partners (*indegree-popularity* Est. _{low} = -0.88, $p_{\text{low}} = .03$, OR = 0.41) resulting in a lower dispersion in academic indegrees. An interpretation is that for students in low-ability classrooms, which are usually not focused on academic achievement, there would be less incentive to increase their number of academic partners over time. Likewise, the negative outdegree-activity effect in mixed-ability classrooms indicates that participants who send more academic nominations, send less additional academic nominations over time (*outdegree-activity* Est. _{mixed} = -0.53, $p_{\text{mixed}} < .001$, OR = 0.59). Consistent with the indegree-popularity effect, for students who already indicate having many academic partners there would be less incentive to find more academic partners in mixed-ability classrooms. Last, in high- and mixed-ability classrooms, students who have many

reciprocated academic ties received fewer additional academic nominations over time (*reciprocal-degree popularity* Est. $_{high} = -0.67$, $p_{high} < .001$, OR = 0.51; Est. $_{mixed} = -0.92$, $p_{mixed} < .001$, OR = 0.40). An interpretation is that students with a large number of reciprocated academic ties are perceived as less available for other classmates to be an academic partner.

In the case of friendship networks, across the three types of classrooms, friendship nominations tended to be reciprocated (*reciprocity* Est. $_{high} = 2.39$, $p_{high} < .001$, OR = 10.95; Est. $_{low} = 2.31$, $p_{low} < .001$, OR = 10.02; Est. $_{mixed} = 3.23$, $p_{mixed} < .001$, OR = 25.20). Participants tended to nominate friends of friends as friends (*transitivity* Est. $_{high} = 0.30$, $p_{high} < .001$, OR = 1.34; Est. $_{low} = 0.29$, $p_{low} < .001$, OR = 1.34; Est. $_{mixed} = 0.46$, $p_{mixed} < .001$, OR = 1.59), but they were less likely to reciprocated friendships within triads (*transitivity \times reciprocity* Est. $_{high} = -0.26$, $p_{high} < .001$, OR = 0.77; Est. $_{low} = -0.27$, $p_{low} < .001$, OR = 0.76; Est. $_{mixed} = -0.46$, $p_{mixed} < .001$, OR = 0.63). Students who received many friendship nominations were less likely to attract new friends over time in low and mixed-ability classrooms (*indegree-popularity* Est. $_{low} = -0.40$, $p_{low} = .05$, OR = 0.67; Est. $_{mixed} = -0.54$, $p_{mixed} < .001$, OR = 0.58), resulting in a lower dispersion in friendship indegrees.

In addition, in both high- and mixed-ability classrooms participants who send many friendship nominations were less likely to give new friendship nominations over time (*outdegree-activity* Est. $_{high} = -0.30$, $p_{high} < .001$, OR = 0.74; Est. $_{mixed} = -0.21$, $p_{mixed} < .001$, OR = 0.81). Results of the two degree-related effects suggest that, particularly in mixed-ability classrooms, there exists a less hierarchical structure in terms of the incoming and outgoing friendship nominations. Last, in low- and mixed-ability classrooms the interaction between the friendship reciprocated degree and indegree-popularity was negative (*reciprocal-degree popularity* Est. $_{low} = -0.40$, $p_{low} = .03$, OR = 0.67; Est. $_{mixed} = -0.57$, $p_{mixed} < .001$, OR = 0.57). A possible interpretation is that students with more mutual friendships are perceived as less available for other classmates to be friends.

Covariates. In line with our first hypothesis, we found that students with higher academic performance received more academic nominations in high- and mixed-ability classrooms but not in low-ability classrooms (*academic performance alter* Est. $_{high} = 0.47$, $p_{high} = .05$, OR = 1.61; Est. $_{mixed} = 0.36$, $p_{mixed} < .001$, OR = 1.44; Est. $_{low} = 0.14$, $p_{low} = 0.40$, OR = 1.15). However, the effect of academic performance on the incoming academic nominations did not differ between high- and low-ability classrooms ($z = 1.45$, $p = .07$). In line with the second hypothesis, students who engaged in school misconduct attracted fewer academic nominations in high-ability, but not in low-ability classrooms (*school misconduct alter* Est. $_{high} = -0.16$, $p_{high} = .03$, OR = 0.85; Est. $_{low} = 0.00$, $p_{low} = .92$, OR = 1.00). This difference was statistically significant ($z = -2.13$, $p = .01$), and consistent with the second hypothesis.

Moreover, students with higher levels of school misconduct did not attract many friendship nominations in either high- or low-ability classrooms (*school misconduct alter* Est. $_{high} = -0.10$, $p_{high} = .46$, OR = 0.91; Est. $_{low} = -0.03$, $p_{low} = .17$, OR = 0.97), rejecting the fourth hypothesis. Also, similarity in academic performance and school misconduct was not associated with selecting academic partners in mixed-ability classrooms (*academic performance similarity* Est. $_{mixed} = -0.35$, $p_{mixed} = .35$, OR = 0.70; *school misconduct similarity* Est. $_{mixed} = -0.17$, $p_{mixed} = .35$, OR = 0.85), rejecting the first part of our fifth hypothesis. Furthermore, school misconduct and academic performance were not associated with selecting friends (*school misconduct similarity* Est. $_{mixed} = -0.34$, $p_{mixed} = .13$, OR = 0.71; *academic performance similarity* Est. $_{mixed} = -0.58$, $p_{mixed} = .06$, OR = 0.56). Hence, the second part of our fifth hypothesis was rejected.

Table 2.3 Academic and friendship networks: RSiena Multi-group Analyses in High-, Low-, and Mixed-ability classrooms

<u>Effects</u>	High-ability classrooms				Low-ability classrooms				Mixed-ability classrooms			
	<u>Est.</u>	<u>SE</u>	<u>p</u>	<u>OR</u>	<u>Est.</u>	<u>SE</u>	<u>p</u>	<u>OR</u>	<u>Est.</u>	<u>SE</u>	<u>p</u>	<u>OR</u>
Academic networks												
<i>Structural effects</i>												
Density	-1.64	0.46	< .001	0.19	-0.44	0.61	0.47	0.65	0.65	0.55	0.23	1.92
Reciprocity	2.35	0.28	< .001	10.46	2.13	0.35	< .001	8.43	2.70	0.24	< .001	14.81
Transitivity	0.50	0.09	< .001	1.65	0.73	0.11	< .001	2.08	0.89	0.09	< .001	2.44
Transitivity x reciprocity	-0.78	0.15	< .001	0.46	-0.45	0.18	0.01	0.64	-0.63	0.12	< .001	0.53
Indegree-popularity	0.10	0.16	0.54	1.10	-0.88	0.40	0.03	0.41	-0.35	0.24	0.14	0.70
Outdegree-activity	0.03	0.08	0.72	1.03	-0.05	0.09	0.60	0.95	-0.53	0.13	< .001	0.59
Reciprocal-degree popularity	-0.67	0.23	< .001	0.51	-0.41	0.28	0.14	0.66	-0.92	0.22	< .001	0.40
<i>Covariates effects</i>												
Same sex	-0.08	0.09	0.34	0.92	0.34	0.11	< .001	1.41	0.12	0.11	0.25	1.13
Same SES	0.01	0.10	0.91	1.01	0.15	0.11	0.18	1.16	-0.15	0.11	0.19	0.86
Academic perf. alter	0.47	0.15	< .001	1.61	0.14	0.17	0.40	1.15	0.36	0.15	0.02	1.44
Academic perf. ego	-0.30	0.13	0.02	0.74	-0.04	0.15	0.81	0.97	-0.33	0.16	0.04	0.72
Academic perf. similarity	0.09	0.44	0.83	1.10	-0.41	0.41	0.31	0.66	-0.35	0.37	0.35	0.70
School misconduct alter	-0.16	0.08	0.03	0.85	0.00	0.03	0.92	1.00	-0.03	0.04	0.35	0.97
School misconduct ego	-0.06	0.06	0.33	0.94	0.02	0.02	0.39	1.02	-0.06	0.03	0.02	0.94
School misconduct similarity	-0.85	0.61	0.16	0.43	-0.28	0.28	0.32	0.76	-0.17	0.28	0.55	0.85
<i>Cross-network effects</i>												
Friendship to Academic	0.90	0.22	< .001	2.46	0.82	0.24	< .001	2.27	0.38	0.20	0.06	1.47

Table 2.3 Academic and friendship networks: RSiena Multi-group Analyses in High-, Low-, and Mixed-ability classrooms (Continued)

Effects	High-ability classrooms			Low-ability classrooms			Mixed-ability classrooms				
	Est.	SE	p	Est.	SE	p	Est.	SE	p		
Friendship networks											
<i>Structural effects</i>											
Density	1.58	1.44	0.27	4.85	0.43	0.99	1.00	1.35	0.45	< .001	3.85
Reciprocity	2.39	0.28	< .001	10.95	2.31	< .001	10.02	3.23	0.21	< .001	25.20
Transitivity	0.30	0.05	< .001	1.34	0.29	< .001	1.34	0.46	0.03	< .001	1.59
Transitivity x reciprocity	-0.26	0.05	< .001	0.77	-0.27	< .001	0.76	-0.46	0.05	< .001	0.63
Indegree-popularity	-0.65	0.92	0.48	0.52	-0.40	0.05	0.67	-0.54	0.17	< .001	0.58
Outdegree-activity	-0.30	0.08	< .001	0.74	-0.06	0.06	0.94	-0.21	0.05	< .001	0.81
Reciprocal-degree popularity	-0.20	0.77	0.80	0.82	-0.40	0.18	0.67	-0.57	0.17	< .001	0.57
<i>Covariates effects</i>											
Same sex	-0.10	0.11	0.38	0.91	0.15	0.08	1.17	-0.30	0.08	< .001	0.74
Same SES	-0.18	0.09	0.06	0.84	0.03	0.09	1.03	-0.18	0.09	0.04	0.83
Academic perf. alter	-0.25	0.13	0.05	0.78	0.13	0.20	1.14	0.31	0.10	< .001	1.37
Academic perf. ego	0.29	0.13	0.03	1.34	0.06	0.10	1.06	-0.10	0.12	0.41	0.91
Academic perf. similarity	-0.16	0.59	0.78	0.85	0.53	0.30	1.70	-0.58	0.31	0.06	0.56
School misconduct alter	-0.10	0.13	0.46	0.91	-0.03	0.02	0.97	-0.04	0.02	0.07	0.96
School misconduct ego	0.13	0.07	0.05	1.14	0.01	0.02	1.01	0.03	0.02	0.07	1.03
School misconduct similarity	-0.72	0.69	0.30	0.49	-0.17	0.19	0.84	-0.34	0.23	0.13	0.71
<i>Cross-network effects</i>											
Academic to Friendship	1.26	0.27	< .001	3.53	1.28	0.01	3.59	0.31	0.24	0.19	1.36

Notes. Each model represents a separate multi-group analysis in RSiena. Due to convergence issues, we fixed the Academic and Friendship rate parameters for one classroom in each model. Based on the average of Friendship and Academic rate parameters in the rest of the classrooms, we fixed the mentioned parameters at 20; For the indegree-popularity, outdegree-activity, and reciprocal-degree activity we use the squared version effects; OR: Odds ratio

Cross-network effects. In both high- and low-ability classrooms, academic nominations led to friendships nominations (*academic to friendship* Est. $_{high} = 1.26$, $p_{high} < .001$, OR = 3.53; Est. $_{low} = 1.28$, $p_{low} = .01$, OR = 3.59). Furthermore, no significant differences were found comparing both types of classrooms for academic nominations leading to friendship nominations ($z = -0.03$, $p = .51$), not supporting the first part of our third hypothesis (*hypothesis 3a*). Finally, as expected, friendship nominations led to academic nominations in both high- and low-ability classrooms (*friendship to academic* Est. $_{high} = 0.90$, $p_{high} < .001$, OR = 2.46; Est. $_{low} = 0.82$, $p_{low} < .001$, OR = 2.27). No significant differences were found between the two types of classrooms ($z = 0.25$, $p = .40$), consistent with the second part of our third hypothesis (*hypothesis 3b*).

2.4 Discussion

The aim of this paper was to examine the association between friendship and academic networks, and their connection with academic performance and school misconduct across three types of classroom ability compositions (high-, low-, and mixed-ability classrooms). To our knowledge, this study is the first in which the combination of friendship and academics relationships was examined using a short-term longitudinal social network analysis. Building on previous studies, we advanced current knowledge by examining the effect of academic performance and school misconduct on academic and friendship networks comparing classrooms with different types of ability composition. Three main conclusions can be drawn from the results.

First, the results indicated the existence of significant differences in the formation and maintenance of academic networks with peers between high- and low-ability classrooms. Academic nominations in high-ability classrooms were driven partially by a preference to form and maintain relationships with higher-performing students as well as by a preference to avoid academic relationships with students who were engaged in school misconduct. Academic nominations in low-ability classrooms, however, were driven by neither academic performance nor school misconduct. Together, these results partially align with the differentiation-polarization theory, suggesting that in high-ability classrooms an academically-oriented culture exists, whereas in low-ability classrooms an anti-school culture dominates (Berends, 1995; Hargreaves, 1967; Van Houtte, 2006). In high-ability classrooms, academic performance appears to be a desirable attribute for being nominated as an academic partner. These findings are in line with previous social network studies in educational settings that indicate that students with higher academic performance are asked for advice on course-related matters by a large number of classmates (Snijders et al., 2013). On the contrary, school misconduct seems to be detrimental to receiving academic nominations. This supports the idea that risk and deviant behavior (e.g., school misconduct) are negatively associated with academic performance (Hinshaw, 1992; McEvoy & Welker, 2000). The association between academic performance and school misconduct seems to be important in defining the formation and maintenance of academic and friendship networks because both behaviors affect adolescents' attraction to and avoidance of certain peers. For example, a study in Dutch secondary education showed that seventh graders who drank alcohol were more likely to select low-achieving peers as friends, whereas students who did not drink alcohol were more likely to choose high-achieving peers as friends (Gremmen et al., 2018).

Second, we found similarities in the link between academic and friendship relationships comparing high- and low-ability classrooms. As expected, friends tended to study together in both high- and low-ability classrooms. Unexpectedly, we did not find that academic partners form or maintain friendships more often in high-ability than in low-ability classrooms. Academic

relationships, however, often take place outside the school, for instance, when doing homework and preparing for exams. Therefore, asking students with whom they study at school might underestimate these interactions. Future studies should incorporate this consideration to gain better knowledge about academic relationships.

Together, the results of this paper are relevant to enhance educational policies. Regarding school practices, results show how ability grouping can affect peer relations, a key aspect of any educational management (Leithwood et al., 2004). For this reason, principals should know and consider the importance of ability grouping strategies in affecting academic and friendship networks. Regarding teaching, the results show the need for teachers to consider academic and friendship relationships as learning resources that can promote the development of equitable social networks (Hamre et al., 2013), where all children interact daily with classmates with different academic performance. Moreover, the overlap between academic and friendship relationships suggest that the modification of one type of network may affect the other type of relationships.

2.4.1 Limitations and future directions

This study has some limitations to be acknowledged. The sample is relatively small and comes from a specific group of schools. The effective-inclusive schools combine school effectiveness and inclusion (Intxausti et al., 2017), showing in general better performance on standardized tests and higher levels of inclusion in terms of academic achievement in comparison to schools with similar socioeconomic backgrounds. Therefore, it is likely that the differences between high- and low-ability classrooms found in this study will be stronger in schools with lower levels of academic performance and inclusion. Future studies could replicate these hypotheses in schools with different levels of academic orientation and inclusion.

Moreover, future studies on academic networks can also analyze the role of factors such as the meeting opportunities via the seating arrangement in the classroom as well as other school-related factors such as school engagement and truancy (Gremmen, van den Berg, Segers, & Cillessen, 2016). Finally, in this study, we assumed that different ability classrooms reflect different norms of schoolwork. However, we did not directly measure the level of academic norms present in the different types of classrooms. Therefore, future studies could examine this aspect through peer norms, which reflect the expected and accepted behavior in social groups and how this might impact peer relations (Dijkstra & Gest, 2015).

Despite these limitations, featuring a sample of students from secondary education in an understudied context constitutes a clear strength of this study. Evidence from previous studies in ability grouping mainly comes from students in the United States or Europe. Furthermore, we took advantage of multiplex longitudinal social network analysis to model academic and friendship networks simultaneously.

Overall, this study contributes to the literature by testing the effects of academic performance and school misconduct on academic and friendship networks in classrooms with different types of ability composition. We found that only in high-ability classrooms did students choose high-achieving peers as academic partners and avoid choosing peers who engaged in school misconduct as academic partners. Furthermore, in both high- and low-ability classrooms, academic relationships led to friendship relationships, and vice versa. This study, thus, opens a promising research area that links school practices with adolescent peer relationships.

Appendixes

Appendix 2.A

Schools information

Table 2.A Schools information

School number	N° classrooms	First grade	School type	Region	SES
1	2	8°	Public	Metropolitan	Middle
2	5	9°	Public	Coquimbo	Low
3	2	8°	Private subsidized	Metropolitan	Lower-middle
4	2	8°	Private subsidized	Metropolitan	Middle
5	8	9°	Public	O'Higgins	Low
6	5	9°	Public	Maule	Lower-middle
7	5	8°	Public	Coquimbo	Lower-middle
8	3	9°	Private subsidized	Metropolitan	Lower-middle
9	3	7°	Public	Metropolitan	Middle

Notes. First grade: First grade of education offered by the school; SES: The school vulnerability index measured the percentage of students in a school that is considered vulnerable based on family income, medical needs, birth weight, and residential conditions; The Chilean school system includes three types of schools: public, private subsidized, and private.

Appendix 2.B
Sample Information

The participating schools were selected according to their trajectories of school effectiveness and educational inclusion between 2010 and 2015. Regarding school effectiveness, schools were selected when the progress of the majority of the students was better than expected, given the socioeconomic conditions of the families (Hopkins & Reynolds, 2001; Mitchell et al., 2002). Selected schools showed a higher average in the Chilean national standardized tests (SIMCE) in Mathematics and Language in 4th and 10th grade, compared to schools with a similar socioeconomic level. Moreover, the selected schools did not apply selection processes for enrolling students and exhibited lower rates of repetition and dropout. Regarding educational inclusion, this was measured through schools' ability to close learning gaps, understanding that schools that reduce differences in academic outcomes among their students are closer to offering more equitable learning opportunities (Breen & Jonsson, 2005). Specifically, we chose schools that decreased their variance in both SIMCE standardized tests (Mathematics and Language) and Grade Point Average (GPA) throughout the secondary education cycle (from 9th to 12th grade in Chile).

Appendix 2.C
Non-selected classroom networks

Table 2.C Descriptive information about the non-selected classroom networks for time 1 and 2

Class	Grade	Type	Size	Girls %	SES	Acad		Miss		Dist		Jac		AvD		AvD		Jn	Lv
						Perf	Misc	t1	t2	AC	FR	AC	FR	AC t1	AC t2	FR t1	FR t2		
1	7°	M	42	48.78	3.07	5.76	5.00	.21	.00	.74	102	.26	.32	2.77	3.42	5.58	9.52	8	2
2	8°	M	67	50.98	3.88	5.84	2.74	.04	.04	.64	89	.05	.11	2.56	2.40	6.70	6.24	21	22
3	8°	M	69	56.14	3.02	5.52	4.79	.09	.00	.3	2	.00	.00	1.59	2.30	6.17	3.69	29	34
4	8°	M	38	5.40	2.86	5.21	4.73	.06	.15	.39	60	.03	.12	1.43	2.34	9.30	8.90	7	9
5	8°	M	38	0.00	3.30	5.12	4.73	.25	.04	.47	84	.20	.25	2.44	2.91	9.01	9.48	4	7
6	9°	M	52	54.83	2.68	5.61	4.44	.21	.10	.43	62	.15	.16	3.90	2.17	5.20	4.40	15	19
7	9°	M	43	46.42	2.82	5.86	3.79	.23	.12	.60	50	.23	.31	2.63	2.81	5.66	4.69	7	14
8	9°	M	40	44.82	2.45	5.33	3.28	.21	.06	.46	76	.20	.18	2.62	2.27	5.46	4.42	5	13
9	9°	M	45	58.62	2.50	5.42	3.92	.21	.02	.47	66	.15	.16	2.22	1.86	5.19	3.71	9	19
10	9°	M	55	100	3.29	5.22	6.41	.16	.03	1.00	167	.17	.18	2.35	3.06	5.28	4.30	8	17
11	9°	M	49	97.61	3.60	5.83	2.42	.22	.08	.92	92	.40	.50	4.21	3.84	6.27	5.74	1	7
12	9°	L	34	30.76	1.96	5.05	5.67	.33	.02	.23	70	.11	.19	1.68	1.59	6.52	8.36	6	8
13	9°	L	56	32.25	2.21	5.20	6.47	.31	.07	.11	24	.00	.04	.80	1.08	2.23	3.27	18	25
14	9°	L	50	58.06	2.69	4.86	4.46	.20	.05	.12	15	.02	.07	1.20	1.59	2.15	3.86	18	20
15	9°	L	44	100	1.76	5.15	5.73	.42	.10	.88	41	.14	.13	2.37	6.47	3.20	6.47	8	11
Av/Tot.	-	-	722	45.71	2.80	5.40	4.57	.21	.06	49.93	66.67	.14	.18	2.32	2.67	5.59	5.80	164	227

Notes. Type of class (M: Mixed-ability classes; H: High-ability classes; L: Low-ability classes); SES: Average of socio-economic background; Acad Perf: Academic performance; Acad Misc: Academic misconduct; Miss: % of missing data; Dist.: Hamming distance; Jac: Jaccard index; AvD: Average degree; Jn: Number of students who joined the study between assessments; Lv: Number of students who left the study between assessments

Appendix 2.D

Distribution difference among the three types of classrooms

First, we conducted three Shapiro-Wilk tests in R to examine whether each sample comes from a normally distributed population. We compared the academic performance (general GPA) of the students from each type of classroom at the first assessment, finding that the three samples (referring to high-, low-, and mixed-ability classrooms) were not normally distributed ($W_{\text{high}} = 0.95$, $p_{\text{high}} < .001$; $W_{\text{low}} = 0.96$, $p_{\text{low}} < .001$; $W_{\text{mixed}} = 0.97$, $p_{\text{mixed}} < .001$).

Second, we tested whether the samples of students from each type of classrooms come from distinct populations. Using the Mann-Whitney-Wilcoxon Test in R, we found that high-, low-, and mixed-ability classrooms come from different populations ($W_{\text{high-low}} = 38,917$, $p_{\text{high-low}} < .001$; $W_{\text{high-mixed}} = 53,266$, $p_{\text{high-mixed}} < .001$; $W_{\text{low-mixed}} = 54,424$, $p_{\text{low-mixed}} < .001$).

Appendix 2.E
Goodness of fit

Once convergence was reached for all three models, we assessed the goodness of fit of the models by examining the extent to which the models explained additional features of the academic and friendship networks that were not explicitly included in the model specification. Specifically, we examined the distribution of academic and friendship outdegree, indegree, geodesic distance, and triad census. The goodness of fit was assessed by comparing the Mahalanobis distance of the observations to the mean of the simulated values and computing the associated p -value (for more details, see Ripley et al., 2018). To combine the results for the multiple classrooms we use the inverse normal method (for more details see Hedges & Olkin, 1985). For the four statistics, the vast majority of the combined p -values for each type of classroom were between .10 and .90, indicating a good fit. The only cases of unsatisfactory fit were the triad census for friendship networks in high- and mixed-ability classrooms, as well as the triad census for academic networks in high-ability classrooms, and the outdegree distribution for academic networks in mixed-ability classrooms. For the triadic census cases, the triadic configuration with the poorest fit was the 021U ($i \rightarrow b; j \rightarrow b$), which number was underestimated for the model. In the case of the outdegree distribution for academic networks in mixed-ability classrooms, the number of students with none outgoing academic nominations was also underestimated.



Examining the role of academic performance, prosocial behavior and friendships on adolescents' preferred studying partners

This chapter is based on:

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3.1 Introduction

Academic behavior in adolescence is a key determinant for future educational chances and career opportunities (Crosnoe & Benner, 2015). Whereas some students work on their assignments, get good grades, and attend school regularly, others skip school and exhibit school misconduct and low effort in school work (Bissell-Havran & Loken, 2009; Demanet & Van Houtte, 2012). Academic behavior is strongly influenced by the social relations in which it is embedded. For example, in dealing with academic tasks, adolescents not only rely on their own problem-solving skills but also seek help and assistance from others (Van Rijsewijk, Oldenburg, Snijders, Dijkstra, & Veenstra, 2018).

Starting in early adolescence, peers take up a central role as sources of help (del Valle et al., 2010). As adolescents spend a significant amount of time with each other (Altermatt & Pomerantz, 2003), peers constitute an important developmental context for adolescent academic behavior (Rodkin & Ryan, 2012), providing support and resources to either promoting or discouraging attitudes and behaviors that contribute to school success, such as school involvement, motivation, and disruptive behavior in class (Kindermann, 2007; Molloy et al., 2011). Because of their proximity and direct interaction with classmates, peers have a unique perspective on classmates' academic behavior, observing, for example, their grades and the speed and ease (or difficulty) with which classmates perform in their assignments, invest effort on tasks, and give or receive help. Students often turn to their peers for help when facing challenges or difficulties (Ryan & Shin, 2011) as they provide valuable academic and social support (Altermatt, 2007).

The literature on academic behavior has often ignored more specific academic relationships, such as studying together or academic helping networks. Previous studies have mostly focused on the role of friendships on academic behavior indicating that adolescents select friends based on similarity in academic achievement as well as that friends become more similar over time regarding academic achievement (Flashman, 2012; Gremmen, Dijkstra, Steglich, & Veenstra, 2017; Rambaran et al., 2017). Only recently, studies have investigated the interplay of studying and friendship networks (Gremmen et al., 2018; Palacios et al., 2019; Stadtfeld, Vörös, Elmer, Boda, & Raabe, 2019), suggesting that not only friendship but also studying networks can impact academic behavior by affecting students' learning interactions. However, this effect might vary depending on the access to academic help and resources and its diversity, for instance, being helped by a few or many classmates or by a specific group of peers (e.g., high-achievers). Indeed, students tend to perform academically better when they have a large number of helpers (Cadima et al., 2012), or if they 'hang out' with multiple peer groups (Nichols & White, 2001).

However, which characteristics are associated with being chosen as a preferred study partner over and above academic performance's similarity remains unknown. This study contributes to filling this gap by analyzing the extent to which adolescents' selection of preferred academic partners (*with whom would you like to study*) is driven by peers' academic performance, prosocial behavior, and friendships. Moreover, as high-achieving students would play an important role in academic settings, we analyze whether they are more likely to prefer to study with similar high-achieving peers and friends. To test these hypotheses, we used longitudinal social network analyses, that is, the stochastic actor-oriented models (Snijders, van de Bunt, & Steglich, 2010).

3.1.1 Characteristics of preferred study partners

Different motivations can be found behind individual decisions for selecting preferred studying partners. To advance personal interests such as academic success, adolescents may select studying

partners whose help they think will be useful (Larson et al., 2012; Sullivan et al., 2002). As a result, the behaviors and characteristics of others are evaluated in light of their contribution to the adolescents' goals. Hence, some adolescents might form relations that are useful for their educational success by preferring to study with high-achieving peers. These peers can provide resources that help adolescents boost or uphold their academic achievement (Dieterich, 2015) by, for example, helping them in gathering new information (Dokuka et al., 2015). As a result, high-achieving students tend to be more often selected as friends and preferred seat neighbors than other peers (Gremmen, van den Berg, Segers, & Cillessen, 2016; Laninga-Wijnen et al., 2017). Accordingly, we expected that adolescents would be more likely to nominate high-achievers as preferred academic partners (*hypothesis 1*).

However, although asking for academic help may intensify positive interpersonal contact with peers, at the same time, it might pose a threat to one's self-image (Ackerman & Kenrick, 2008) by showing one's weaknesses or the risk of being refused. As a consequence, adolescents might prefer to study with more approachable and friendly classmates, such as prosocial peers or friends. Prosocial behavior has been shown to impact individual social adjustment and academic achievement in children and early adolescents (Caprara et al., 2000; Chen et al., 2008). Adolescents tend to bond with prosocial peers in academic activities as the latter may produce enduring school environments that are conducive to academic learning. More broadly, prosocial adolescents tend to exhibit better peer relationships compared with their less prosocial peers (Eisenberg et al., 2006), as well as a high sense of belonging to the community (Young & Glasgow, 1998) and civic engagement (Luengo Kanacri et al., 2014).

Furthermore, aspects of prosocial behavior such as cooperativeness, helpfulness, sharing, willingness to help others, and being empathic are likely to promote positive and supportive academic interactions (Dijkstra, Lindenberg, & Veenstra, 2007; Gifford-Smith & Brownell, 2003). Consequently, we expected that adolescents would be more likely to nominate prosocial peers as preferred academic partners (*hypothesis 2*).

Adolescents also often turn to their friends for academic help and assistance (Azmitia et al., 2009). As friends experience similar challenges and care about each other's well-being (Buhrmester & Prager, 1995), friends are uniquely positioned to serve as academic resources. Increased communication and interaction among friends provide opportunities to learn and model a range of behaviors, including academic strategies and skills. Friends may provide adolescents with support and confidence facilitating school involvement (Berndt & Keefe, 1995). Moreover, friendship characteristics such as security and intimacy (Newcomb & Bagwell, 1995) create an environment in which help can be easily provided without fearing social repercussions (Hiatt et al., 2015).

Finally, due to the affection felt for friends, the time and effort invested in helping relationships such as studying together may be perceived as less costly and tiring (McGuire, 2003). Accordingly, we expected that adolescents would be more likely to nominate friends as preferred academic partners (*hypothesis 3*).

3.1.2 High achieving peers' choices in preferred study partners

High-achieving adolescents might be motivated to seek out similarly high-achieving peers to take advantage of their knowledge and abilities to help further their own academic success (Laninga-Wijnen et al., 2017). According to homophily theory, individuals prefer to befriend similar peers because, on average, those who are similar in behaviors, characteristics, and attitudes understand

each other better (McPherson et al., 2001). Befriending similar peers increase trustworthiness and predictability by enabling individuals to communicate with less effort and to share feelings of understanding (Byrne, 1971). As a result, relationships between similar people tend to be more rewarding, stable, with less conflict as well as a source of validation for development and reinforcement of social identity (Hallinan, 1980; Veenstra et al., 2013). As high-achieving students would share their focus and interest on academic success as well as exchange their academic knowledge and abilities to help their peers, we expected that high-achievers would be more likely to nominate other high-achievers as preferred academic partners (*hypothesis 4*).

Moreover, adolescents with high academic performance might be inclined to study with friends as they have already attained academic success. As a result, they can focus on attaining other social goals, such as having fun or establish intimate relationships. Consequently, we expected that high-achievers would be more likely to nominate friends as preferred academic partners (*hypothesis 5*). Furthermore, adolescents' preference to study with friends is likely to be associated with their academic performance. Adolescents might be inclined to prefer to study with high-achieving friends as the latter offer not only academic help but also intimate and close relationships. Friendships with high-achieving peers may produce benefits for academic achievement by motivating improvements in academic standards and performance, and by providing models for how to complete challenging academic tasks (Altermatt & Pomerantz, 2005; Gibbons et al., 2000). Accordingly, we expected that adolescents would be more likely to nominate high-achieving *friends* as preferred academic partners (*hypothesis 6*).

3.1.3 Present study

We aimed to assess whether the adolescents' selection of preferred academic partners is driven by peers' academic performance, prosocial behavior, and friendships. Moreover, we examined whether friends are more likely to prefer to study with one another when one of them is a high academic achiever. The present study provides insights into which characteristics are associated with preferred academic partners. We expected that adolescents would choose high-achievers (*hypothesis 1*), prosocial peers (*hypothesis 2*), and friends (*hypothesis 3*) as preferred academic partners. In addition, we expected that high-achievers would also choose high-achievers as preferred academic partners (*hypothesis 4*). Finally, we expected that preference to study with friends would be higher for adolescents who themselves or their friends exhibit higher academic performance (*hypothesis 5* and *hypothesis 6*, respectively). We examined our hypotheses using longitudinal social network analysis implemented in RSiena (Snijders et al., 2010), also controlling for students' socioeconomic status and sex as both variables are related to academic behavior (Crosnoe & Benner, 2015; Kretschmer et al., 2018; Sirin, 2005).

3.2 Method

3.2.1 Sample

We use data from the PROCIVICO-project, an intervention study aimed at increasing prosocial behavior and civic engagement among seventh-grade adolescents (for details see also Luengo Kanacri & Jiménez-Moya, 2017; Luengo Kanacri et al., 2019). The intervention is centered around the idea that prosocial behavior, as an exercise of active citizenship, can be taught and developed through appropriate formative experiences. Schools were randomly assigned to the intervention (nine classrooms from four schools) and control (seven classrooms from four schools) condition.

The intervention ran from May until November 2017. Assessments took place three times over the course of the study (April, November 2017, and May 2018).

To discard any effect of the intervention on the results, we conducted supplementary analyses comparing control and intervention classes. No significant differences were found regarding any variable related to the hypotheses of the study (see details in Appendix 3.A).

3.2.2 Procedure

During the survey, participants answered the questionnaires individually during regular school hours, while research assistants assisted participants when needed. Children were assured that their answers would be kept confidential and that they could stop participating at any time. The Institutional Review Board of the local university approved all the instruments and procedures to protect the confidentiality and rights of participants. Parental active consent and adolescents' assent were obtained for all participants included in the study.

3.2.3 Participants

The data were composed of 659 seventh graders from Santiago (Chile) from 16 classes ($M_{\text{age}}=12.3$; $SD=0.2$, 48% girls) from eight publicly and privately subsidized schools. According to the Chilean Ministry of Education, these schools are categorized as middle-low to middle socioeconomic status schools. The average classroom size was 41 students ($SD=8.1$). Three classes were excluded from the analyses. First, an only-boy class was excluded because processes regarding aggression and social norms may unfold differently in single-sex classes (Johnson & Gastic, 2014). Two classes were excluded because of high levels of missing data (above 20%). The final sample contained 537 students from 13 classes over three waves ($M_{\text{age}t1} = 12.3$; $SD_{\text{age}}= 0.2$, 52% girls). This study included both intervention and control classes in the analyses.

3.2.4 Measures

Academic preference networks (T1–T2–T3). Participants were to check on a roster and nominate up to three classmates who best fit the descriptor *with whom you would like to study*. Adjacency matrices were created for each classroom on each assessment, representing the different networks with nominations coded as 1 and non-nominations coded as 0.

Friendships (T1–T2). Participants were asked to check on a roster and nominate up to three classmates who best fit the descriptor *with whom do you hang out at school during recess* (Espelage, Holt, & Henkel, 2003; Schacter, White, Chang, & Juvonen, 2014).

Academic performance (T1–T2). Participant schools provided the general grade point average (GPA). The grades on Mathematics, Spanish, Sciences, History, and English were averaged as a composite measure of academic achievement. The Chilean grading scale ranges from 1 (poor) to 7 (excellent). GPA as a measure of academic performance has been widely used in the literature about peer selection processes (e.g., Flashman, 2012; Rambaran et al., 2017).

Prosocial behavior (T1–T2). Participants rated the frequency with which each of their classmates *helps those students in need* (from 1 = almost never to 5 = almost always). All the scores reported by all classmates about each student were aggregated, resulting in an individual score.

Socioeconomic status. SES was measured by parents' educational level, that is, their highest obtained educational degree. Parents' educational level was measured on a six-point scale, ranging from low (primary school) to high (obtained a postgraduate degree). Parents' educational level has

been suggested as the most reliable single indicator to evaluate the family's SES (Alexander et al., 1988).

Sex. Participants were asked about their sex, which was coded 0 for boys and 1 for girls.

3.2.5 Analytical strategy

Analyses were conducted using longitudinal multiplex social network models implemented in RSiena ('Simulation Investigation for Empirical Network Analysis'), which allows unraveling the development of academic networks over time (Ripley et al., 2018) while taking into account students' individual covariates (academic performance, prosocial behavior, socioeconomic status, and sex). RSiena models are actor-based models (Snijders et al., 2010), which assume that between assessments, actors (e.g., students) modify their relationships (e.g., academics relationships) based on their individual preferences.

At a given moment, students may change a friendship tie (i.e., creating a new tie, dropping one existing tie, or keeping the relationship unchanged) in response to the current state of the network structure and the attribute scores of both the actors and other students (see Ripley et al., 2018). The estimates of the model are obtained through an iterative simulation following a Markov Chain approach (Snijders et al., 2010), expressing the strength of the effects included in the model. These unstandardized estimates resemble regression coefficients in (logistic) regression indicating the importance of each effect (predictor variables) in creating or maintaining a tie.

Two models were estimated for testing the six hypotheses. Model 1 examined the hypotheses regarding the characteristics associated with preferred academic partners (*hypotheses 1 to 3*) as well as the preference of high-achievers to choose other higher-achievers as academic partners (*hypothesis 4*). Model 2 tested the two last hypotheses regarding the interaction between academic performance and friendship (*hypotheses 5 and 6*). The two models were estimated for each classroom separately using the Methods of Moments estimator and specifying 5000 iterations in phase 3 for calculating standard errors. The results of individual classes were combined in a meta-analysis using the Snijders-Baerveldt test (Snijders & Baerveldt, 2003), which makes inferences about parameters in the population of classes (from which the participant classes are considered to be a sample). The meta-analysis combined the analyzed parameter estimates across classrooms by testing the mean and variance of parameter values among classrooms.

To facilitate the interpretation of the results, we calculated the odds ratio of the parameter estimates. For instance, the odds ratio of 2 for reciprocity indicates that a participant is twice as likely to reciprocate a friendship than not to reciprocate, all else being equal. However, this assumption is strong, as parameters might correlate and co-occur. Therefore, the odds ratio (OR) reported in Table 3.3 should be interpreted with caution.

Missing data because of non-response were handled through the RSiena default missing data method (Ripley et al., 2018). Participants who joined and left the classroom network in-between time points were replaced by structural zeros, which specified the incoming and outgoing nominations at the moment that they were not present in the study. All models showed a good convergence of the algorithm (with overall maximum convergence ratios smaller than .15 for each model), and overall satisfactory goodness of fit (see details in Appendix 3.B).

3.2.6 Model specification and effect interpretation

Structural network effects were included to capture the basic tendencies of actors to form and maintain academic preference relationships. *Density* describes the tendency of actors to establish

relationships. *Reciprocity* is the tendency to reciprocate relationships (referring to forming mutual ties). The *transitive triplets* effect was included to measure the tendency of adolescents to prefer academic partners who also are chosen by their preferred academic partners (*transitivity*). The *indegree-popularity* and *outdegree-popularity* effects were included to represent the tendency of actors who already receive many nominations to receive more nominations over time and the tendency of actors to send who send many nominations to receive more nominations over time, respectively. Additionally, as some classes showed time heterogeneity (when parameters in the model are not constant in time), we added dummy variables for density and reciprocity representing that the formation and maintenance of ties might be different in period 2 (this period coincides with the summer break and the beginning of a new school year in Chile).

Regarding actor attributes, *ego*, *alter*, and *ego-alter* effects were included for academic performance and prosocial behavior. The *ego* and *alter* effects indicate that actors with higher scores on the covariate give and receive more nominations. The interaction *ego* \times *alter* indicates that actors with a higher value on the covariate prefer ties to others who also have a relatively high value on the covariate. *Friendship* was included in the model as a changing dyadic covariate (exogeneous network variable) to measure the effect of friendships on academic preference nominations (i.e., whether friends are chosen as preferred academic partners). Additionally, socioeconomic status and sex were included as control variables, by including the selection effects for the *same* sex and the *similarity* in socioeconomic status.

3.3 Results

3.3.1 Descriptive analysis

Academic preference networks. Table 3.1 presents a description of academic preference networks and longitudinal transitions between the three waves. The Jaccard index indicated moderate stability in academic preference ties between time points (around .25 in the first period and .22 in the second period). The highest turnover in academic preference ties occurred between waves 2 and 3, which corresponded with a summer break and the beginning of a new school year in Chile. Although the Jaccard index was relatively low in the present study, this had no consequences for the analyses, as all models showed good convergence statistics (below .25). Regarding the patterns of change in academic preference ties, a large proportion corresponds to dissolved and created ties and a smaller proportion to maintained ties. The average number of academic preference nominations was 2.52 in the first and second wave ($SD_{T1} = 0.36$; $SD_{T2} = 0.40$), decreasing to 2.32 in the third wave ($SD_{T3} = 0.35$).

Covariates. Table 3.2 presents descriptive information about covariates. At the first wave, the average educational level of the parents was 2.37 ($SD=1.02$), indicating that most parents completed a high-school education. Overall, academic performance, friendships, and prosocial behavior were stable across waves 1 and 2. On average, the academic performance of the students for the first wave was 5.02 ($SD=0.65$) and 5.13 for the second wave ($SD=0.61$), which is considered good in the Chilean grading system (between 5 and 5.9). The average prosocial behavior was 2.81 ($SD=1.12$) in the first wave and 2.89 in the second wave ($SD=1.08$), revealing that, on average, students sometimes *help those classmates in need*. Finally, the number of friendship nominations was 2.51 in the first and second wave ($SD_{T1} = 0.35$; $SD_{T2} = 0.37$).

Table 3.1 Description of academic preference networks per time point and periods

Class	Jaccard index		Hamming distance		Academic preference Av. Degree			Academic preference changes T1→T2			Academic preference changes T2→T3		
	T1-T2	T2-T3	T1-T2	T2-T3	T1	T2	T3	0→1	1→0	1→1	0→1	1→0	1→1
1A	.22	.19	116	145	2.47	2.82	2.90	76	58	38	77	75	35
1B	.25	.24	112	103	2.24	2.66	2.41	77	58	46	66	80	46
2B	.39	.31	60	46	2.88	2.77	2.20	34	34	44	30	45	33
2C	.30	.30	59	44	2.64	2.39	2.02	31	31	26	27	30	24
4A	.27	.20	92	88	2.75	2.73	2.46	52	53	38	55	64	29
4B	.21	.21	108	95	2.88	2.79	2.41	59	62	33	52	62	30
4C	.21	.24	98	86	2.71	2.77	2.32	53	51	33	41	55	31
5A	.20	.19	124	105	2.55	2.63	2.34	68	65	33	54	71	30
6B	.36	.33	90	77	2.99	3.00	2.40	45	45	51	39	49	44
7A	.27	.24	98	91	2.30	2.29	2.28	55	55	41	53	61	35
7B	.19	.16	128	107	2.60	2.37	2.39	71	81	36	80	77	30
7C	.23	.17	90	83	2.13	1.78	2.25	48	59	31	69	54	25
8A	.18	.11	64	80	1.67	1.72	1.82	48	47	22	53	56	14
Av.	.25	.22	95.3	88.5	2.52	2.52	2.32	55.2	53.8	36.3	53.5	59.9	31.2

Notes. Jaccard index refers to tie stability between observations; Hamming distance is the number of tie changes between observations; 0→1: Number of created ties; 1→0: Number of dissolved ties; 1→1: Number of maintained ties

3.3.2 Longitudinal social network analyses

Table 3.3 presents the results of the RSiena meta-analyses for the academic preference networks. The estimates and standard errors are based on the models estimated separately for the 13 classes, which were combined in a meta-analysis (Snijders & Baerveldt, 2003). We also reported the standard deviation of parameter estimates across classes (σ), and whether the standard deviation significantly differed from zero. Results on almost all the effects are very similar in Model 1 and Model 2. We reported in the text all the results of Model 1, except for the two interaction effects related to *hypotheses 5* and *6* (see Model 2 in Table 3.3).

A significant negative effect for the *density* was found (Est. = -1.15, $p < .001$, OR = 0.32), indicating that students were selective choosing preferred academic partners. Moreover, adolescents tended to reciprocate academic preference relations (Est. = 0.86, $p < .001$, OR = 2.35) and were likely to form triadic structures in which adolescents prefer academic partners who also are chosen by their academic partners (Est. = 0.29, $p < .001$, OR = 1.33). Students who send many academic preference nominations tended to receive fewer nominations over time (Est. = -0.19, $p < .001$, OR = 0.83). Furthermore, a significant *indegree-popularity* was found (Est. = 0.05, $p < .001$, OR = 1.05), indicating a tendency of students who already receive many nominations to receive more academic preference nominations over time. Also, adolescents selected same-gender peers as preferred academic partners (Est. = 0.40, $p < .001$, OR = 1.50). We found no tendency to nominate classmates with similar socioeconomic status as preferred academic partners (Est. = -0.03, $p = .84$, OR = 0.98).

Table 3.2 Descriptive of covariates for each class

Class	Type	N	% girls	SES				Friendship AvD		Academic Performance		Prosocial behavior	
				T1	T1	T2	T3	T1	T2	T1	T2	T1	T2
1A	INT	47	.44	3.00	.15	.14	.18	2.49	2.82	4.80	4.99	3.40	3.35
1B	INT	50	.49	2.98	.07	.05	.07	2.24	2.66	4.88	5.08	3.57	3.46
2B	INT	30	.50	1.60	.10	.06	.00	2.73	2.70	5.00	5.21	2.64	2.67
2C	INT	29	.48	1.54	.26	.18	.13	2.46	2.35	4.90	5.16	2.82	2.78
4A	INT	35	.47	2.10	.06	.03	.02	2.66	2.73	5.11	5.01	3.35	3.29
4B	INT	34	.50	2.45	.00	.05	.00	2.85	2.83	4.56	4.81	3.22	3.30
4C	INT	31	.39	2.24	.00	.00	.00	2.90	2.74	4.84	5.04	2.65	2.90
5A	CON	43	.58	2.26	.11	.11	.16	2.60	2.57	5.04	4.96	3.43	3.36
6B	CON	39	.68	2.91	.18	.18	.11	2.99	3.00	5.16	5.28	3.33	3.31
7A	CON	50	.50	2.12	.14	.14	.18	2.26	2.30	5.36	5.31	3.00	3.16
7B	CON	47	.38	1.88	.04	.04	.02	2.62	2.26	5.41	5.34	3.02	2.91
7C	CON	51	.64	2.50	.17	.13	.18	2.13	1.89	5.31	5.45	3.06	3.19
8A	CON	51	.68	2.33	.19	.20	.18	1.72	1.79	4.89	5.13	2.85	3.15
Av.	-	41.3	.52	2.30	.10	.13	.14	2.51	2.51	5.02	5.14	3.10	3.14

Notes. Type: Type of class (INT: Intervention class; CON: Control class); Friendship AvD: Friendship network average degree

We found significant *academic performance ego* and *alter* effects, indicating that students with higher academic performance sent fewer nominations (Est. = -0.17, $p < .001$, OR = 0.85) but received more nominations (Est. = 0.46, $p < .001$, OR = 1.58). The latter result is consistent with *hypothesis 1*, which is that high achieving peers are more likely to be chosen as study partners. Also, as expected, high-achievers tended to nominate other high-achievers as preferred academic partners (Est. = 0.17, $p = .01$, OR = 1.19) (*hypothesis 4*).

Regarding prosocial behavior, the findings were in line with *hypothesis 2*: prosocial peers were more nominated as preferred academic partners (Est. = 0.26, $p < .001$, OR = 1.29). No significant effects were found regarding prosocial peers nominating more classmates or other prosocial peers as preferred academic partners (Est. = -0.07, $p = .16$, OR = 0.93; Est. = 0.16, $p = .25$, OR = 1.18, respectively). Further, adolescents tended to choose friends as preferred academic partners (Est. = 0.33, $p < .001$, OR = 1.39), consistent with *hypothesis 3*.

Finally, we tested the interaction of students' academic performance and friendship in predicting academic preference relationships (Model 2 in Table 3.3). As expected, and conform *hypothesis 5*, we found that the effect of adolescents' selecting friends as academic partners was increased when those adolescents were high-achievers (Est. = 0.18, $p = .04$, OR = 1.19). However, there was no evidence that the effect of selecting friends as academic partners changed when those friends were high-achievers (Est. = -0.03, $p = .60$, OR = 0.97), not supporting *hypothesis 6*.

Table 3.3 Rsiena meta-analysis on academic preference networks (13 classes)

Effect	Est.	SE	σ	OR	Est.	SE	σ	OR	
Academic pref. networks		Model 1				Model 2			
Density	-1.15***	0.23	0.63**	0.32	-0.98***	0.27	0.74**	0.38	
Reciprocity	0.86***	0.08	0.00	2.35	0.82***	0.08	0.00	2.28	
Transitivity	0.29***	0.04	0.11*	1.33	0.28***	0.04	0.10*	1.33	
Indegree-popularity	0.05**	0.02	0.04**	1.05	0.05**	0.02	0.04**	1.05	
Outdegree-popularity	-0.19***	0.03	0.00	0.83	-0.18***	0.03	0.00	0.84	
Same-sex	0.40***	0.08	0.23**	1.50	0.39***	0.08	0.21**	1.48	
SES similarity	-0.03	0.12	0.00	0.98	-0.01	0.12	0.00	0.99	
Ac. perf. <i>alter</i>	0.46***	0.06	0.09	1.58	0.41**	0.12	0.19	1.51	
Ac. perf. <i>ego</i>	-0.17***	0.05	0.00	0.85	-0.08	0.09	0.00	0.93	
Ac. perf. <i>ego</i> \times <i>alter</i>	0.17**	0.07	0.08	1.19	0.18*	0.07	0.11	1.19	
Prosociality <i>alter</i>	0.26***	0.07	0.13	1.29	0.26***	0.07	0.13	1.30	
Prosociality <i>ego</i>	-0.07	0.05	0.00	0.93	-0.06	0.05	0.00	0.94	
Prosociality <i>ego</i> \times <i>alter</i>	0.16	0.14	0.34*	1.18	0.15	0.14	0.34*	1.16	
Friendship	0.33**	0.11	0.33***	1.39	0.42***	0.10	0.27***	1.53	
Ac. perf. <i>alter</i> \times Friendship	-	-	-	-	-0.03	0.06	0.00	0.97	
Ac. perf. <i>ego</i> \times Friendship	-	-	-	-	0.18***	0.09	0.00	1.19	
Dummy <i>ego</i>	0.04	0.06	0.09	1.04	0.04	0.06	0.08	1.04	
Dummy reciprocity	-0.16	0.21	0.56**	0.85	-0.16	0.21	0.57**	0.85	

Notes. *p < .05; **p < .01; ***p < .001; Est.: Estimate; SE: standard error; σ : across-classrooms standard deviation; OR: odds ratio; Ac. perf: Academic performance

3.4 Discussion

Academic behavior is strongly influenced by the social relations in which it is embedded. In contrast to the characteristics of students, teachers, and parents, there has been limited attention to academic relationships in the literature. This paper examined the extent to which the selection of preferred academic partners is driven by academic performance, prosocial behavior, and friendships. We investigated academic preference networks by asking adolescents to mention classmates *with whom they would like to study*.

We tested the extent to which academic performance, prosociality, and friendships are attractive characteristics of preferred study partners. First, we expected that adolescents would be more likely to nominate high-achievers as preferred academic partners. Our findings were consistent with this hypothesis, suggesting that adolescents are likely to prefer as study partners someone whom they can learn from. Second, we also expected that adolescents would be more likely to nominate prosocial peers and friends as preferred academic partners. Our findings were in line with these two hypotheses, indicating that adolescents prefer to study with more approachable, cooperative, and befriended classmates. Regarding prosociality, these results suggest that prosocial peers are attractive as academic partners because they might promote education environments that are conducive to academic learning, and also because they are perceived as empathic and willing to help others (Dijkstra et al., 2007; Gifford-Smith & Brownell, 2003). Regarding friendships, adolescents probably select friends as academic partners, because they not

only can provide access to valuable information, knowledge, and resources (Baldwin et al., 1997), but also are the persons with whom adolescents feel secure and connected, have fun and like to spend time with, and share personal issues (Hommel et al., 2012).

Furthermore, we tested hypotheses regarding the role of high-achieving peers in selecting preferred study partners. First, and as expected, high-achieving students chose similar peers as preferred academic partners. These results align with the idea that students prefer academic partners with similar academic interests and motivation that can help them to boost or maintain their academic success. Finally, we expected that high-achievers would be more likely to nominate friends as preferred academic partners and that adolescents would be more likely to nominate high-achieving friends as preferred academic partners. We only found support for the first hypothesis, suggesting that high achievers are inclined to study with friends as they have already attained academic success but also as they do not depend on others for their academic success. Together, the evidence that high-achievers tend to prefer similar peers and friends as academic partners might be related to high-achievers being more selective in their friendship and academic interactions than low-achievers. For instance, there is evidence showing that among college students, high-achievers form close and dense groups between each other, as well as avoid interactions with their low-achieving peers, a phenomenon known as the “rich-club” (Dokuka et al., 2015; Vaquero & Cebrian, 2013).

3.4.1 Limitations and Future directions

There are some limitations in the present study that should be acknowledged. First, adolescents might pursue different goals that impact their academic relationships. For example, whereas some adolescents may aim to reach academic success, others may be more inclined to pursue intimate relationships such as friendships or increase their status. Those diverse goals are likely to affect what characteristics adolescents find attractive for preferring academic partners. Accordingly, future research should include measures regarding academics or other relevant goals (e.g., affection and status). Along the same line, the extent to which certain behaviors and relationships are valued could depend on the classroom norms (Dijkstra & Gest, 2015). For example, in competitive settings that emphasize academic success (e.g., high-ability classrooms), adolescents tend to choose high-achievers and avoid deviant peers (i.e., those high in school misconduct) as academic partners (Palacios, Dijkstra, et al., 2019). Therefore, future studies can include measures of descriptive (what adolescents actually do), injunctive (what adolescents approve), or popularity norms (what behaviors are associated with popularity) to better understand the link between academic preference relationships and social norms.

3.5 Conclusion

This paper contributes to the field of adolescents' academic behavior by being the first to examine academic preference networks and its association with academic performance, prosocial behavior, and friendships. Academic preference networks can impact academic behavior by affecting students' learning interactions in schools and their access to and diversity of academic help. We focused on the characteristics associated with being chosen as a preferred study partner as well as the preferences of high-achieving students. We found that high-achievers, prosocial peers, and friends were more nominated as preferred academic partners. Furthermore, we found that high-achievers tend to choose other high-achievers and friends as preferred academic partners. These results indicate that motivations for choosing academic partners include not only academic success

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but also studying with supportive and close classmates. This study provides insights for teachers and school administrators on the importance of academic peer interactions in the classroom context.

Appendixes

Appendix 3.A

RSiena results comparing control and intervention classes

Table 3.A RSiena meta-analysis on academic preference networks comparing control and intervention classes

Effect	Est.	SE	<i>p</i>	Est. ^a	SE	<i>p</i>
<i>Acad. preference networks</i>	Control (n=6)			Intervention (n=7)		
Density	-0.99	0.42	.02	-0.16	0.54	.77
Reciprocity	0.86	0.13	< .001	-0.01	0.16	.94
Transitivity	0.28	0.07	< .001	0.02	0.09	.83
Indegree-popularity	0.08	0.02	< .001	-0.06	0.03	.03
Outdegree-popularity	-0.22	0.05	< .001	0.06	0.07	.38
Same-sex	0.24	0.11	.03	0.31	0.15	.05
SES similarity	-0.20	0.22	.36	0.25	0.27	.34
Academic perf. <i>alter</i>	0.37	0.10	< .001	0.15	0.13	.24
Academic perf. <i>ego</i>	-0.17	0.08	.02	0.01	0.09	.91
Academic perf. <i>ego</i> × <i>alter</i>	0.16	0.12	.19	0.02	0.15	.92
Prosociality <i>alter</i>	0.34	0.11	< .001	-0.13	0.14	.35
Prosociality <i>ego</i>	-0.15	0.08	.06	0.13	0.10	.22
Prosociality <i>ego</i> × <i>alter</i>	0.47	0.16	< .001	-0.57	0.21	.01
Friendship	0.37	0.16	.02	-0.06	0.22	.77
Dummy <i>ego</i>	0.12	0.08	.12	-0.15	0.11	.15
Dummy reciprocity	-0.37	0.32	.25	0.35	0.42	.40

Notes. ^a The estimates and standard errors in this model refer to the effect of the intervention on each parameter above the average value in the control group; Est.: Estimate; SE: standard error; *p*: p-value

Appendix 3.B
Goodness of fit

The fit of the models was assessed by examining the extent to which the models explained additional features of the academic preference networks that were not explicitly included in the model specification. We evaluated the distribution of outdegrees, indegrees, geodesic distance, and triad census. For the four statistics, most p -values were between .10 and .90, indicating a good fit. Regarding the outdegree distribution, the model slightly overrepresented the number of outgoing nominations with values of one and two and underestimated the outdegrees with a value of three. The cause of these results is probably that the number of nominations was limited up to the three.



Disentangling Dyadic and Reputational Perceptions of Prosociality, Aggression, and Popularity in Explaining Friendship Networks in Early Adolescents

This chapter is based on:

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4.1 Introduction

During late childhood and adolescence, friendships play an increasingly important role in satisfying the fundamental goals of affection and status (Giordano, 2003; Johnson et al., 2011). In light of these goals, adolescents evaluate the behaviors and characteristics of others based on whether they will gain affection or status. Being perceived as prosocial, aggressive, and popular has been associated with receiving friendship nominations (Cillessen & Rose, 2005; Rodkin, Farmer, Pearl, & Van Acker, 2000). Peers' prosocial (e.g., being cooperative and kind) and aggressive (e.g., starting fights and making fun of others) behavior may give early adolescents information about the potential affection they can gain through friendships, whereas peers' popularity may offer information on the status they might gain through friendships. However, there is little research on whether adolescents rely on their own perception of a peer's behavior (*dyadic perception*) or the reputation of that peer (*reputational perception*) when selecting friends.

Most previous research examining factors that contribute to friendships have usually aggregated peer nominations (e.g., who is popular, who cooperates with others) at the group level by counting the number of nominations received by each student in the classroom (or grade), and then either standardized these scores (z -scores) or divide them by the total number of possible nominations (proportion scores). These scores reflect the agreement among peers about friendships, status, or behaviors of classmates (or schoolmates). However, individual students may not have nominated the same children as aggressive and as a friend, even in cases where researchers find a positive correlation between aggressive behavior and friendship nominations (Kiefer & Ryan, 2011; LaFontana & Cillessen, 2002). Disentangling the dyadic nominations from aggregated scores might elucidate, for example, why previous literature has consistently found that although aggressive peers are usually rejected by others (Ladd, 2006), they still have a considerable number of friends (Rodkin et al., 2000). It might be that some classmates consider aggressive peers as violent and, therefore, do not nominate them as friends. At the same time, those students who nominate aggressive peers as friends might not perceive them as aggressive. Unfortunately, analyses that focus exclusively on the aggregated level are unable to disentangle the dyadic perception from the reputational one.

We aim to tackle this issue by distinguishing between how early adolescents' own perception (*dyadic perception*), and the reputation (*reputational perception*) of a peer's behavior is related to friendships. Specifically, we are interested in disentangling (1) the effect of student i 's perception of student j 's characteristics on student i 's friendship nomination to j (e.g., How does Jenny's perception of Jim as aggressive affects her friendship nomination to Jim?), with (2) the effect of other peers' nominations of j on i 's friendship nomination to j (e.g., How does Jim's reputation of being aggressive affects Jenny in her friendship nomination to him). In this paper, we analyze the effect of dyadic and reputational perceptions of peers' prosociality, aggression, and popularity on the formation and maintenance of friendship networks. This research emphasizes the importance of understanding the characteristics attributed to befriend other peers. In this way, this study can inform researchers about the processes that underlie how children establish their social relationships.

4.1.1 Goal-framing perspective on friendship selection

The goal-framing perspective (Lindenberg, 2001; 2008), which has been successfully applied in friendship selection (Sijtsema et al., 2009, 2019; Veenstra et al., 2007), states that goals related to fundamental needs such as affection and status are particularly powerful in influencing selective

attention and evaluation. According to this theory, individuals pay close attention to what they think is instrumental in (or disturbs) the achievement of their goals. As friendships contribute to achieving both affection and status, identifying which characteristics make peers attractive as friends become crucial (Lindenberg, 1996). In this study, we focus on the effect of early adolescents' dyadic and reputational perception of peers' prosociality, aggression, and popularity on friendship formation.

4.1.2 Prosociality, aggression, friendships, and the dyadic perception

Friendships reflect personal preferences at the dyadic level, which directly links to the goal of affection. Friendships become more important as adolescents increasingly interact with each other (Newcomb & Bagwell, 1995) and are, therefore, central to fulfilling the needs for intimacy and belonging (Bukowski & Sippola, 2005). Behavioral characteristics such as prosocial and aggressive behavior might indicate the affection that a potential friendship may yield. Friendships containing at least one aggressive child are characterized by more frequent, lengthy, and intense conflicts, whereas friendships of prosocial children show positive qualities and lower conflict (Cillessen, Jiang, West, & Laszkowski, 2005). Here, we argue that early adolescents' perception of peers' prosocial and aggressive behaviors may provide valuable information about the quality of friendships with them. The perception of peers' prosocial and aggressive behavior might enable children, on the one hand, to obtain affection by establishing supportive and trustful friendships with prosocial peers, and, on the other hand, to avoid detrimental friendships by not befriending aggressive peers. Because affection is formed in dyads, we argue that children's personal (dyadic) experiences are more likely to steer the selection and maintenance of friendships rather than the reputation of their peers' prosocial behavior and aggression. Put differently, friendship selection is more likely to be driven by students' own perceptions of peers' prosocial or aggressive behavior rather than by the aggregated perception of classmates (i.e., reputation) about the same peers' behaviors.

Starting in early adolescence, peers play a central role as recipients and sources of support (del Valle et al., 2010). Prosocial behavior is closely related to friendship emergence, stability, and satisfaction (Barry & Wentzel, 2006; Parker & Asher, 1993; Hiatt, Laursen, Mooney, & Rubin, 2015), because intimacy and mutuality, two important aspects of friendship, can be reached through the exchange of help and support. Prosocial peers tend to form and maintain friendships more frequently than their less prosocial peers (Bowker et al., 2010), as well as to establish more positive interactions and to experience positive well-being (Cillessen, Jiang, West, & Laszkowski, 2005). Furthermore, in comparison to other classmates, prosocial children are inclined to value their interactions and to be intrinsically motivated to build relationships (Hawley et al., 2002). As prosocial peers exhibit positive characteristics, it is likely that they are attractive as potential friends. Because prosocial behavior is linked to establishing intimate and close interactions, we expected that early adolescents would befriend peers based primarily on their own experience of peers' prosocial behavior. Consequently, prosociality would be likely to positively affect friendships on the dyadic but not on the reputational level (*hypothesis 1*).

Conversely, physical aggression is usually seen as a negative feature because it directly compromises closeness and intimacy with a peer (Ojanen et al., 2012). Aggressive youths tend to develop poorer interactions with their peers, such as excluding their peers and experiencing diminished well-being (Slee, 1995). Aggressive adolescents tend to have an unclear understanding of relational expectations, often hampering the establishment of social relations by being perceived

as unfriendly (Veenstra, 2006). Furthermore, some aggressive children lack the necessary social skills to provide emotional and practical support, therefore, becoming less attractive as potential friends who offer affection (Sijtsema, Lindenberg, et al., 2010). Yet, aggressive children can develop instrumental friendships. For example, bullies usually pursue friendships strategically to reach power and status instead of personal fulfillment (Hawley et al., 2002; Ryan & Shim, 2008). As aggression is linked to having detrimental relationships, we hypothesized that early adolescents would avoid befriending peers based primarily on their own experience of peers' aggressive behavior. Therefore, aggression would be likely to negatively affect friendships on the dyadic but not on the reputational level (*hypothesis 2*).

4.1.3 Popularity, friendships, and the reputational perception

Popularity has been portrayed as a shared recognition among peers that a particular individual holds power, prestige, visibility, and social dominance (Cillessen, Schwartz, & Mayeux, 2011; Bellmore and Cillessen, 2006). Especially during late childhood and adolescence, peers tend to attach great importance to popularity (LaFontana & Cillessen, 2010). Popular adolescents possess many characteristics that make them attractive, such as having fun and exciting social lives and being socially powerful and visible, getting much attention from teachers and classmates (Adler & Adler, 1998; Hawley et al., 2007; Vaillancourt & Hymel, 2006). Consequently, peer relationships and groups are, to a large extent, defined along the dimension of popularity (Dijkstra, Cillessen, & Borch, 2013). Being popular requires a degree of compatibility with the values and behavioral orientations of the larger peer structure, such as classrooms or schools (Brown et al., 1986). In order to be popular, it is necessary that others want to be associated with them (Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010).

From a goal-framing perspective, to achieve status, it may be useful for early adolescents to befriend popular peers rather than peers of similar status. Befriending high-status peers can enhance one's own status, a phenomenon known as "basking in reflected glory" (Cialdini & Richardson, 1980). As popularity is about a shared recognition of who is popular in the peer group, we expected that for choosing friends, the reputational perception of popularity would overrule the dyadic perception. Accordingly, the selection of friends would be driven by the reputational but not by the dyadic perception of peers' popularity (*hypothesis 3*). To conclude, we investigated the interplay of early adolescents' dyadic and reputational perceptions of prosociality, aggression, and popularity with friendship networks. For this purpose, we used longitudinal social networks analysis, specifically, the stochastic actor-oriented models (SAOM) (Ripley et al., 2018).

4.2 Method

4.2.1 Sample

Participants were 1,170 fourth, fifth, and sixth graders (52% girls_{T1}; Age range_{T1} = 10 to 12 years old) from 30 classrooms in four schools in metropolitan Santiago, Chile. All schools were public subsidized, which is the case for 54.6% of schools in Chile (Ministerio de Educación de Chile, 2015). According to the Chilean national socioeconomic classification, one school corresponds to lower-middle, two schools to middle, and one school to upper-middle socioeconomic status (based on parents' educational level, family income, and school vulnerability index, which measures the percentage of students in a school that is considered vulnerable based on family income, medical needs, birth weight, and residential conditions). In the Chilean education system, students tend to

spend their entire elementary education (first to eighth grade) with the same classmates and in the same schools. Therefore, classrooms are stable environments in which peer relationships unfold. Despite this particularity, research on adolescent peer relationships with Chilean samples has shown similar patterns to American and European populations (Berger & Rodkin, 2012; Dijkstra, Berger, & Lindenberg, 2011), and the study of peer relationships and adolescent development in Latin America follows similar trends to those in western societies (Berger et al., 2016).

In view of SAOM missing data requirements, only classrooms that had a participation rate higher than 80% were included in the analyses, resulting in a sample of 18 classrooms. Because the participation considerably declined from the third wave onwards, we only examined waves 1 and 2 (collected in April and October of the same academic year). Finally, two classes were excluded due to convergence issues in the social network analyses (i.e., low reliability of estimates). The final sample contained 694 students from 16 classrooms (45% girls) (see Table 4.1). A small number of students named almost everyone (above 85%) as friends in their classroom (6 and 5 participants in the first and second wave, respectively). As these students may have interpreted the question differently from their classmates, we recoded their outgoing nominations as missing data while retaining their incoming nominations. Similar strategies to handle outliers have been used in previous research with longitudinal social network analyses (Light et al., 2013; Van Rijsewijk et al., 2019).

4.2.2 Procedure

Principals were approached and informed about the study and asked for their authorization. Surveys were administered to the whole classroom in regular classroom hours in the presence of research assistants. Surveys were completed during regular class hours, taking approximately 45 minutes per classroom. During the survey, participants answered the questionnaire individually, while trained administrators assisted participants when needed. All instruments and procedures were approved by the Institutional Review Board of the local university and by the funding institution. Parental active consent and students' assent were gathered for all participants taking part in a 3-year research project (five assessments, with six months intervals) that focused on peer relationships (see also Berger & Caravita, 2016; Cuadros & Berger, 2016; Palacios & Berger, 2016).

4.2.3 Measures

A standard peer-nominations procedure was used to assess prosociality, aggression, popularity, and friendships (Berger & Rodkin, 2012; Cillessen & Mayeux, 2004; Logis, Rodkin, Gest, & Ahn, 2013). Participants were asked to nominate classmates from a roster with all names listed.

Friendship (T1-T2). Participants could nominate an unlimited number of their classmates whom they considered to be their best friends (*'Who are your best friends?'*). For friendships, we constructed adjacency matrices for each classroom in each wave, containing 0 and 1, representing the absence and presence of a nomination between actors i and j .

Prosociality, Aggression, and Popularity (T1). Participants could nominate an unlimited number of their classmates whom they considered as prosocial (*'Who cooperates? They help and share with others'*), aggressive (*'Who starts fights? They hit, kick, or punch others'*) and most popular in their classroom (*'Who are the most popular and visible students in your class?'*). For the dyadic perception, we constructed adjacency matrices for each classroom in wave 1, containing 0 and 1, representing the absence and presence of a nomination between actors i and j . For the reputational perception, we computed

Table 4.1 Changes in networks variables across the two observations

Class	Size	Miss t1	Miss t2	Miss Av.	Jacc	Dist	FR t1	FR t2	FR 0→1	FR 1→0	FR 1→1	% girls	PR t1	AG t1	PO t1
2	40	.15	.00	.08	.19	381	8.50	7.12	182	199	90	55.0	.13	.10	.17
3	38	.05	.00	.03	.32	255	7.36	6.05	107	148	117	36.8	.08	.12	.17
4	40	.17	.02	.10	.33	311	9.66	8.51	146	165	154	52.5	.19	.13	.20
5	41	.02	.05	.04	.21	486	12.90	7.10	145	341	130	39.0	.19	.14	.29
8	41	.09	.14	.12	.37	360	10.27	11.17	166	140	181	42.5	.19	.14	.24
9	41	.07	.19	.13	.36	291	9.13	11.09	171	120	168	51.2	.16	.14	.17
11	37	.15	.10	.13	.33	171	6.01	5.27	76	96	85	51.4	.16	.16	.20
12	38	.10	.18	.14	.39	235	9.26	10.25	140	95	152	44.7	.12	.15	.23
13	39	.17	.05	.11	.32	227	6.67	8.43	130	99	109	53.8	.22	.12	.26
17	38	.26	.10	.18	.35	179	6.51	8.85	106	73	97	31.6	.16	.14	.17
18	40	.15	.15	.15	.35	367	12.55	10.73	154	213	193	60.0	.23	.09	.32
20	45	.35	.00	.18	.36	259	9.55	8.93	131	128	149	31.6	.16	.14	.17
21	43	.14	.00	.07	.38	240	7.73	6.62	103	137	149	42.2	.12	.06	.09
22	43	.25	.02	.14	.43	305	15.53	9.42	73	232	238	48.8	.24	.10	.23
23	45	.40	.00	.20	.42	253	11.59	8.24	127	126	187	46.5	.20	.05	.18
24	45	.22	.00	.11	.47	235	9.60	7.20	108	127	209	35.6	.08	.03	.13
Tot/Av	694	.18	.07	.13	.34	282.29	9.43	8.32	127.7	151.7	145.9	45.7	.16	.11	.21

Notes. Miss: % of missing data; Jacc: Jaccard index; Dist: Hamming distance; FR 0→1: Number of created friendships ties; FR 1→0: Number of dissolved friendships ties; FR 1→1: Number of maintained friendships ties; PR t1: Average degree of pro-sociality at time 1; AG t1: Average degree of aggression at time 1; PO t1: Average degree of popularity at time 1.

proportion scores for each variable (at time 1) by taking the number of nominations received on each variable and dividing them by the number of participants in the classroom minus 1.

Sex. Boys were coded 0, and girls were coded as 1.

4.2.4 Analytical Strategy

Analyses were conducted using longitudinal social network modeling (RSiena; ‘Simulation Investigation for Empirical Network Analysis’) (Ripley, Snijders, Boda, Voros, & Preciado, 2017; Snijders et al., 2013). This approach allows unraveling the dyadic and reputational perception of prosociality, aggression, and popularity on friendship networks while taking network structural effects (e.g., reciprocity, transitivity) as well as students’ individual covariates (e.g., sex) into account. RSiena models are actor-oriented models (Snijders, van de Bunt, & Steglich, 2010), which assume that actors (here: students) modify their relationships (here: friendships) between assessments based on structural (network) and individual preferences. The model determines likely trajectories between observations with information from the baseline as a starting point. The estimates of the model are obtained through an iterative simulation following a Markov Chain approach, expressing the strength of the effects included in the model. The unstandardized estimates resemble regression coefficients in logistic regression, indicating the strength of each effect in creating or maintaining a tie. To facilitate the interpretation of the findings, we calculated odds ratios by taking the exponential function of the parameter estimates. For example, an odds ratio of two indicates that a participant is twice as likely to reciprocate a friendship than not to reciprocate, all else being equal. However, this assumption is strong, as parameters in social network analyses often correlate and co-occur. Consequently, the odds reported should be interpreted with caution.

Missing data due to non-response were handled through the RSiena default missing data method, and participants who joined and left the classrooms network in-between time points were treated using structural zeros (i.e., impossible nominations). The model was estimated for each classroom separately using the Methods of Moments estimator and specifying 5,000 iterations in phase 3 for calculating standard errors. The estimation was performed in two steps. First, we analyzed each classroom separately and made sure that the algorithm converged well. Second, for each model, the findings of all classes’ analyses were combined in a meta-analysis using the Snijders-Baerveldt test (Snijders & Baerveldt, 2003). The meta-analysis combined the analyzed parameter estimates across classrooms by testing the mean and variance of parameter values among classrooms. Goodness-of-fit tests were conducted to each class to assess how well the model reproduced the observed data (Lospinoso & Snijders, 2019). Overall, the results for the four types of networks indicated a good representation of the indegree, outdegree, and geodesic distance distributions, and the triad census in all classrooms (p -values between .10 and .90).

4.2.5 Model specification

We included four types of effects: rate effects that model students’ opportunities to maintain ties, drop existing ties or creating new ties; structural network effects that model how the changes in each network depend on the network itself; effects for measuring the impact of the dyadic and reputational perception on friendships; and covariate effects (e.g., sex) that model how changes in each network depend on attributes of actors.

Structural network effects were included to capture the basic tendencies of actors to form and maintain relationships in each of the four types of networks. *Density* describes the tendency of actors to form relationships. *Reciprocity* is the tendency toward reciprocation of relationships (i.e.,

mutual ties). We included the *transitive triplets* effect that reflects the tendency to form friendships in triadic structures (friends of friends tend to be my friends). In addition to these effects, we included two degree-related effects to differentiate between actors who receive or send many (or few) nominations in each type of network. The *indegree-popularity*² effect reflects the tendency of actors with an already high number of incoming nominations to attract additional nominations, whereas the *outdegree-activity* effect reflects the tendency of actors with already high tendencies to nominate others to send additional nominations. Also, the *balance* effect was added, representing the tendency to have and create ties to other actors who make the same choices as the focal actor.

In order to test our hypotheses, we analyzed both the dyadic and reputational level dependencies. To measure the effect of the dyadic perception on friendships, we operationalized prosociality, aggression, and popularity as constant dyadic covariates (measured at wave 1). Specifically, we examined whether dyadic prosociality, aggression, or popularity nominations led to friendship nominations. To measure the effect of the reputational perception on friendships, we operationalized the reputational perception as the proportion of incoming prosociality, aggression, and popularity nominations (measured at wave 1). Thus, we analyzed whether the number of prosociality, aggression, or popularity nominations received led to friendship nominations. Additionally, we controlled for sex in the analyses. Research has shown that sex has an impact on friendship, prosociality, aggression, and popularity nominations (Card et al., 2008; van der Ploeg et al., 2020; Van Rijsewijk et al., 2016; Veenstra et al., 2013). We included the *same-sex* effect, indicating whether nominations tend to occur more often between actors of the same sex.

4.3 Results

4.3.1 Descriptive statistics

Table 4.1 provides the descriptive statistics averaged across the 16 classrooms. The average degree shows that students nominated around nine classmates as friends in the first assessment and eight classmates in the second assessment. The Jaccard indexes, which indicates the proportion of stable nominations among the total number of created, dissolved, and stable friendships, showed satisfactory stability in friendship networks for almost every class (.34 on average). Regarding the dyadic covariates, students' proportion scores were on average .16 for prosociality, .11 for aggression, and .21 for popularity.

4.3.2 Longitudinal social network analysis

Table 4.2 presents the results of the RSiena meta-analysis for friendship networks. The estimates and standard errors are based on the models estimated separately for the 16 classrooms. We also included the standard deviation of parameter estimates across classrooms (σ), and whether the standard deviation significantly differs from zero. Students had, on average, 17 opportunities for changing (or not) their friendship ties. A significant negative effect for the *density* was found (Est. = -1.19, $p < .001$, OR = 0.15), indicating that students were selective choosing friends. Furthermore, friendship nominations were likely to be reciprocated (Est. = 0.95, $p < .001$, OR = 2.58), and friends of friends tended to become friends as well (Est. = 1.01, $p < .001$, OR = 2.74).

² The term popularity here refers to the number of incoming nominations, but not to visibility or prominence.

Table 4.2 Friendship networks: Rsiena meta-analysis (16 classrooms)

Effect	Est.	SE	σ	OR
Friendship networks				
Rate parameter ^a	17.42***	1.05	2.29	-
Density	-1.93***	0.16	0.38	0.15
Reciprocity	0.95***	0.09	0.27**	2.58
Balance	0.05***	0.01	0.01	1.05
Transitivity triplets	1.01***	0.09	0.00	2.74
Indegree-popularity	-0.05***	0.01	0.02	0.95
Outdegree-activity	0.04***	0.01	0.00	1.04
Indegree-activity	-0.09***	0.02	0.05*	0.91
Same-sex	0.38***	0.06	0.20***	1.46
Prosociality (dyadic)	0.01	0.06	0.14	1.00
Prosociality indegree (reputational)	0.72**	0.24	0.50	2.06
Aggression (dyadic)	-0.16*	0.07	0.15	0.85
Aggression indegree (reputational)	-0.19	0.16	0.00	0.83
Popularity (dyadic)	-0.02	0.08	0.28***	0.98
Popularity indegree (reputational)	0.83***	0.17	0.26	2.29

Notes. * $p < .05$; ** $p < .01$; *** $p < .001$.; Est.: Estimate; SE: standard error; σ : across-classrooms standard deviation; OR: odds ratio; ^a Due to convergence issues, the rate parameter of three classes was fixed to the average of the rest of classes

We also found a positive *balance* effect, which refers to the tendency of having and creating ties to other actors who make the same friendship choices as ego (Est. = 0.05, $p < .001$, OR = 1.05) as well as a tendency for *same-sex* friendships (Est. = 0.38, $p < .001$, OR = 1.46). The positive *outdegree-activity* effect indicates the tendency for students who already nominated many others as friends to give extra friendship nominations (Est. = 0.04, $p < .001$, OR = 1.04). The negative *indegree-popularity* effect indicates that students who received many nominations were less likely to receive more nominations over time (Est. = -0.05, $p < .001$, OR = 0.95). Moreover, the negative *indegree-activity* effect indicates that students who received many nominations gave fewer nominations (Est. = -0.09, $p < .001$, OR = 0.91).

With regard to our hypotheses, there is no evidence that students' own perception of peers' prosociality was related to friendship selection (Est. = 0.01, $p = .956$, OR = 1.00), but students perceived by many classmates as prosocial received more friendship nominations over time (Est. = 0.72, $p = .002$, OR = 2.06). These results are contrary to *hypothesis 1*: only the reputational perception of peers' prosociality plays a role in friendship selection. Regarding the effects of the perception of peers' aggression on friendship selection, students perceived as aggressive on the dyadic level were less nominated as friends (Est. = -0.16, $p = .028$, OR = 0.85), but we did not find that students perceived as aggressive by many classmates were less nominated as friends (Est. = -0.19, $p = .219$, OR = 0.83). These results are in line with *hypothesis 2*: adolescents avoid befriending aggressive peers based on the dyadic but not on the reputational perception. There is no evidence that adolescents considered as popular on the dyadic level were more likely to be nominated as friends (Est. = -0.02, $p = .848$, OR = 0.98), but adolescents considered by many classmates as popular were more likely to be nominated as friends (Est. = 0.83, $p < .001$, OR = 2.29). These

results support *hypothesis 3*: the selection of friends is mainly driven by the reputational rather than the dyadic perception of peers' popularity.

4.4 Discussion

In this study, we examined the interplay of prosociality, aggression, and popularity with friendships in a sample of early adolescents in Chilean schools. We aimed to disentangle the extent to which the dyadic and reputational perception of prosociality, aggression, and popularity affect friendship networks. To this end, we used a longitudinal network approach, which yields a richer understanding of the development of early adolescents' friendship dynamics. The hypotheses were derived from a goal-framing perspective emphasizing the importance of affection and status goals for the cognitive and evaluative processes associated with friendship selection.

The study contributes to the distinction between dyadic and reputational perceptions. This distinction gives us a fine-grained picture of the way that perceptions of others' behavior affect peer relationships. For instance, the results of this study suggest that for befriending classmates, the reputation of peers as prosocial matters more than the dyadic perception of peers' prosocial behavior. The distinction between dyadic and reputational perception followed literature that focused on the impact of how adolescents perceive peers' behavior on the development of peer relationships (Pál et al., 2016; Palacios, Berger, et al., 2019). Previous studies have investigated the effect of the dyadic perception of disdain and respect on disliking and gossiping relationships (Kisfalusi et al., 2019; Pál et al., 2016) as well as the effect of victimization and aggression on friendships and disliking (Palacios, Berger, et al., 2019; Rambaran et al., 2020). Our study extends previous literature by examining the extent to which the dyadic and reputational perceptions of peers' prosociality, aggression, and popularity affect the formation and maintenance of friendship networks.

We expected that prosociality would be likely to positively affect friendships on the dyadic but not on the reputational level. However, our results indicate the opposite, namely, early adolescents prefer to befriend peers that are widely perceived as prosocial. This means that on top of the reputational perception of prosociality, there is no additional effect of early adolescents' own perception of peers' prosocial behavior on friendship selection. Early adolescents may consider that peers perceived as prosocial by reputation are associated with being kind and empathic to others, turning them more trustworthy as friends. Conversely, the adolescents' own perception of other peers as prosocial could be linked to instrumental and short-term friendships. This idea is aligned with recent findings indicating that adolescents may question whether they want to receive help from certain peers (Ackerman & Kenrick, 2008; Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010). Not all friends are salient as helpers, some helpers are not friends, and not all help nominations are mutual, suggesting that help relations might be sometimes instrumental as they aid in achieving personal goals, such as being helped with homework or being comforted with emotional problems (Van Rijsewijk, Snijders, Dijkstra, Steglich, & Veenstra, 2019).

We hypothesized that aggression would be likely to negatively affect friendships on the dyadic but not on the reputational level. As expected, we found that students perceived as aggressive on the dyadic level were less likely to be nominated as friends, but we did not find that students widely perceived as aggressive were less likely to be nominated as friends. Students make this decision based on their dyadic instead of the reputational perception. These results suggest that aggression is seen as an undesired characteristic that does not fit with the establishment of

supportive, intimate, and meaningful friendships (Ojanen et al., 2012; Sijtsema, Ojanen, et al., 2010).

We expected that popularity would be likely to positively affect friendships on the reputational but not on the dyadic level. As expected, only the reputational perception of popularity made friendship nominations more likely. First, the results are aligned with the idea that early adolescents give increasing importance to popularity as power, prestige, visibility, and social dominance became more relevant features in the transition from late childhood to adolescence. Popular adolescents are considered attractive as friends, probably because they are fun to be around with, have active social lives, are socially powerful (Hawley, Little, & Card, 2007; Vaillancourt & Hymel, 2006). Friendship with popular peers can enhance one's own status (Cialdini & Richardson, 1980).

4.4.1 Limitations and directions for further research

Our results contribute to existing research despite certain limitations. First, our measures of perception on the dyadic level referred to who is perceived as prosocial or aggressive in general but not to who helps whom or who is aggressive to whom. It is likely that the effects of befriending peers who help me and not befriending peers who are aggressive to me should be even larger than those effects found in this study. Second, we only examined the impact of the dyadic and reputational perception of other peers as prosocial, aggressive, or popular on friendship selection, and not vice versa. Future studies can incorporate these bi-directional effects by using multiplex network analysis. Third, there is an alternative approach to measure the reputational perception of peers' behavior by asking students whom they think that their classmates perceive as prosocial or aggressive (Pál et al., 2016). Future research could include this measure and compare it to the dyadic and reputational perception featured in this study. Fourth, this study did not include a measure of peer norms, which reflect the expected and accepted behavior of a social group (Dijkstra & Gest, 2015). Because the display of aggressive and prosocial behaviors might depend on the extent to which the peer context motivates adolescents to do so (Laninga-Wijnen et al., 2017; Wentzel et al., 2007), future research could consider the role of the social context. Finally, although we tested for parameters' differences across classrooms, these differences were not examined. Future studies can include characteristics such as classroom size, composition, or social norms to gain knowledge about classroom-level factors.

4.5 Conclusion

During adolescence, affection and status emerge as two significant goals. Early adolescents become aware of what they think is instrumental in (or disturbs) the achievement of those goals. As a result, they focus on cues and information that help them predict the usefulness or fitting of peer features for the realization of their goals. Accordingly, this study examined the extent to which early adolescents' dyadic and reputational perceptions of prosociality, aggression, and popularity affect friendship networks. Our findings indicate that early adolescents' friendship networks are affected in different ways by prosocial, aggressive, and popularity perceptions. As expected, friendships were driven by the dyadic perception of peers' aggression and by the reputational perception of peers' popularity. However, unexpectedly, friendships were only driven by the reputational perception of peers' prosociality. Overall, these results suggest the importance of including and examining the dyadic and reputational perception simultaneously.



The Interplay of Adolescents' Aggression and Victimization with Friendship and Antipathy Networks within an Educational Prosocial Intervention

This chapter is based on:

Palacios, D., Berger, C., Luengo Kanacri, B. P., Veenstra, R., & Dijkstra, J. K. (2019). The Interplay of Adolescents' Aggression and Victimization with Friendship and Antipathy Networks within an Educational Prosocial Intervention. *Journal of Youth and Adolescence*, *48*(10), 2005–2022. <https://doi.org/10.1007/s10964-019-01105-z>

5.1 Introduction

Peers constitute an important social context for adolescents' development (Furman & Rose, 2015). Peer relations may take positive forms, such as friendships (Bagwell & Smith, 2011), but also negative forms, such as antipathies (Berger et al., 2011; Card, 2010). Both types of relations have been linked to aggression and victimization. The detrimental role of aggression in the emergence and maintenance of friendships and antipathies in adolescence has been widely reported. Research indicates that aggressive youth are less likely to be selected as friends (e.g., Logis et al. 2013). Similarly, adolescents who display aggressive behavior are commonly disliked by peers (Card & Hodges, 2007; van den Broek et al., 2016). Victimization also plays a role in the formation and maintenance of friendships and antipathies. Adolescents who are victimized tend to be socially isolated and have fewer friends (Berger & Rodkin, 2009). In fact, if victims do not have friends, they might end up isolated and disliked by their peers (Salmivalli et al., 2000; Scholte et al., 2009), and continue to be victimized (Sentse et al., 2017).

Peer relationships do not emerge in isolation but arise in the larger peer context. As students spend a large part of their time interacting with classmates, classrooms are important in adolescents' social development (Card & Schwartz, 2009). Classrooms might, however, differ in the way behaviors are evaluated and appreciated (Dijkstra & Gest 2015), and therefore differ in promoting prosocial and nurturing relationships (Schacter & Juvonen, 2018) or, by contrast, in fostering negative peer processes, such as rejection and victimization (Berger & Caravita, 2016; Martin Babarro et al., 2017). Social norms that sanction aggression, or promote and value prosocial behaviors, are relevant for interpersonal processes and might play a central role in how the perception of aggression and victimization affect peer relations such as friendships and antipathies. One way to change social norms is via educational interventions that can promote classroom peer ecologies in which adolescents positively regulate their behaviors improving mutual prosocial responses, cooperation, and supportiveness, thereby creating a naturally positive and more inclusive classroom environment (Caprara et al., 2015; Luengo Kanacri et al., 2017).

This study aims to examine whether an educational intervention impacts the association between the adolescents' perception of peers' aggression and victimization, and friendship and antipathy relationships by adopting a longitudinal social network approach. In order to do this, classrooms participating in an educational intervention aimed at promoting prosocial behavior and social cohesion, ProCiviCo (*Promoting prosocial behavior and civic engagement for social cohesion in school settings*; Luengo Kanacri & Jiménez-Moya 2017) were compared with control classrooms. This study incorporates a novel perspective by examining the dyadic perception (student A's perception of student B's behavior) about aggression and victimization as network information. This approach allows assessing the effect of perceiving a peer as aggressive or victimized on the interpersonal relationships with that adolescent, either positive (friendship) or negative (antipathy). It is expected that the interplay between the dyadic perceptions of aggression and victimization, and friendships and antipathies would differ between the intervention and control classrooms due to differences in peer norms and normative behaviors.

5.1.1 Aggression, friendships and antipathies

Studies have consistently shown that befriended adolescents display similar levels of aggressive behavior (Dijkstra et al. 2011), although possibly based on a default selection in which aggressive adolescents are left with similar peers as the only option for establishing friendships (Deptula & Cohen, 2004; Sijtsema & Lindenberg, 2018). This default selection builds on studies showing that

aggressive adolescents are less likely to be selected as friends (Logis et al., 2013), although they are usually nominated as cool and popular. This implies that aggression is a valued social asset, as shown by several studies evidencing its association with popularity and coolness (Berger & Rodkin, 2012; Kiefer & Wang, 2016). However, aggression is also a rejected attribute (Ettetal & Ladd, 2015). Although aggressive adolescents are popular and cool, they are not socially preferred (Kraft & Mayeux, 2018), which might explain their lower friendship' nomination rates. For instance, several studies show that adolescents who bully are disliked (Pouwels et al., 2016; van den Broek et al., 2016), probably because it generates anxiety and fear (Vaillancourt et al., 2010).

5.1.2 Victimization, friendships and antipathies

Adolescents who experience peer victimization tend to have fewer friends (Berger et al., 2019). Peers avoid befriending victimized adolescents because of fear of becoming victimized themselves (Boulton, 2013). Having fewer friendships represents a social disadvantage for victimized adolescents because friendships are important for social adaptation and well-being (Holder & Coleman, 2015; Lansford et al., 2014). Friends can offer support and protection when necessary (Cuadros & Berger, 2016), but also enable adolescents to build and confirm their identities (Bukowski & Sippola, 2005). Conversely, if victims do not have friends, they might end up isolated and disliked by their peers (Salmivalli et al. 2000; Scholte et al. 2009), and continue to be victimized (Sentse et al., 2017). Although previous studies show that rejection can lead to peer victimization (Salmivalli & Isaacs 2005; Serdiouk et al. 2015), the path from being victimized to being rejected has been less studied.

5.1.3 Peer relationships within educational contexts

Schools are important socializing venues for promoting prosocial behavior and civic engagement. Educational interventions following a Socioemotional Learning (SEL) framework (Durlak et al., 2011), besides having a direct effect on individual behavior, also have an impact on school social climate. For instance, Hendrickx and colleagues (2016) showed that when students perceived higher teacher support, the classroom peer ecology was more prosocial and rejection rates were lower. Seemingly, classrooms' prosocial norms (both descriptive and prescriptive) were associated with higher levels of individual prosocial behavior (Laninga-Wijnen et al., 2018).

Interventions focusing on behaviors involving cooperation, helping, sharing, and displaying concern for others (Eisenberg et al., 2006) may be effective strategies to produce more positive, cooperative social interactions (Batson, 2011) and to reduce both the emergence and the negative consequences of aggression and victimization (Obsuth et al., 2015). In this sense, educational interventions such as ProCiviCo could foster classroom peer ecologies in which adolescents positively regulate their behaviors, improving mutual prosocial responses, cooperation, and supportiveness, producing a positive and more inclusive classroom environment (Caprara et al., 2015; Luengo Kanacri et al., 2017). It is expected that in positive environments, adolescents that are responsive to peers' problems and difficulties and are able to help them would be supportive to victims in terms of befriending them more frequently and rejecting them less frequently. Conversely, because the adoption of prosocial norms and the development of prosocial behavior are to a greater extent considered as incompatible with aggressive behavior (Siu et al., 2012), adolescents who display aggressive behaviors would be negatively sanctioned by means of not befriending and rejecting them more frequently.

5.1.4 The effect of prosocial behavior and sex

The literature on peer relations shows that adolescents who display prosocial behaviors are valued as friends (Poorthuis et al., 2012) and are socially preferred by their peers (Berger et al., 2015; Card, 2010). Moreover, several studies report a negative association of prosocial behavior with both aggression (Berger et al., 2015; Molano et al., 2013) and victimization (Coleman & Byrd, 2003; Griese et al., 2016). Because the focus of ProCiviCo was the promotion of prosocial behavior among peers, this intervention should also affect friendships, antipathies, and perceptions of peers' aggression and victimization. Therefore, individual levels of prosocial behavior need to be controlled for.

Seemingly, there is ample evidence on the effects of sex on friendships, particularly a preference for same-sex over cross-sex friendships during adolescence (Simpkins et al., 2013; Veenstra & Dijkstra, 2011). Conversely, the evidence about same-sex antipathies (Rambaran et al., 2015; Witkow et al., 2005) and sex differences in aggression is still inconclusive (Batanova & Loukas, 2011; Peets & Kikas, 2006). For instance, Faris and Felmlee (2011) found that differences in aggression are less attributable to individual sex differences, and are more dependent on social ecology and, in particular, the implications of aggression for social status. Similarly, earlier studies show sex differences in peer victimization, both in their frequency and implications (Berger & Rodkin, 2009), which again might suggest differential experiences of victimization for boys and girls. Thus, sex should also be taken into account when studying peer processes (Sentse et al., 2015).

5.1.5 Present study

The present study examines the extent to which the dyadic perceptions of peers' aggression and victimization are related to friendships and antipathies (see Figure 5.1) comparing network processes in intervention and control classrooms using longitudinal multiplex social network analysis (Snijders et al. 2013). To this end, the perception of peers' aggression and victimization, along with friendships and antipathies, are treated as network relationships, examining the associations between the dyadic perception of peer's aggression and victimization, and friendship and antipathy relationships. It is expected that in intervention classrooms (characterized by higher levels of cooperation, empathy, and concern for others) compared to control classrooms, students would be less likely to exclude victimized adolescents, but not aggressors, by befriending them. Consequently, compared to control classrooms, adolescents in the intervention classrooms would be less befriended by classmates who consider them as aggressors (*hypothesis 1*) and more befriended by classmates who consider them as victims (*hypothesis 2*). Furthermore, positive classroom environments would be particularly relevant for those who are generally more disliked, such as aggressive peers and victimized adolescents. Accordingly, compared to control classrooms, adolescents in the intervention classrooms would be more disliked by classmates who consider them as aggressors (*hypothesis 3*) and less disliked by classmates who consider them as victims (*hypothesis 4*). Moreover, considering the relevance of both prosocial behavior and sex on peer relations (friendships and antipathies) as well as on aggression and victimization, the analyses controlled for individual effects of prosocial behavior and sex.

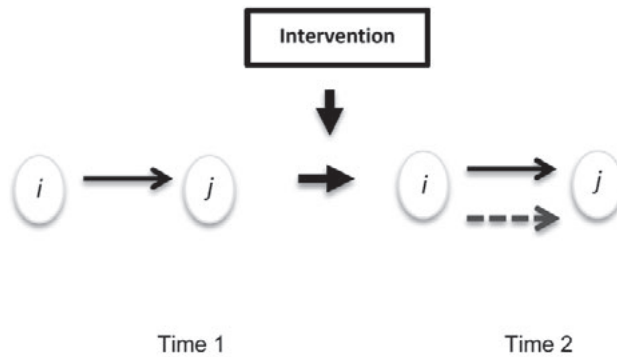


Figure 5.1. The figure represents whether an existing tie between from student i to j in one type of network (e.g., aggression, victimization) leads to the formation or maintenance of a tie in another type of network (e.g., friendship, antipathy), moderated by receiving the intervention.

5.2 Method

This study is part of a larger project aimed at developing, implementing, and evaluating a school-based intervention to promote prosocial behavior and civic engagement, *ProCiviCo* (Luengo Kanacri & Jiménez-Moya 2017). The intervention, as designed and implemented in Chile, was adapted from an intervention created in Italy (CEPIDEA) and also implemented in Colombia (Caprara et al., 2015). The intervention is intended to promote interpersonal social cohesion among students by increasing adolescents' prosocial behavior and civic engagement and its main determinants, referring to emotion regulation, empathic skills, prosocial moral values, (Luengo Kanacri et al., 2015). The program includes five components: (a) prosocial responding in the peer context, (b) empathic skills, (c) emotion regulation, (d) prejudice and social identities, (e) and civic engagement within the school community. The intervention used two main strategies over an academic year: workshops and lessons. Workshops were led by the research team, but in collaboration with the teachers, and consisted of weekly group discussions, role-playing, and interviews. Lessons were led by teachers and consisted of integrating civic issues in regular classwork across subjects. On average, the number of workshops was 16 per school and 4-5 lessons per classroom. The intervention is centered around the idea that prosocial behavior, as an exercise of active citizenship, can be taught and developed through appropriate formative experiences (for details about the intervention see Luengo Kanacri & Jiménez-Moya 2017; Luengo Kanacri et al. 2019). A cluster randomized controlled trial of the ProCiviCo program showed positive effects on prosocial behavior across multiple informants (students, parents, and teachers), which in turn decreased aggressive behaviors among adolescents (Luengo Kanacri et al. 2019).

5.2.1 Sample

Initially, the data was composed of 659 seventh graders from Santiago (Chile) from 16 classrooms ($M_{age} = 12.32$; $SD = 0.22$, 48% girls) from eight public and private subsidized schools. Schools were randomly assigned to the intervention (nine classrooms from four schools) and control (seven

classrooms from four schools) condition. According to the Chilean Ministry of Education, these schools are considered as middle-low to middle socioeconomic status schools. The average classroom size was 41.2 students ($SD = 8.1$, range from 29 to 51). The intervention ran from May till November 2017. Students were measured three times over the study: pre-test (April 2017), post-test (November 2017), and a follow-up assessment (May 2018). All participants attended seventh grade at the pre-test.

Three classrooms were excluded from the analyses. First, an only-boy classroom was excluded because of potential different processes regarding aggression and social norms in single sex-classrooms (Johnson & Gastic, 2014). A second classroom was excluded because of its combination of a few tie changes between assessments, a small fraction of stable relationships relative to all new, lost, and stable relationships, and a high percentage of missing data (for details see Appendix 5.A1). Finally, due to some convergence issues in the social network analyses (i.e., low reliability of estimates), a third classroom was excluded. The final sample contained 530 students from seven intervention ($M_{age\ it} = 12.35$; $SD = 0.21$, % 47 girls) and six control classrooms ($M_{age\ it} = 12.29$, $SD = 0.26$; 61% girls).

Students in Chilean schools tend to remain together with their classmates across elementary education (first to eighth grade). Therefore, classrooms are stable environments in which peer relations unfold. Despite this particularity, research on adolescent peer relations with Chilean samples has shown similar patterns to American and European populations (Berger and Rodkin 2012; Dijkstra et al. 2011), and the study on peer relations and adolescent development in Latin America follows similar trends to those in western societies (Berger et al., 2016).

5.2.2 Procedure

Questionnaires were administered to the whole classroom in regular school hours in the presence of research assistants. Children were assured that their answers would be kept confidential and that they could stop participating at any time. Measures and procedures to protect the confidentiality and rights of participants were approved by the Institutional Review Board of the participating university. Parental active consent and adolescents' assent were obtained for all participants included in the study.

5.2.3 Measures

Peer nominations procedures assessed aggression, victimization, friendships, and antipathies (Cillessen & Mayeux, 2004). Participants were asked to check on a roster and nominate up to three classmates per measure. Adjacency matrices were created for each classroom on each assessment, representing the different networks with nominations coded as 1 and non-nominations coded as 0.

Aggression networks (T1-T3). A comprehensive measure of aggression was used (Hamre & Pianta, 2006; Logis et al., 2013). Participants were asked to identify classmates who best fit the descriptor *they behave aggressively or make fun of others* (average degree_{T1} = 2.47, SD_{T1} = 0.37; average degree_{T2} = 2.54, SD_{T2} = 0.32; average degree_{T3} = 2.27, SD_{T3} = 0.25).

Victimization networks (T1-T3). Participants were asked to identify classmates who best fit the descriptor *they are victimized, or kids make fun of him* (Dijkstra et al. 2010; average degree_{T1} = 2.37, SD_{T1} = 0.37; average degree_{T2} = 2.47, SD_{T2} = 0.36; average degree_{T3} = 2.17, SD_{T3} = 0.27).

Friendship networks (T1-T3). Participants were asked to identify classmates who best fit the descriptor *with whom do you hang out at school during recess* (Espelage et al. 2003; Schacter et al. 2014;

average degree_{t1} = 2.51, SD_{t1} = 0.35; average degree_{t2} = 2.54, SD_{t2} = 0.36; average degree_{t3} = 2.32, SD_{t3} = 0.27).

Antipathy networks (T1-T3). Participants were asked to identify classmates who best fit the descriptor *with whom you would not like to hang out at school during recess* (average degree_{t1} = 2.55, SD_{t1} = 0.38; average degree_{t2} = 2.55, SD_{t2} = 0.34; average degree_{t3} = 2.27, SD_{t3} = 0.29).

Prosocial behavior (T1-T2). Students rated their own prosocial behavior using the 16-item Prosociality Scale (Caprara et al., 2005). Sample items are *I am available for volunteer activities to help those who are in need*, *I try to help others*, and *I am empathic with those who are in need*. Each item was rated on a 5-point scale from 1 = (almost) never true to 5 = (almost) always true (M_{t1} = 3.48, SD_{t1} = 0.16, M_{t2} = 3.43, SD_{t2} = 0.19; α_{t1} = 0.90, α_{t2} = .91).

Sex. Participants were asked about their sex, which was coded 0 for boys and 1 for girls (for details see Appendix 5.A2).

5.2.4 Analytical Strategy

Analyses were conducted using longitudinal social network modeling (RSiena; Simulation Investigation for Empirical Network Analysis). This allowed us to unravel the development of aggression, victimization, friendship, and antipathy networks over time (Ripley et al., 2018) while taking into account network structural effects (e.g., reciprocity, transitivity) as well as students' individual covariates (e.g., sex and prosocial behavior). RSiena models are actor-based models (Snijders et al. 2010), which assume that actors (here; students) modify their relationships (here; aggression, victimization, friendships and antipathies) between assessments based on their individual preferences. The model determines likely trajectories between observations with the information from time 1 taken as a starting point. The estimates of the model are obtained through an iterative simulation following a Markov Chain Monte Carlo approach (Burk et al., 2007), expressing the strength of the effects included in the model. These unstandardized estimates are comparable to regression coefficients in (logistic) regression indicating the importance of each effect (predictor variables) in creating or maintaining a tie. Missing data due to non-response were handled through the RSiena default missing data method, and participants who joined and left the classrooms network in-between time points were treated using structural zeros (for details see Appendix 5.B1).

The model was estimated for each classroom separately using the Methods of Moments estimator and specifying 5,000 iterations in phase 3 for calculating standard errors. To test the four hypotheses and to keep the model parsimonious, two models were estimated: The first including friendship, aggression, and victimization networks (hereafter referred to as the friendship model), and the second one including antipathies, aggression, and victimization networks (hereafter referred to as the antipathy model). For each model (friendship and antipathy), two separate meta-analyses were conducted: the first for intervention classrooms and the second for control classrooms (for more details, see Appendix 5.B2). After that, test statistics³ were performed to examine significant differences between the parameter estimates related to the hypotheses. Finally, to help the interpretation and comparison between intervention and control classrooms, the expected relative importance of each effect was calculated for each classroom and then averaged

³ This test statistic results in a z score which under the null hypothesis of equal parameters with an approximately standard normal distribution (for more details see Ripley et al. 2018, p.87).

for intervention and control classrooms (Indlekofer & Brandes, 2013). This measure is analogous to an effect size measure capturing the influence of each effect on actor's decisions of creating or maintaining ties. The sum of the expected relative importance of all effects included in a model is 1.

5.2.5 Model selection procedure

The choice of the model parameters was based on recent research that used multiplex social networks analyses (Huitsing et al. 2012, 2014; Rambaran et al. 2015) as well as research on friendship and antipathy networks (Berger & Dijkstra, 2013) (for details see Appendix 5.B3). Moreover, time heterogeneity tests indicated no significant differences between effects' estimates across periods for most classrooms (for details, see Appendix 5.B4). Accordingly, the information from the two periods (from time 1 to 2, and from time 2 to 3) was examined in one model. Also, goodness of fit tests were conducted to assess how well the model reproduced auxiliary network statistics (outdegree, indegree, geodesic distance, and triad census distributions) of the observed data not explicitly fit in the model (Lospinoso, 2012). Overall, the results for the four types of networks indicated an excellent representation of the indegree, geodesic distance, and triad census distributions, and an acceptable representation of the outdegree distribution (for details see Appendix 5.B5).

5.2.6 Model specification

Structural network effects. These effects were included to capture the basic tendencies of actors to form and maintain relationships within the different types of networks. *Density* describes the tendency of actors to establish relationships. *Reciprocity* is the tendency to reciprocate relationships (referring to forming mutual ties). Only for friendship networks, two versions of the geometrically weighted edgewise shared partners (GWESP) were included: one to measure the tendency of students to become friends with the friends of their friends (*transitivity* GWESP FF), and other to capture the tendency toward non-hierarchical triadic structures (*cyclical* GWESP BB). For the four types of networks, the *indegree-popularity*, and *indegree-activity* effects were included representing the tendency of actors who receive many nominations to receive and to send more nominations over time, respectively. Finally, to improve the goodness of fit of the models, the *balance* effect was added, representing the similarity between the outgoing ties of student i and the outgoing ties of the other students j to whom i is tied, indicating the preference for classmates who choose the same as i . Because aggression and victimization were measured as perception networks, the reciprocity and triadic effects for both types of networks were not included.

Covariates. Sex and prosocial behavior were included as control variables, by including the selection effects for each of these covariates. These selection effects can be either dynamic (referring to change over time) or remain constant. Three selection dynamic effects (*prosocial behavior alter*, *prosocial behavior ego*, *prosocial behavior similarity*) and three selection constant effects (*sex alter*, *sex ego*, *same-sex*) were included. The alter and ego effects capture the effects of covariates on received nominations ("popularity" effect) or given nominations ("activity" effect), respectively. The same and similarity effects capture the effect of similarity for covariates on tie formation or maintenance between a focal actor (ego) and a peer (alter).

Cross-network effects. For the four types of networks, the entrainment effect was included, referring to the extent to which the existence of a tie from the student i to j promotes the creation or maintenance of a tie in another type of network from the student i to j . The four hypotheses

were tested through the effect of aggression and victimization ties on friendship ties (*hypotheses 1 and 2*), and the effect of aggression and victimization ties on antipathies ties (*hypotheses 3 and 4*), controlling for the four opposite effects (referring to the effect of friendships on aggression and victimization ties, and the effect of antipathies on aggression and victimization ties).

5.3 Results

5.3.1 Descriptive analysis

Table 5.1 provides descriptive information about the changes in the four types of networks from time 1 to 2 (period 1), and from time 2 to 3 (period 2). Distance shows that the number of tie changes was higher in the first period than in the second period. Similarly, Jaccard indexes (referring to tie stability between two consecutive assessments) indicate a substantial rearrangement of ties between assessments, with antipathy, aggression, and victimization ties being less stable than friendship ties. In the case of antipathy networks, previous research has shown its stability tends to be above .20 (Berger & Dijkstra 2013; Daniel et al. 2016; Rambaran et al. 2015). Also, Jaccard indexes in the first period were slightly higher than in the second period, suggesting an effect of the summer break (January and February in Chile) on classrooms' composition (referring to students who left classrooms at the end of the academic year, and students who joined classrooms at the beginning of the new academic year). Although a Jaccard index of at least .20 is recommended for using stochastic actor-oriented models (Ripley et al., 2018), satisfactory convergence was obtained (overall maximum convergence ratios < .20 and mean absolute individual *t* statistics < .10 for all models).

Table 5.1 Average changes in networks variables across the three observations for intervention and control classrooms

	Intervention classrooms (n=7)		Control classrooms (n=6)	
	T1 → T2	T2 → T3	T1 → T2	T2 → T3
N students total	256		274	
<i>Antipathy networks</i>				
Number of tie changes ^a	117.3	103.6	109.2	95.4
Jaccard index ^b	.15	.13	.18	.16
Creating tie (0 → 1)	68.0	62.4	62.5	61.3
Disolving tie (1 → 0)	65.0	71.1	62.2	68.0
Stable tie (1 → 1)	23.0	18.6	26.8	23.4
<i>Friendship networks</i>				
Number of tie changes	76.9	70.1	81.7	70.3
Jaccard index	.35	.30	.30	.27
Creating tie (0 → 1)	47.0	43.6	47.3	45.7
Disolving tie (1 → 0)	42.0	51.3	47.3	51.8
Stable tie (1 → 1)	43.7	39.3	41.3	36.3
<i>Aggression networks</i>				
Number of tie changes	104.9	91.0	83.8	81.0
Jaccard index	.20	.17	.27	.22
Creating tie (0 → 1)	62.6	56.4	52.8	47.6
Disolving tie (1 → 0)	56.0	64.9	49.2	59.0
Stable tie (1 → 1)	28.0	24.0	38.0	31.2

Table 5.1 Average changes in networks variables across the three observations for intervention and control classrooms (continued)

	Intervention classrooms (n=7)		Control classrooms (n=6)	
	T1 → T2	T2 → T3	T1 → T2	T2 → T3
Victimization networks				
Number of tie changes	104.3	90.7	97.4	84.8
Jaccard index	.14	.14	.23	.19
Creating tie (0 → 1)	67.3	57.1	55.6	51.2
Dissolving tie (1 → 0)	57.1	65.4	54.2	61.2
Stable tie (1 → 1)	20.9	20.3	32.0	25.8

Notes. ^a The Hamming distance reflects the total number of nominations in the network for which there is observed change between data observations and includes the sum of new nominations and lost nomination;

^b Network stability was measured by the Jaccard index, which reflects the number of changing relationships between assessments.

5.3.2 Longitudinal social networks analysis

Tables 5.2 and 5.3 present the results of the RSiena analyses for the friendship and antipathy models comparing intervention and control classrooms. Because the focus of this study was on the cross-network effects, the results of structural network effects and covariates (sex and prosocial behavior) were reported succinctly.

Structural network effects. Looking at the structural network effects between intervention and control classrooms revealed similar findings. The negative *density* effect for all types of networks indicates that in all two contexts, participants nominated less than half of their classmates as friends, rejected, aggressive, or victimized students. Also, friendship and antipathy nominations were reciprocal (positive *reciprocity* effect) and tended to be transitive for friendships; that is, friends of friends were likely to become friends (*Transitivity GWESP FF* effect). Moreover, students who received many antipathy, aggression, and victimization nominations tended to receive more nominations in each type of network over time (a positive *indegree-popularity* effect).

Covariates. In both types of classrooms, a significant same-sex preference in selecting friends (*same-sex* Est. _{intervention} = 0.189, $p < .05$; Est. _{control} = 0.338, $p < .001$) but not in disliking peers were found (*same-sex* Est. _{intervention} = -0.043, $p < .616$; Est. _{control} = -0.108, $p < .410$). Also, there were no significant effects of prosocial behavior on friendship or antipathies. Furthermore, regarding the friendship and antipathy model, boys only receive significantly more aggression (*sex* Est. _{control} = -0.374, $p < .001$; Est. _{control} = -0.448, $p < .001$) and victimization nominations in control classrooms (Est. _{control} = -0.200, $p < .05$; Est. _{control} = -0.203, $p < .05$).

Cross-network effects. For the effect of aggression on friendship nominations, there were no significant effects in both types of classrooms (*Aggression to Friendship* Est. _{intervention} = 0.090, $p = .842$; Est. _{control} = -0.657, $p = .171$). Moreover, neither a difference between the two effects' parameters ($z = 1.132$, $p = .128$) nor a difference in the expected relative importance for this effect was found (Int_{w1} = .02, Int_{w2} = .02, Int_{w3} = .01; Con_{w1} = .02, Con_{w2} = .02, Con_{w3} = .02). These results suggest that there is no relationship between perceiving someone as aggressive and nominating him/her as a friend (not supporting *hypothesis 1*). Also, no significant effects were found in both types of classrooms regarding the effect of friendship on aggression nominations (*Friendship to Aggression* Est. _{intervention} = -0.051, $p = .812$; Est. _{control} = -0.089, $p = .744$).

Table 5.2 Meta-analysis results from longitudinal multiplex models predicting Friendship, Aggression, and Victimization networks

Effects parameters	Intervention classrooms						Control classrooms							
	Est	SE	σ	Q	RI w1	RI w2	RI w3	Est	SE	σ	Q	RI w1	RI w2	RI w3
Friendship														
<i>Structural effects</i>														
Density	-0.859 **	0.224	0.000	3.608	.11	.12	.11	-1.000 **	0.230	0.002	2.433	.17	.17	.18
Reciprocity	1.190 **	0.294	0.558	12.480	.08	.08	.09	1.009 **	0.174	0.000	3.806	.07	.08	.08
Balance	0.261 **	0.038	0.000	2.190	.19	.21	.19	0.275 **	0.044	0.000	2.895	.26	.26	.25
Transitive GWESP FF	1.165 **	0.316	0.000	5.092	.12	.13	.14	1.137 **	0.302	0.000	3.393	.08	.09	.09
Cyclical GWESP BB	0.333	0.258	0.000	2.128	.05	.04	.04	-0.235	0.221	0.000	2.100	.02	.03	.02
Indegree - popularity	-0.053	0.034	0.000	2.903	.06	.07	.06	-0.100 *	0.035	0.000	2.306	.10	.10	.10
Indegree - activity	-0.425 **	0.080	0.000	1.527	.15	.14	.15	-0.160 *	0.071	0.000	0.993	.05	.05	.05
<i>Covariate effects</i>														
Sex (girls) alter	-0.033	0.126	0.209	11.456	.05	.05	.05	-0.143	0.095	0.135	0.000	.03	.03	.03
Sex (girls) ego	0.083	0.112	0.000	2.089	.01	.01	.01	-0.016	0.117	0.894	0.000	.01	.01	.01
Same sex ^a	0.189 *	0.089	0.092	6.394	.06	.06	.05	0.338 **	0.073	0.000	0.000	.09	.08	.08
Prosocial beh. alter	0.058	0.060	0.000	5.213	.02	.02	.02	0.104	0.075	0.162	0.000	.02	.02	.01
Prosocial beh. sex	0.009	0.089	0.000	4.806	.02	.02	.02	0.018	0.093	0.848	0.000	.01	.01	.01
Prosocial beh. similarity	-0.099	0.230	0.000	3.611	.02	.02	.02	0.279	0.394	0.478	0.681	.05	.05	.05
<i>Cross-network effects</i>														
Aggression to Friendship ^{a,b}	0.090	0.452	0.531	5.135	.02	.02	.01	-0.657	0.480	0.000	0.268	.02	.02	.02
Victimization to Friendship ^a	0.016	0.422	0.000	4.058	.03	.02	.02	0.061	0.301	0.000	3.106	.02	.02	.02
Aggression														
<i>Structural effects</i>														
Density	-1.503 **	0.100	0.001	6.361	.40	.39	.42	-2.048 **	0.266	0.560	21.611 *	.37	.36	.39
Balance	0.161 **	0.040	0.071	11.073	.17	.18	.15	0.046	0.068	0.131	14.335 *	.12	.11	.11
Indegree - popularity	0.082 **	0.011	0.020	12.383	.25	.25	.24	0.113 **	0.013	0.024	13.980 *	.31	.34	.33
Indegree - activity	0.008	0.010	0.000	1.195	.02	.02	.03	0.006	0.008	0.000	1.648	.02	.02	.02
<i>Covariate effects</i>														
Sex (girls) alter	-0.201	0.142	0.339	33.088 **	.08	.08	.08	-0.374 **	0.094	0.095	6.375	.08	.08	.07
Sex (girls) ego	0.019	0.074	0.000	0.845	.01	.01	.01	-0.044	0.079	0.000	0.163	.01	.01	.01
Prosocial beh. alter	-0.002	0.044	0.022	5.284	.02	.02	.02	0.102	0.062	0.000	1.917	.02	.02	.01
Prosocial beh. sex	-0.038	0.059	0.000	0.856	.01	.01	.01	-0.020	0.063	0.000	1.018	.01	.01	.01
<i>Cross-network effects</i>														
Friendship to Aggression	-0.051	0.215	0.296	7.157	.03	.02	.03	-0.089	0.273	0.000	2.913	.02	.02	.02
Victimization to Aggression	0.437 *	0.165	0.000	3.134	.03	.02	.03	0.579 *	0.176	0.001	5.514	.04	.04	.03
Victimization														
<i>Structural effects</i>														
Density	-1.503 **	0.094	0.000	3.083	.38	.38	.38	-1.561 **	0.196	0.392	16.443 *	.36	.37	.38
Balance	0.152 **	0.041	0.073	11.171	.18	.17	.16	0.141	0.079	0.166	21.579 *	.21	.22	.22
Indegree - popularity	0.085 **	0.009	0.012	7.378	.21	.23	.23	0.087 **	0.012	0.022	13.328 *	.26	.26	.23
Indegree - activity	-0.005	0.012	0.000	2.854	.03	.04	.05	0.003	0.009	0.000	0.939	.01	.01	.01
<i>Covariate effects</i>														
Sex (girls) alter	-0.207	0.117	0.267	28.699 **	.07	.07	.07	-0.200 *	0.069	0.002	5.071	.06	.06	.06
Sex (girls) ego	-0.012	0.073	0.000	1.921	.02	.02	.02	-0.054	0.073	0.000	1.002	.01	.01	.02
Prosocial beh. alter	-0.032	0.039	0.001	6.758	.03	.03	.03	-0.050	0.051	0.000	1.988	.02	.02	.02
Prosocial beh. sex	0.016	0.060	0.000	3.833	.02	.02	.02	-0.025	0.055	0.000	0.824	.01	.01	.01
<i>Cross-network effects</i>														
Friendship to Victimization	0.177	0.147	0.000	4.954	.03	.02	.02	-0.201	0.225	0.000	2.109	.02	.02	.02
Aggression to Victimization	-0.002	0.170	0.000	1.811	.02	.02	.02	0.071	0.191	0.236	5.635	.02	.02	.02

Notes. σ : standard deviation; Q: chi-squared test statistic; RI: Expected relative importance effects; ^a For one intervention classroom these effects were fixed to the average of the rest of the classrooms because of their high standards errors; ^b For two control classrooms these effects were fixed to the average of the rest of the classrooms because of their high standards errors.

* $p < .05$; ** $p < .001$.

Similarly, no support was found for the second hypothesis as it was no evidence that, first, adolescents were more befriended by classmates who considered them as victims in both types of classrooms (*Victimization to Friendship* Est. *intervention* = 0.016, $p = .969$; Est. *control* = 0.061, $p = .839$), and second, that a significant difference between the two effects' parameters ($z = -0.086$, $p = .465$) or a difference in the expected relative importance exists (Int_{w1}=.03 Int_{w2}=.02, Int_{w3}=.02; Con_{w1}=.02, Con_{w2}=.02, Con_{w3}=.02). Additionally, no significant effects in both types of classrooms were found regarding the effect of friendship on victimization nominations (*Friendship to Victimization* Est. *intervention* = 0.177, $p = .227$; Est. *control* = -0.201, $p = .372$).

In both intervention and control classrooms, adolescents were more disliked by classmates who considered them as aggressors (*Aggression to Antipathy* Est. *intervention* = 0.643, $p < .001$; Est. *control* = 1.061, $p < .001$). However, a difference between the two effects' parameters was found ($z = -1.74$, $p < .05$), as well as a difference in the expected relative importance for this effect (Int_{w1}=.08, Int_{w2}=.06, Int_{w3}=.06; Con_{w1}=.11, Con_{w2}=.09, Con_{w3}=.09) These results indicate that adolescents who were considered as aggressive were more disliked in control than intervention classrooms, which was in the opposite direction of the third hypothesis. This finding suggests that intervention classrooms could be more inclusive in terms of antipathy nominations, even for adolescents considered as aggressive. In addition, in both types of classrooms adolescents who were disliked were also perceived as aggressors (*Antipathies to Aggression* Est. *intervention* = 0.813, $p < .001$; Est. *control* = 1.082, $p < .001$).

Concerning the effect of victimization on antipathies (fourth hypothesis), adolescents who were perceived as victims were more disliked only in control classrooms (*Victimization to Antipathy* Est. *intervention* = 0.100, $p = .616$; Est. *control* = 0.499, $p < .05$). The comparison between the parameter estimates ($z = -1.76$, $p < .05$) and the expected relative importance of the effects (Int_{w1}=.02, Int_{w2}=.01, Int_{w3}=.02; Con_{w1}=.04, Con_{w2}=.03, Con_{w3}=.04), suggest that victimized adolescents were slightly less disliked by their peers in intervention than in control classrooms (consistent with the fourth hypothesis). In addition, adolescents who were disliked were also perceived as victims in intervention classrooms, although this effect only approached significance (*Antipathies to Victimization* Est. *intervention* = 0.545, $p = .052$; Est. *control* = 0.205, $p = .586$).

Additionally, and given that the hypotheses are at the classroom (referring to the network) level, it is also possible to confound those effects with mechanisms operating at the individual level. That means that adolescents with higher individual prosocial behavior will more strongly dislike and less strongly befriend whom they consider as aggressors, and less strongly dislike and more strongly befriend whom they consider as victims. To discard those hypotheses, supplementary analyses were performed to examine the interaction between students' prosocial behavior and the interplay of dyadic perception of aggression and victimization with friendships and antipathies. Results indicated no effects of the individual prosocial behavior on the extent to which students befriend and dislike classmates whom they considered as aggressive or victimized (see details in Appendix 5.B6).

Table 5.3 Meta-analysis results from longitudinal multiplex models predicting Antipathy, Aggression, and Victimization networks

Effects parameters	Est	Intervention classrooms						Est	SE	Control classrooms					
		SE	σ	Q	RI	RI	RI			Σ	σ	RI	RI	RI	
					w1	w2	w3					w1	w2	w3	
Antipathy															
<i>Structural effects</i>															
Density	-1.320 **	0.105	0.000	3.322	.37	.39	.40	-1.799 **	0.211	0.435	19.366 *	.36	.38	.40	
Reciprocity	0.316 *	0.103	0.000	4.694	.02	.03	.03	0.395 *	0.137	0.042	6.181	.03	.03	.03	
Balance	0.124 *	0.048	0.108	27.408 **	.16	.16	.15	0.037	0.048	0.092	14.211 *	.13	.13	.13	
Indegree - popularity	0.061 **	0.010	0.000	5.280	.14	.14	.12	0.080 **	0.010	0.000	4.809	.15	.17	.15	
Indegree - activity	-0.013	0.022	0.019	6.156	.05	.05	.05	-0.016	0.019	0.008	4.018	.02	.03	.03	
<i>Covariate effects</i>															
Sex (girls) alter	0.109	0.094	0.189	14.184 *	.05	.05	.05	0.053	0.072	0.000	3.630	.04	.03	.03	
Sex (girls) ego	0.057	0.073	0.000	0.549	.01	.01	.01	0.033	0.073	0.000	3.262	.01	.01	.01	
Same sex	-0.043	0.087	0.189	18.568 *	.06	.05	.05	-0.108	0.131	0.276	19.155 *	.06	.06	.05	
Prosocial beh. alter	-0.018	0.043	0.000	5.542	.02	.02	.02	0.009	0.056	0.047	4.893	.02	.02	.02	
Prosocial beh. sex	0.008	0.054	0.000	1.433	.01	.01	.01	-0.028	0.058	0.000	0.819	.01	.01	.01	
Prosocial beh. similarity	-0.129	0.142	0.000	1.627	.02	.02	.01	-0.077	0.187	0.000	1.870	.02	.02	.02	
<i>Cross-network effects</i>															
Aggression to Antipathy	0.643 **	0.156	0.000	4.172	.08	.06	.06	1.061 **	0.181	0.161	4.404	.11	.09	.09	
Victimization to Antipathy	0.100	0.199	0.000	2.336	.02	.01	.02	0.499 *	0.163	0.001	6.287	.04	.03	.04	
Aggression															
<i>Structural effects</i>															
Density	-1.661 **	0.111	0.002	7.316	.39	.39	.43	-2.187 **	0.268	0.555	19.491 *	.37	.37	.39	
Balance	0.159 **	0.041	0.074	11.524	.17	.17	.14	0.043	0.065	0.129	14.728 *	.11	.11	.11	
Indegree - popularity	0.077 **	0.011	0.021	12.657 *	.22	.23	.21	0.105 **	0.011	0.021	11.553 *	.27	.30	.29	
Indegree - activity	0.009	0.010	0.000	0.961	.02	.02	.03	0.006	0.008	0.000	1.995	.01	.02	.02	
<i>Covariate effects</i>															
Sex (girls) alter	-0.235	0.134	0.308	23.178 *	.07	.07	.07	-0.448 **	0.116	0.171	7.909	.08	.08	.08	
Sex (girls) ego	0.022	0.075	0.000	0.452	.01	.01	.01	-0.044	0.082	0.000	0.199	.01	.01	.01	
Prosocial beh. alter	0.001	0.047	0.018	5.411	.02	.02	.02	0.087	0.061	0.000	1.572	.02	.02	.01	
Prosocial beh. sex	-0.027	0.061	0.000	0.736	.01	.01	.01	-0.035	0.063	0.000	1.172	.01	.01	.01	
<i>Cross-network effects</i>															
Antipathy to Aggression	0.813 **	0.209	0.232	6.389	.07	.05	.05	1.082 **	0.226	0.000	1.381	.09	.06	.06	
Victimization to Aggression	0.432 *	0.181	0.000	3.980	.02	.02	.02	0.349	0.238	0.298	6.720	.03	.03	.02	
Victimization															
<i>Structural effects</i>															
Density	-1.498 **	0.102	0.048	5.320	.35	.35	.36	-1.633 **	0.200	0.396	16.329 *	.36	.37	.38	
Balance	0.163 **	0.039	0.065	9.408	.16	.16	.15	0.143	0.079	0.165	22.525 **	.20	.21	.21	
Indegree - popularity	0.085 **	0.009	0.010	6.424	.19	.21	.22	0.090 **	0.012	0.021	12.213 *	.25	.25	.22	
Indegree - activity	-0.003	0.012	0.000	2.761	.02	.03	.03	0.005	0.010	0.000	1.349	.02	.02	.01	
<i>Covariate effects</i>															
Sex (girls) alter	-0.226	0.128	0.287	23.677 *	.08	.08	.08	-0.203 *	0.073	0.000	3.420	.05	.05	.05	
Sex (girls) ego	-0.004	0.075	0.000	1.983	.02	.02	.02	-0.047	0.077	0.000	0.985	.01	.01	.02	
Prosocial beh. alter	-0.039	0.042	0.003	6.315	.03	.03	.03	-0.043	0.052	0.000	1.355	.02	.02	.02	
Prosocial beh. sex	0.005	0.065	0.000	3.535	.02	.02	.02	-0.027	0.056	0.000	1.000	.01	.01	.01	
<i>Cross-network effects</i>															
Antipathy to Victimization	0.545	0.281	0.002	7.997	.09	.07	.06	0.205	0.377	0.501	7.732	.06	.04	.06	
Aggression to Victimization	-0.019	0.243	0.000	4.863	.05	.04	.04	0.005	0.253	0.000	1.905	.02	.02	.02	

Notes. σ : standard deviation; Q: chi-squared test statistic; RI: Expected relative importance effects
 * $p < .05$; ** $p < .001$.

5.4 Discussion

Peer relationships play a central role in adolescents' social development. Peer relationships might take positive forms, such as friendships (Bagwell & Smith, 2011), but also negative forms, such as antipathies (Berger et al., 2011). Both types of relationships can be affected by how students perceive peers' aggression and victimization. However, aggression and victimization may be evaluated and appreciated differently in classrooms depending on the extent that classrooms' social norms sanction aggression, or promote and value prosocial behaviors. One way to change social norms is via educational interventions that can foster positive and more inclusive classroom environments.

This study examined whether the interplay of the dyadic perception of aggression and victimization with friendship and antipathy networks unfolds differently in classrooms that were part of a school-based intervention for promoting prosocial behaviors and civic engagement, using data from 530 Chilean seventh-grade students. A longitudinal social network approach was used to test the four hypotheses. In the models, the coevolution of aggression, victimization, and friendship or antipathies ties were modeled simultaneously controlling for network structural effects as well as the impact of prosocial behavior and sex.

It was expected that adolescents participating in this intervention would be less befriended by classmates who considered them as aggressors and more befriended by classmates who considered them as victims, compared to control classrooms. The effects of aggression and victimization on friendships were not significant in either intervention or control classrooms. An explanation for this finding might be that friendships, compared to antipathies, are more stable and permanent over time (Daniel et al., 2016; Hayes, 1978). Therefore, it might be that prosocial interventions are more successful in ceasing antipathies than modifying friendships. Overall, positive classroom contexts seem to counteract the negative consequences of being disliked for aggressive and victimized students. Promoting prosocial behaviors across adolescence may reinforce a peer context in which externalizing (i.e., aggression) and internalizing (i.e., isolation) peer behaviors might be attenuated by the inclusive role of prosocial tendencies, where adolescents can support and cooperate with peers above and beyond their personal characteristics and their status in the peer network.

It also was anticipated that adolescents in intervention, compared to control classrooms, would be more disliked by classmates who considered them as aggressors and less disliked by classmates who considered them as victims. The findings indicate that in intervention classrooms, adolescents who were considered as victims by peers were less likely to be disliked by those same peers. Similarly, compared to control classrooms, in intervention classrooms, adolescents who were considered as aggressive by peers were less likely to be disliked by those same peers. Even though this might seem counterintuitive since aggression should be more sanctioned in prosocial classrooms, it might be that in these classrooms sanctions to aggressive peers are not associated to social exclusion, but to other means, for example, by a decrease in social status instead of an increase in antipathy nominations. In other words, aggression may become less salient as a social asset in intervention classrooms. Together, the results show that the intervention was associated with classrooms in which perceived aggressors and victimized adolescents were less disliked. In this direction, educational interventions might be helpful in terms of reducing their involvement in antipathies, and consequently, its negative consequences. Positive peer contexts, including social support from peers, can serve a protective function, especially for victims (Storch et al., 2003). These results stress the importance of developing prosocial and empathic skills in schools.

One important feature of this study was the novel use of the dyadic perception networks, specifically about aggression and victimization. Previous research on peer relations (e.g., Dijkstra et al. 2012; Logis et al. 2013) has often treated aggression and victimization as individual characteristics by aggregating the dyadic information in proportion or standardized scores per student. However, this approach comes with the cost of losing the dyadic information (e.g., an aggression nomination of the student i over student j). Only recently, studies (Kisfalusi et al., 2019; Pál et al., 2016) have investigated the effect of the dyadic perception of disdain and respect on disliking and gossiping relationships, suggesting the importance of incorporating the dyadic perception on the study of peer relationships' dynamics. Precisely, the combination of dyadic perception networks and multiplex social networks models represents an advance for modeling different types of networks (perceptions and relationships) simultaneously. This approach may open a promising area for further research that examines the effects of interventions on how perceptions of peers' behaviors are associated with actual relationships with them.

5.4.1 Limitations and future directions

This study has some limitations that should be considered. First, in this study, aggression, victimization, friendship and antipathy networks were constrained within school classes, as Chilean students spend most of their time in the same class. However, peer relationships may also occur at the grade or school level, and even outside school (Kerr et al., 2007), and particularly in the realm of problem behaviors (Kiesner et al., 2003, 2004). Future research can examine these various contexts (e.g., classroom, grade, school, and outside of school), providing a complete picture of the interplay of different types of peer relationships (Veenstra & Dijkstra, 2011). Second, the fact that the maximum number of nominations was established on three could artificially limit the selection of classmates for the four types of networks, especially for friendships. There is evidence that the average number of friendship nominations per student tend to be higher than three (e.g., Gremmen et al. 2018; Laninga-Wijnen et al. 2018; Rulison et al. 2013) also being larger in comparison to other types of networks such as antipathies, aggression, victimization, bullying, and defending (Daniel et al., 2016; Fujimoto et al., 2017; Huitsing et al., 2014, 2019).

Finally, due to the limited number of nominations, the focus of this study was limited to the interplay of the perception of aggression and victimization, and friendships and antipathies at the dyadic level. However, this interplay could also occur at both actor- and triadic-level. Future research should include these two levels by examining, for example, whether students less strongly dislike those who are generally considered as aggressor or victim, and whether friends tend to agree in their perception of a third classmate as an aggressor or victim.

5.5 Conclusion

Both positive (e.g., friendships) and negative relationships (e.g., antipathies) can be affected by aggression and victimization, but also by how students perceive peers' behaviors (Kisfalusi et al., 2019; Pál et al., 2016). The present study focuses on the associations between adolescents' dyadic perceptions of peers' aggression and victimization and peer relations, also considering how these associations differ in classroom contexts with different levels of prosocial norms. This study constitutes a methodological advance by combining the use of longitudinal multiplex social networks analysis with dyadic perception networks to examine the interplay of different types of adolescents' relationships. The results indicate that dyadic perceptions of aggression and victimization have a significant effect on antipathies. This approach overcomes limitations of using

Chapter 5

aggregated scores on aggression and victimization based on peer nominations, acknowledging the particularity of dyadic perceptions and how these might affect the formation and maintenance of interpersonal ties. From an intervention perspective, these results evidence that educational interventions aimed at promoting prosocial behavior and civic engagement can play a significant role in how these perceptions are intertwined in adolescent peer dynamics. In this sense, prosocial interventions could protect students by fostering social settings in which antipathies are less associated with aggression and victimization at the dyadic level. This study provides insights for research-based intervention strategies designed to promote adolescents' positive relationships in the classroom context.

Appendix
Appendix 5.A1
Classroom network information

Table 5.1A Descriptive classroom network information

Class	Type	N	% missing			Friendship AvD			Antipathy AvD			Aggression AvD			Victimization AvD		
			T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
1A	INT	47	.15	.14	.18	2.49	2.82	2.91	2.54	2.82	2.89	2.44	2.82	2.89	2.34	2.80	2.71
1B	INT	50	.07	.05	.07	2.24	2.66	2.45	2.26	2.66	2.45	2.05	2.60	2.41	1.90	2.58	2.23
2A*	INT	34	.16	.22	.19	1.71	2.27	1.59	1.78	2.27	1.63	1.78	2.27	1.49	1.74	2.27	1.52
2B	INT	30	.10	.06	.00	2.73	2.70	2.17	2.99	2.77	2.13	2.81	2.70	2.17	2.77	2.73	2.13
2C	INT	29	.26	.18	.13	2.46	2.35	1.94	2.64	2.39	1.98	2.64	2.39	1.98	2.41	2.26	2.06
3A*	INT	48	.02	.02	.08	2.49	2.81	2.57	2.49	2.81	2.46	2.44	2.81	2.37	2.47	2.76	2.55
4A	INT	35	.06	.03	.02	2.66	2.73	2.43	2.78	2.73	2.46	2.75	2.73	2.40	2.48	2.70	2.22
4B	INT	34	.00	.05	.00	2.85	2.83	2.47	2.91	2.82	2.47	2.71	2.79	2.35	2.56	2.63	2.21
4C	INT	31	.00	.00	.00	2.90	2.74	2.45	2.77	2.65	2.00	2.74	2.74	2.13	2.39	2.52	1.74
5A	CON	43	.11	.11	.16	2.60	2.57	2.34	2.65	2.57	2.34	2.57	2.65	2.34	2.63	2.55	2.34
6A	CON	40	.23	.23	.17	2.54	2.62	2.18	2.54	2.62	2.18	2.46	2.42	2.12	2.47	2.55	2.18
6B	CON	39	.18	.18	.11	2.99	3.00	2.42	2.99	3.00	2.34	2.95	2.97	2.37	2.89	2.97	2.37
7A	CON	50	.14	.14	.18	2.26	2.30	2.33	2.28	2.30	2.33	2.21	2.30	2.28	2.30	2.23	2.23
7B*	CON	47	.04	.04	.02	2.62	2.26	2.41	2.64	2.37	2.36	2.60	2.35	2.30	2.44	2.28	2.36
7C	CON	51	.17	.13	.18	2.13	1.89	2.28	2.13	1.87	2.28	2.13	1.89	2.28	2.13	1.89	2.16
8A	CON	51	.19	.20	.18	1.72	1.79	1.82	1.69	1.91	1.72	1.67	2.03	1.86	1.50	1.72	1.62
Av./Total	-	659	.12	.11	.10	2.46	2.52	2.30	2.51	2.53	2.25	2.43	2.53	2.23	2.34	2.47	2.16

Notes. Type: Type of classroom (INT: Intervention classrooms; CON: Control classrooms); N: the total number of students in the three measurement times; AvD: network average degree; *classrooms removed from the analyses

Appendix 5.A2
Covariates information

Table 5.2A Percentage of girls and average of prosocial behavior per classroom

Classroom	% of Girls	Prosocial Behavior	
		Time 1	Time 2
1A	44	3.69	3.55
1B	49	3.54	3.63
2B	50	3.10	3.01
2C	48	3.17	3.14
4A	47	3.56	3.47
4B	50	3.57	3.41
4C	39	3.44	3.34
5A	58	3.55	3.49
6A	56	3.50	3.26
6B	68	3.52	3.51
7A	50	3.49	3.67
7C	64	3.60	3.53
8A	68	3.50	3.60
Av./Total	53	3.48	3.43

Appendix 5.B1

Missing data and composition change

For the four types of networks, ordinary missing data were handled through the default RSiena procedure called last value carried forward method (Ripley et al., 2018) in which the impact of imputations on the results is minimized (Huisman & Steglich, 2008). For each missing tie variable, the non-missing value (if any) is imputed; if the previous values are missing as well, the value 0 (referring to the absence of a tie) is assigned. Whenever imputed values are used, parameter estimate updates are based on the non-imputed parts of the data. Missing covariate data are, by default, replaced by the variable's global mean.

To account for classroom composition changes (e.g., participants joining and leaving classrooms at the beginning or the end of the school year), structural zeros were specified for all ties toward and from participants who were absent at a given observation (Ripley et al., 2018).

Appendix 5.B2

Meta-analytic procedure

The bivariate estimations of the fifteen classrooms were summarized using a meta-analytic procedure with the *metafor* package in R (Viechtbauer, 2010). This approach estimates and tests the mean as well as the standard deviation of each effect included in the model, using a method based on an iterated weighted least squares method and without making the assumption of a normal distribution (for more details, see Snijders and Baerveldt 2003). For each model (friendship and antipathy), two meta-analyses were performed; one for intervention classrooms, and other for control classrooms.

Appendix 5.B3

Model specification

The choice of the model parameters was based on a combination of three aspects: to control for structural networks effects (e.g., reciprocity, transitivity, balance) and relevant covariates (e.g., sex, prosocial behavior); to capture the interaction between networks adequately (e.g., the effect of one type of network on another type of network); and to keep the model parsimonious by assessing model convergence and goodness of fit. Specifically, three types of effects were included: structural network effects that model how the changes in each network depend on the network itself; cross-network effects that model how the changes in each network depend on the other network (e.g., antipathies depending on aggression); and covariate effects that model how changes in each network depend on actors' attributes.

Appendix 5.B4
Time heterogeneity tests

By conducting time heterogeneity tests for each classroom, it was evaluated whether the effects' estimates differed across the two periods. The overall test, including all the effects present in the models, indicated that time heterogeneity occurred only in a small subset of classrooms (three classrooms in the friendship model, and one classroom in the antipathy model). For this subset of classrooms, it was examined whether the cross-network effects (related to the four hypotheses) differed significantly across the two periods. Because the estimate for one cross-network effect (Aggression to Antipathy) in only one classroom differed significantly across periods, it was decided not to include additional effects in the model representing time heterogeneity.

Appendix 5.B5
Goodness of fit

The goodness of fit of the models was assessed by examining the extent to which the models explained additional features of the academic and friendship networks that were not explicitly included in the model specification. For the four types of networks, the distribution of outdegrees, indegrees, geodesic distance, and triad census were evaluated. The goodness of fit is assessed by comparing the Mahalanobis distance of the observations to the mean of the simulated values and computing the associated p -value (for more details, see Ripley et al. 2018). For the four statistics, the vast majority of the p -values for each type of classroom were between .10 and .90, indicating a good fit. The cases of unsatisfactory fit were associated with the outdegree distribution, in which the model slightly overrepresented the number of outgoing nominations with values of one and two, and underestimated the outdegrees with a value of three. An explanation for this poorer fit is that the number of outgoing nominations in each assessment point was limited to a maximum of three.

Appendix 5.B6
Alternate models

To examine whether adolescents with higher individual prosocial behavior will more strongly dislike and less strongly befriend whom they consider as aggressors, and less strongly dislike and more strongly befriend whom they consider as victims, two interaction effects were included in each model. While for the friendship model, the *prosocial behavior x aggression to friendship*, and the *prosocial behavior x victimization to friendship* effects were included, for the antipathy model the *prosocial behavior x aggression to antipathy*, and the *prosocial behavior x victimization to antipathy* effects were included. The friendship and antipathy model were firstly estimated for each classroom, and then, the information was aggregated by conducting two meta-analyses (one for intervention and another for control classrooms).

In the case of the friendship model, because of the addition of these interaction effects, some classrooms presented convergence problems (i.e., low reliability of estimates). Accordingly, when necessary, one of the two interaction effects were fixed to the effect's average of the rest of the classrooms of its type (intervention or control). The results of the meta-analysis showed no significant effects for the two interaction effects in either intervention (Est. *pros. beh. x aggression to friendship* = 0.171, $p = .844$; Est. *pros. beh. x victimization to friendship* = -1.534, $p = .273$) or control classrooms (Est. *pros. beh. x aggression to friendship* = -0.486, $p = .642$; Est. *pros. beh. x victimization to friendship* = -0.935, $p = .193$). In the case of the antipathy model, all the classrooms presented good convergence indicators. No significant effects were found for the two interaction effects in either intervention (Est. *pros. beh. x aggression to antipathy* = -0.176, $p = .454$; Est. *pros. beh. x victimization to antipathy* = -0.212, $p = .570$) or control classrooms (Est. *pros. beh. x aggression to antipathy* = -0.174, $p = .516$; Est. *pros. beh. x victimization to antipathy* = 0.049, $p = .888$). Overall, these results suggest no effects of individual prosocial behavior on the extent to which aggressive and victimized adolescents are befriended and disliked.



Conclusion and Discussion

6.1 Summary and discussion of the findings

During adolescence, peer relationships not only reach their peak in terms of frequency and prominence (Giordano, 2003; Johnson et al., 2011) but also grow in complexity by including both positive (e.g., friendships, academics) and negative relationships (e.g., antipathies, bullying). Moreover, the social context starts to influence peer relationships by affecting which behaviors are sanctioned or reinforced and, consequently, which behaviors are associated with high and low status (Dijkstra & Gest, 2015).

In this dissertation, I studied the interplay of different types of peer relationships in schools. In Chapters 2 and 3, I addressed the extent to which academic relationships are affected by friendships and adolescents' characteristics, such as academic performance, school misconduct, and prosocial behavior. Furthermore, in Chapters 4 and 5, I examined the extent to which adolescents' perceptions of peers' behavior (aggression, prosociality) and characteristics (victimization, popularity) affect peer relationships, such as friendship and antipathy networks.

In this concluding chapter, I will first summarize the main findings of the four empirical studies. Second, I will discuss these findings focusing on the role of 1) the interdependence of networks, 2) the peer context, and 3) the perceptions of peers' behaviors. Finally, I will discuss the limitations and potential directions for future research.

6.2 Main Findings

In Chapter 2, I focused on the link between classroom ability grouping strategies and academic (*who do you study with?*) and friendship relationships. Specifically, I examined whether the interplay of friendships and academic relationships and their association with academic performance and school misconduct differs when comparing three types of classroom ability composition (i.e., high-, low-, and mixed-ability classes). The results showed that academic relationships in high-ability classrooms were driven by a preference to form and maintain relationships with high-achieving students as well as to avoid academic relationships with students engaged in school misconduct. Conversely, academic relationships in low-ability classrooms were driven by neither academic performance nor school misconduct. Finally, the findings indicated not only that friends study together but also that studying partners become friends across all types of classrooms.

In Chapter 3, I examined which characteristics are associated with preferred academic partners (*with whom would you like to study at school?*). Specifically, I analyzed the extent to which adolescents' selection of preferred academic partners is driven by peers' individual (academic performance and prosocial behavior) and dyadic characteristics (friendships). The results indicated that adolescents were more likely to select high-achievers, friends, and prosocial peers as preferred academic partners. Moreover, high-achievers were more likely to choose other high-achievers as well as friends as preferred academic partners.

In Chapter 4, I examined whether friendship selection differs when considering adolescents' perceptions of their peers' behavior (*dyadic perception*) or the reputation of those peers (*reputational perception*). Specifically, I analyzed the effects of the dyadic and reputational perceptions of prosociality, aggression, and popularity on friendship selection. The findings indicated that adolescents preferred to befriend peers that were widely perceived as prosocial (*reputational perception*). Conversely, adolescents were less likely to befriend classmates whom they perceived as aggressive on the dyadic level. Finally, adolescents preferred to befriend peers that were perceived as popular by peers.

In Chapter 5, I analyzed the extent to which adolescents befriend or dislike peers whom they consider aggressors or victims, comparing classrooms that received an intervention to promote prosocial behavior with classes without the intervention. The findings showed that classmates perceived as aggressive or victims were less likely to be disliked in classrooms that were part of the intervention group.

6.3 Discussion

6.3.1 The interdependence of peer relationships

In this dissertation, I adopted a multiple network perspective. The concept of multiplexity describes situations in which two or more types of relationships (e.g., friendship and help) co-occur between individuals. The findings of previous multiplex studies show that one type of relationship is not only a consequence of individuals' behaviors and characteristics but may also emerge as the result of the association with other types of relationships (e.g., Huitsing et al., 2014; Rambaran et al., 2020; van der Ploeg et al., 2020).

In Chapters 2 and 3, I focused on the interplay of two positive relationships: academic relationships and friendships. In Chapter 2, the results showed a strong association between academic and friendship networks, indicating that adolescents tend to study with friends but also that friends tend to study together. Similarly, in Chapter 3, adolescents chose friends as preferred academic partners. These findings suggest that academic relationships foster friendships and vice versa, resembling previous findings on the interplay of friendship and helping relationships (Van Rijsewijk et al., 2016, 2019). The formation and maintenance of academic relationships might be linked to experience affective and safe environments. Indeed, the results of this dissertation showed that adolescents chose not only friends but also prosocial peers as preferred academic partners. High-achieving students, who already enjoyed academic success, also were more likely to nominate friends as preferred academic partners. Friendships were frequently linked to the provision of other positive relationships (e.g., academic, helping) and the access to the resources associated with them. For instance, friendship stability can affect academic performance (Lessard & Juvonen, 2018) by altering the access to resources for emotional support, advice, and assistance with academic tasks (Wentzel, 1993).

However, to advance the understanding of the conditions in which academic and friendship relationships unfold, it is necessary to conduct analyses that distinguish 1) the creation and maintenance of academic and friendship ties and 2) unilateral and mutual relationships (e.g., non-reciprocal and reciprocal friendships). In this line, a recent study by Van Rijsewijk et al. (2019), which analyzed the interplay of friendship and help networks (*who helps you with problems such as homework, repairing a flat [bicycle] tire, or when you are feeling down?*), found that mutual help was important for the maintenance of friendship, but not for the initiation of friendship. Moreover, mutual friendships provided a context in which help took place. This could mean, in the case of academic and friendship networks, that studying together with others is related to the maintenance and not the formation of friendships. Reciprocal, probably high-quality friendships, offer perfect conditions for studying together and are important to maintain.

Overall, the findings of this dissertation indicate the importance of adopting a multiplex perspective. Peer relationships, such as academic or friendship relationships, cannot and should not be examined in isolation. Therefore, to understand the dynamics of a specific relationship, it is important to examine its interplay with other types of relationships.

6.3.2 The peer context

Adolescents' peer relationships with friends or academic partners are also embedded within the broader peer context of the classroom. In Chapter 2, I focused on the link between classroom ability grouping strategies and academic relationships and friendships. It was expected that classroom ability composition would impact the interactions among adolescents by modifying their opportunities to interact with students with different academic performance. Specifically, I examined whether the interplay of academic relationships and friendships and its association with academic performance and school misconduct differ when comparing three types of classroom ability composition (i.e., high-, low-, and mixed-ability classes). The results suggested important differences in the formation and maintenance of academic networks comparing high- and low-ability classrooms. Particularly, in high-achieving classrooms, academic performance appeared to be central in shaping positive relationships such as friendships and study partners, whereas this was not the case in low-achieving classrooms. As a consequence, academic relationships seemed to be structured more around academic success, making students in high-ability classrooms more prone to achieve academic success because they are able to access support through their friendship networks. Moreover, these findings were consistent with high achievers being attractive as advisers or helpers (Snijders et al., 2013), and with students engaged in deviant behavior (e.g., school misconduct, truancy) being avoided in academic relationships by their classmates (Rambaran et al., 2017).

Moreover, results presented in Chapter 5, results showed that, compared with control classrooms, adolescents in intervention classrooms who were considered aggressive or seen as victims by their peers, were less disliked by the same classmates. The findings suggested that the promotion of prosocial behaviors can protect against peer rejection, especially for victims and aggressive peers (Storch et al., 2003). Nevertheless, victims and aggressive peers were as unlikely to be befriended in the prosocial intervention classrooms as in the control classrooms. This points at an interesting asymmetry, where victims and aggressors were less negatively rejected and not more positively accepted. An explanation for this might be that friendships, compared with antipathies, are more stable and permanent over time. Therefore, it might be that prosocial interventions are more successful in ceasing antipathies than modifying friendships. As prosocial environments could protect, particularly aggressive and victimized students of being disliked, these findings stress the importance of developing prosocial skills in schools.

Together, these results suggest that the social context can shape the development of peer relationships, such as academic, friendship, and antipathy networks. First, academic performance and school misconduct were differently evaluated and associated with academic relationships in high- and low-ability classrooms. Second, adolescents perceived by their peers as aggressive or victims were significantly less rejected in classrooms that received an intervention on prosocial behavior and civic engagement. Together, both studies indicate that the social context plays an important role in the development of peer relationships through characteristics such as classroom ability composition and interventions on prosocial behavior.

The implications for researchers and educational policymakers are that prosocial interventions might protect students by fostering social settings in which adolescents perceived as aggressive or victims are less likely to be rejected. Victims tend to benefit from prosocial school environments by exhibiting significantly less anxiety, loneliness, and unsafety (Schacter & Juvonen, 2018). Similarly, recent findings suggest that schools that promote inclusiveness and equity can foster positive relationships among students (Rivas-Drake et al., 2019) as well as that schools with

a positive climate can reduce the prevalence of bullying and victimization (Fink et al., 2018; Van Ryzin & Roseth, 2018).

6.3.3 The perception of peers' behavior

In Chapters 4 and 5, adolescents were asked about their perceptions of peers' behaviors and characteristics, such as prosociality, aggression, victimization, and popularity. The idea behind the two chapters was that adolescents evaluate the behaviors and characteristics of their peers based on whether peers contribute to the fulfillment of affection or status (Chapter 4) and on the prosocial environment of their classroom (Chapter 5).

The study in Chapter 4 incorporated the distinction between dyadic (adolescents' individual perception of a peer's behavior) and reputational perception (the consensual reputation of a peer). The results of this chapter showed the importance of distinguishing between dyadic and reputational perception when examining prosociality, aggression, and popularity. As expected, adolescents avoided befriending peers whom they perceived as aggressive and befriended peers who were widely perceived as popular. Conversely, adolescents befriended peers widely perceived by others as prosocial instead of befriending peers whom they themselves perceived as prosocial. These results suggest that adolescents may consider that peers perceived as prosocial by reputation are associated with being kind and empathic to others, turning them into more trustworthy as friends.

Chapter 5 focused on the importance of the dyadic perception of peers' aggression and victimization for selecting friends, comparing intervention with control classrooms. The findings revealed that intervention classrooms fostered environments in which adolescents perceived as aggressive or seen as victims by peers were less disliked by those same peers. The results suggest that the perception of others' behaviors and characteristics, as well as the relationships established with them are affected by the classroom context.

Earlier studies on examining characteristics that contribute to peer relationships such as friendships or antipathies often aggregated peer nominations (e.g., who is popular, who cooperates with others) at the group level by counting the number of individual nominations received by each student in the classroom (or grade), and then either standardized these scores (z -scores) or divided them by the total number of possible nominations (proportion scores). These scores tend to reflect the agreement among peers about behaviors or characteristics of adolescents, such as friendships, popularity, or victimization. However, individual students may not have nominated the same adolescent as aggressive and as a friend, even in cases where researchers find a positive correlation between aggressive behavior and friendship nominations (Kiefer & Ryan, 2011; LaFontana & Cillessen, 2002). This dissertation shows that the study of peer relationships should be careful in interpreting the effects of aggregated measures because they do not have the same meaning as dyadic measures. Whereas, in some scenarios, the reputational perception is more important; in others, the dyadic perception seems to play a more crucial role. Consequently, the best option is to examine both simultaneously, but if that is not possible, the interpretation should be cautious, noticing that reputational measures do not necessarily follow the same pattern as dyadic measures.

Incorporating the adolescents' perception of the behaviors and characteristics of their peers as predictors of peer relationships offers an exciting avenue for future research. First, it provides a closer look at how adolescents see the behaviors and characteristics of their peers, and consequently, how these evaluations are associated with actual relationships with them. Second, it offers a way to examine the extent to which adolescents establish relationships with classmates

based on a match between their own goals (e.g., affection, status) and their evaluations on peers' behaviors and characteristics. For instance, adolescents who score high in status goals might befriend or help peers that they perceive as popular or admired. Third, it allows connecting the individual and group-level characteristics by linking, for example, how the evaluation of peers' behavior and characteristics, and its association with peer relationships (e.g., friendship, antipathies) are linked to characteristics such as classroom climate or norms. Finally, it provides a way to study whether adolescents align and conform to their evaluations and peer relationships with that of their peers or friends (Fiske et al., 2002).

6.4 Limitations and directions for future research

This dissertation provides new insights into adolescents' peer relationships by focusing on the interplay of different types of peer relationships, the role of the peer context, and the perception of peers' behavior. However, the findings should be interpreted, bearing in mind some limitations, which, in turn, suggest different avenues for future studies. I focused on four topics: the inclusion of information on adolescents' relationships outside schools, the quality of peer relationships, the role of students' goals for establishing peer relationships, and missing network data.

6.4.1 Outside school relationships

As the focus of this dissertation was on peer relationships in classroom contexts, I did not measure relationships between adolescents' social networks outside the school context (Kiesner et al., 2003). Classrooms are close contexts in which students not only spend a lot of time, but they also facilitate the study and collection of peer-relationships data. However, it is important to acknowledge that this is not the whole picture. Helping relationships such as academic relationships can also happen outside schools. For example, adolescents might search for help in extracurricular activities such as arts, sports, being part of an orchestra or band (Pierce et al., 2010). Future studies can incorporate this consideration to gain better and fine-grained knowledge about peer relationships such as academics and friendships.

6.4.2 Quality of relationships

A common assumption of social network analysis is that all peer relationships are equally important. However, adolescents might have closer relationships and more interactions with some peers than with others (Granovetter, 1973). For instance, close friendships are more likely to involve the exchange of intimacy, companionship, and time spent together (Berndt, 2002), whereas weaker friendships do not provide most of these characteristics. Moreover, the quality of peer relationships, such as friendships, might be directly related to the interplay with other relationships such as studying together. For example, academic relationships may be more likely to occur in high-quality friendships. Students can be asked about their relationships with friends and academic partners, focusing on the contact duration, frequency, and diversity of contact. Alternatively, recent developments such as wearable devices (e.g., Bluetooth beacons) make it more feasible to measure the characteristics of social contact by assessing physical proximity between students (Goh et al., 2019).

6.4.3 The role of students' goals

In this dissertation, I analyzed the extent to which adolescents establish their relationships based on peers' individual (e.g., academic performance, prosocial behavior) and dyadic characteristics

(e.g., friendships, aggression). I assumed that there were several goals behind establishing peer relationships, such as friendships and academic relationships. For instance, adolescents can focus on improving their academic success by selecting high-achieving classmates as study partners or focus on studying with more approachable and friendly classmates by choosing prosocial peers and friends, respectively. However, adolescents' goals were not directly measured in the different chapters of this dissertation. Examples of goals that can be included in future research are achievement goals such as mastery (focus on developing academic competence) and performance goals (focus on social comparison and competition), status (focus on power and dominance), and affection (focus on love and intimacy) (Shin & Ryan, 2014b; Sijtsema et al., 2019). Incorporating such information could help to elucidate questions such as: Do students befriend high achieving prosocial peers because they are more likely to help them with their homework or because they are genuinely more pleasant to be around? (Chapter 3), or Do students strategically try to befriend people who are perceived by others as popular to gain status and respect from the group? (Chapter 4).

6.4.4 Missing Network Data

In this dissertation, network missing data due to nonresponse were handled using the RSiena missing data procedure (Huisman & Steglich, 2008) for classes with 20% or less of network missing data. Classes with higher levels of missing data (above 20%) were excluded from the analyses. This exclusion considerably reduced the sample size in Chapters 2 and 4. However, recent developments in multiple imputation methods for social network analysis offer a way to overcome this issue (Krause et al., 2018, 2020). The use of these methods, in cases with moderate missing data (20% or more), will lead to not only more reliable estimates than using the standard estimation procedures (e.g., methods of moments), but also to preserve and analyze larger samples of networks (e.g., classrooms, schools).

6.4.5 The role of the social and cultural context: Chilean schools

Studying different socio-cultural contexts allows evaluating the normative character of peer processes in diverse populations helping to identify common patterns in peer relationships and groups. In this dissertation, I focused my attention on Chilean schools, which present some particularities. In the Chilean educational system, students tend to remain together with the same classmates for at least their whole primary education (grades 1 to 8), and commonly also through their secondary education (grades 9 to 12). As a result, classrooms constitute highly stable contexts. Also, the ethnic composition of the Chilean society is quite homogeneous, with 91% of the population self-identifying as white (or mixed-race with European ascendancy), and only 9% of the national population identifying themselves as belonging to an indigenous ethnic minority, with even a lower proportion (7%) in Santiago (Ministerio de Desarrollo Social de Chile, 2017). Despite these differences with US and European countries, the development of research on adolescents' peer relations in Latin America shows comparable trends to those in western societies (Berger et al., 2016). More specifically, research on adolescent peer relations with Chilean samples using longitudinal social network analysis has shown consistent results in the USA, Europe, and Latin America (e.g., Berger et al., 2019; Berger & Dijkstra, 2013; Dijkstra et al., 2011; Dijkstra & Berger, 2018). Overall, the findings of this dissertation can be generalized with caution to other populations.

6.5 Concluding remarks

This dissertation zoomed in and provided insights on understudied areas in the peer relationships literature investigating the role of multiplexity (e.g., the interdependence between academic relationships and friendships, dislike, and victimization), peer context (e.g., classroom ability composition, intervention in classroom norms), and status (e.g., the distinction between dyadic and reputational perceptions) in different peer relationships such as academic relationships, friendships, aggression, victimization, and antipathies. This dissertation showed that classroom composition is differently associated with academic relationships (Chapter 2). Moreover, high-achieving students, prosocial peers, and friends were likely to be chosen as preferred academic partners (Chapter 3). Furthermore, adolescents avoided befriending peers whom they perceived as aggressive and befriended peers who had a reputation for being popular and prosocial (Chapter 4). Finally, within classrooms that received an intervention fostering prosocial behavior, adolescents perceived as victims or aggressors were less likely to be rejected (Chapter 5). Together, the results indicated the importance of 1) a multiplex perspective for examining peer relationships, as looking at one single network in isolation is artificially separating it from its embedded context; 2) the social context such as ability grouping practices and prosocial behavior interventions, as both can shape peer relations by setting norms of what is considered ‘good behavior’; 3) the perception of peers’ behavior as both dyadic and reputational perception have effects on peer relationships. To acquire these insights, longitudinal social network analyses were implemented. In addition to addressing some gaps in the literature, the findings from this dissertation provided directions for further research. In this way, this dissertation might inspire researchers to explore further the interplay of peer relationships as well as their role in shaping students’ academic behavior. This can provide educational practitioners and policymakers with knowledge to enhance adolescents’ bonding, learning, and success in school.



Samenvatting

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Sociale relaties spelen een cruciale rol in de ontwikkeling van adolescenten. Relaties met leeftijdsgenoten worden frequenter en prominenter tijdens de adolescentie (Giordano, 2003; Johnson, Crosnoe, & Elder, 2011). In deze ontwikkelingsfase worden leeftijdsgenoten een belangrijk sociaal referentiepunt, aangezien adolescenten een groot deel van hun tijd met leeftijdsgenoten omgaan en elkaar beïnvloeden (Card & Schwartz, 2009) en steeds meer aandacht besteden aan de verwachtingen en meningen van leeftijdsgenoten. Tijdens de adolescentie wordt het steeds belangrijker om bij een groep te horen, en om geaccepteerd en gewaardeerd te worden door leeftijdsgenoten. Frequent contact, gemeenschappelijke activiteiten en hechte relaties tussen leeftijdsgenoten bieden talrijke mogelijkheden voor adolescenten om zowel van anderen te leren als sociale steun te krijgen om met stress en aanpassingsproblemen om te gaan (Hartup, 1992; Rubin et al., 1998). Deze kenmerken maken de adolescentie een bijzonder cruciale en interessante periode om relaties met leeftijdsgenoten te bestuderen.

De toename van relaties met leeftijdsgenoten tijdens de adolescentie voegt verschillende lagen van complexiteit toe aan het onderwerp. Deze complexiteit geeft op zijn beurt aanleiding tot een aantal overkoepelende vragen die centraal staan in mijn proefschrift. Ten eerste, *relaties met leeftijdsgenoten zijn complex en met elkaar verweven*. Sociale relaties tussen adolescenten zijn niet alleen positief, zoals vriendschap en hulprelaties, maar ook negatief, zoals slachtofferschap en antipathie. Deze relaties zijn ingebed in sociale netwerken (bijvoorbeeld in een klas of school), waar adolescenten gevoelig zijn voor de dynamiek in deze netwerken. Bovendien zijn verschillende soorten relaties vaak onderling afhankelijk. Zo is het verband tussen vriendschappen en hulprelaties wederkerig, wat wil zeggen dat niet alleen vriendschappen aanleiding kunnen geven tot hulp, maar dat hulp ook kan bijdragen tot het ontstaan van vriendschappen (Wentzel & Erdley, 1993; Van Rijsewijk et al., 2016, 2019). Dit roept de vraag op: hoe zijn verschillende soorten onderlinge relaties met elkaar verbonden?

Ten tweede, *relaties met leeftijdsgenoten ontstaan in een groter netwerk*. De schoolomgeving biedt aantoonbaar de meest directe en relevante context die het gedrag van jongeren en relaties met leeftijdsgenoten definieert. De sociale context, bijvoorbeeld binnen een school of binnen een groep, heeft waarschijnlijk invloed op de manier waarop gedrag en relaties worden geëvalueerd en gewaardeerd (Dijkstra & Gest, 2015). Een omgeving met leeftijdsgenoten kan daarom zowel positieve relaties bevorderen, zoals vriendschappen en hulprelaties (Schacter & Juvonen, 2018) als negatieve relaties versterken, zoals afwijzing en slachtofferschap (Berger & Caravita, 2016; Martín Babarro, Díaz-Aguado, Martínez Arias, & Steglich, 2017). Daarom richt dit proefschrift zich op de vraag: hoe is de context van invloed op de relaties met leeftijdsgenoten?

Ten derde, *status wordt een cruciaal element van relaties met leeftijdsgenoten tussen adolescenten*. Hiërarchieën ontstaan binnen het netwerk, waarbij bepaalde individuen en groepen aantrekkelijker of populairder zijn dan anderen (Brown, Von Bank, & Steinberg, 2008; Horn, 2006; Cillessen & Rose, 2005). Wanneer adolescenten relaties met leeftijdsgenoten of groepen aangaan, zijn ze gevoelig voor statusverschillen. Zelfs binnen vriendschappen of hulprelaties, wat vaak wederzijdse relaties zijn, lijkt de ene partner vaak meer macht te hebben dan de andere (Giordano, Longmore, & Manning, 2006; Updegraff et al., 2004). Aangezien de mening van leeftijdsgenoten van aanzienlijk belang is in het gedrag van adolescenten, ontstaat de volgende vraag: beïnvloeden de collectieve perceptie (reputatie) en individuele (dyadische) perceptie van andere leeftijdsgenoten de relaties met die personen?

In dit proefschrift heb ik longitudinale sociale-netwerkanalyse toegepast op verschillende schoolcontexten om deze vragen te beantwoorden. Ik heb aan de literatuur over relaties met leeftijdsgenoten bijgedragen door de perceptie van gedrag en kenmerken van andere leeftijdsgenoten en het effect op relaties met leeftijdsgenoten te bestuderen én door informatie over verscheidene type relaties in alle hoofdstukken op te nemen. Aangezien het meeste onderzoek naar relaties met leeftijdsgenoten is uitgevoerd in de VS of Europa, breidt dit onderzoek de literatuur bovendien uit door de focus op Chileense scholen.

In dit proefschrift heb ik het samenspel van verschillende relaties met leeftijdsgenoten bestudeerd. In de Hoofdstukken 2 en 3 heb ik gekeken naar de mate waarin academische relaties worden beïnvloed door vriendschappen en kenmerken van adolescenten, zoals academische prestaties, wangedrag op school en prosociaal gedrag. Verder heb ik in de Hoofdstukken 4 en 5 onderzocht in hoeverre de perceptie van adolescenten op het gedrag (agressie, prosociaal gedrag) en kenmerken (slachtofferschap, populariteit) van andere leeftijdsgenoten van invloed is op relaties tussen leeftijdsgenoten, zoals vriendschaps- en antipathienetwerken.

Het doel van Hoofdstuk 2 was om het effect van vaardigheidsgroepering ('ability grouping') op academische netwerken (met wie studeer je op school?) en vriendschapsnetwerken te onderzoeken. Bij vaardigheidsgroepering worden leerlingen ingedeeld in verschillende klassen op basis van hun vaardigheden, ambitie of leerniveau (Belfi, Goos, De Fraine, & Van Damme, 2012). Door leerlingen aan verschillende klassen toe te wijzen, bepaalt vaardigheidsgroepering de samenstelling van een klas, niet alleen door een homogene onderwijsomgeving te creëren, maar ook door de mogelijke academische vergelijkingen en sociale interacties tussen klasgenoten te bevorderen en te beperken (Marsh et al., 2008). In dit hoofdstuk heb ik onderzocht of het samenspel van academische en vriendschapsnetwerken en hun associatie met schoolprestaties en wangedrag verschilt voor de drie soorten vaardigheidsgroepering (klassen met een hoog, gemengd en laag niveau).

In Hoofdstuk 3 heb ik onderzocht welke kenmerken een effect hebben op de voorkeur voor studiepartners (met wie zou je op school willen studeren?). Er kunnen verschillende redenen zijn om studiepartners te kiezen. Ten eerste kunnen adolescenten zich concentreren op het verbeteren van hun academisch succes door studiepartners te kiezen wiens hulp zij nuttig achten (Larson et al., 2012; Sullivan, Marshall, & Schonert-Reichl, 2002). Ten tweede zouden adolescenten er de voorkeur aan kunnen geven om met meer open en vriendelijke klasgenoten (prosociale leeftijdsgenoten en vrienden) te studeren, omdat het vragen om academische hulp een bedreiging kan zijn voor het zelfbeeld vanwege de kans dat de hulp wordt geweigerd of dat het de zwakheden van iemand blootlegt. Aangezien goed presterende leerlingen een belangrijke rol kunnen spelen in een academische omgeving, analyseer ik of ze eerder geneigd zijn om te leren met vergelijkbare goed presterende leeftijdsgenoten en vrienden. Deze studie focust op multiplexiteit van netwerken en houdt rekening met een dyadisch perspectief en de collectieve reputatie van klasgenoten.

Het doel van Hoofdstuk 4 was om te onderzoeken of vriendschapsselectie verschilt wanneer adolescenten kijken naar verschillende informatiebronnen, namelijk individuele perceptie van het gedrag van een leeftijdsgenoot (*dyadische perceptie*) en de reputatie van die leeftijdsgenoot (*reputatie*). Aangezien vriendschappen een belangrijke rol spelen bij het bereiken van de fundamentele doelen affectie en status (Giordano, 2003; Johnson et al., 2011), evalueren adolescenten het gedrag en de kenmerken van anderen op basis van de vraag of ze zullen bijdragen aan het bereiken van deze doelen. Hoewel het prosociale en agressieve gedrag van leeftijdsgenoten adolescenten informatie kan geven over de potentiële kwaliteit van een hechte relatie, kan de populariteit van

leeftijdsgenoten informatie bieden over ieders sociale positie, zichtbaarheid en sociale dominantie. In dit hoofdstuk heb ik geanalyseerd of het in het sluiten van vriendschappen verschil maakt of iemand wordt gezien als prosociaal, agressief of populair door de individuele klasgenoot (*dyadische perceptie*) of door vele klasgenoten (*reputatie*). Hierdoor onderzoekt deze studie het belang van de individuele en collectieve perceptie van het gedrag van leeftijdsgenoten op relaties met leeftijdsgenoten.

In Hoofdstuk 5 heb ik me gericht op hoe klassen kunnen verschillen in de manier waarop gedrag wordt geëvalueerd en gewaardeerd (Dijkstra & Gest, 2015), en dus in de mate waarin ze positieve relaties bevorderen, zoals vriendschappen, of juist negatieve relaties versterken, zoals antipathieën en slachtofferschap. Een manier om de evaluatie en waardering van gedrag en kenmerken zoals agressie en slachtofferschap te beïnvloeden, is door schoolbrede interventies die prosociaal gedrag bevorderen. Concreet heb ik in dit hoofdstuk geanalyseerd in hoeverre jongeren vriendschappen sluiten met, of antipathie ontwikkelen tegen, leeftijdsgenoten die zij beschouwen als agressief of die slachtoffer zijn van pesten, en of deze selectie verschilt tussen klassen die een interventie hebben gehad om prosociaal gedrag te bevorderen en klassen zonder de interventie. Dit onderzoek houdt rekening met zowel de peercontext als de onderlinge afhankelijkheid van netwerken door interventie- en controleklassen te vergelijken en door het samenspel van agressie en slachtofferschap met vriendschappen en antipathienetwerken te onderzoeken.

Samengevat biedt dit proefschrift inzichten in weinig bestudeerde gebieden in de literatuur over relaties met leeftijdsgenoten door de rol van multiplexiteit te onderzoeken (bijv. de onderlinge afhankelijkheid tussen academische relaties en vriendschappen, afkeer en slachtofferschap), door rekening te houden met de peercontext (bijvoorbeeld de samenstelling van een groep en de deelname aan een interventie), en door status te betrekken (bijvoorbeeld het verschil tussen dyadische perceptie en reputatie) in verschillende relaties met leeftijdsgenoten, waaronder academische relaties, vriendschappen, agressie, slachtofferschap en antipathieën. Dit proefschrift toonde aan dat vaardigheidsgroepering in de klas samenhangt met uiteenlopende academische relaties (Hoofdstuk 2). Verder bleek er een voorkeur te zijn voor goed presterende leerlingen, prosociale leeftijdsgenoten en vrienden als studiepartners (Hoofdstuk 3). Bovendien vermeden adolescenten vriendschap te sluiten met leeftijdsgenoten die zij als agressief beschouwden en sloten ze vriendschap met leeftijdsgenoten die de reputatie hadden populair en prosociaal te zijn (Hoofdstuk 4). Ten slotte werden in de interventieklassen, jongeren die als slachtoffer of agressor werden beschouwd, minder snel afgewezen (Hoofdstuk 5).

Bij elkaar geven de resultaten het belang aan van 1) een multiplex-perspectief voor het onderzoeken van relaties met leeftijdsgenoten, aangezien het afzonderlijk bekijken van één enkel netwerk het kunstmatig scheidt van zijn ingebedde context; 2) de sociale context zoals vaardigheidsgroepering en prosociale-gedragsinterventies, aangezien de sociale context relaties met leeftijdsgenoten kan vormgeven door normen te stellen over wat gezien wordt als 'goed' gedrag; 3) de perceptie van het gedrag van leeftijdsgenoten, aangezien zowel de dyadische perceptie als de collectieve reputatie duidelijke effecten hebben op de vorming van relaties met leeftijdsgenoten.

Om deze inzichten te verwerven, zijn longitudinale sociale-netwerkanalyses uitgevoerd. De bevindingen uit dit proefschrift geven aanwijzingen voor verder onderzoek. Op deze manier zou dit proefschrift onderzoekers kunnen inspireren om het samenspel van relaties met leeftijdsgenoten verder te onderzoeken. Of door verder in te gaan op de rol van relaties met leeftijdsgenoten bij het vormgeven van hun schoolse gedrag van leerlingen. Dit kan onderwijsprofessionals en

beleidsmakers voorzien van kennis om de onderlinge verband tussen adolescenten, het leren en hun succes op school te bevorderen.



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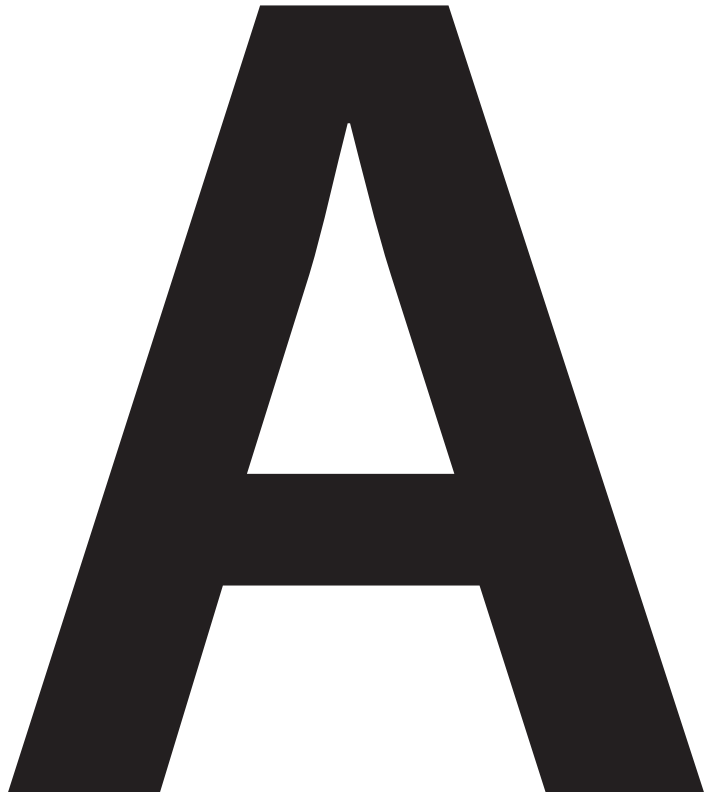
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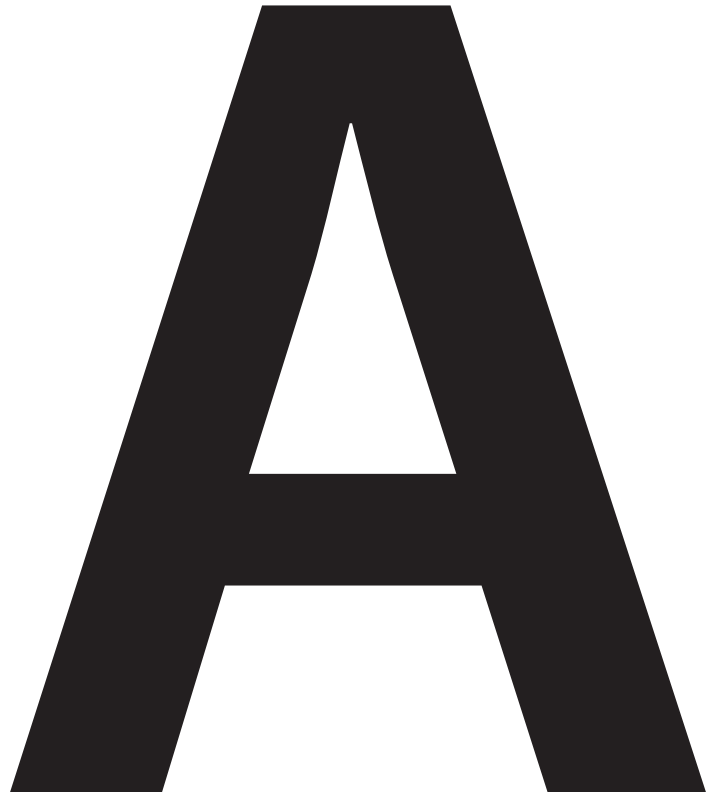
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About the author



About the Author

Diego Palacios Fariás was born in Santiago, Chile, on September 16, 1986. In 2010 he obtained his bachelor's degree in Sociology at the Pontificia Universidad Católica de Chile, after which he earned a Research Master's degree in Educational Psychology in the same university. His master thesis resulted in a first-authored scientific article in an international peer-reviewed journal. After that, Diego worked for three years as a research assistant at the MIDE UC Measurement Center at the Pontificia Universidad Católica de Chile. In September 2016, he started a PhD position at the Interuniversity Center for Social Science Theory and Methodology (ICS) at the Sociology Department of the University of Groningen, funded by a scholarship from the Chilean government. During his PhD, he visited the Psychology department at the Pontificia Universidad Católica de Chile to collaborate in various publications on the effect of a prosocial intervention on adolescents' peer relationships in Chilean schools. His research interests include the interplay of several positive and negative peer relationships such as friendships, aggression, helping behavior, studying together and rejection, and how these networks might unfold differently depending on classroom or school characteristics (e.g., social norms, students' composition), as well as the application of social network analysis to school networks.



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