Social network processes and academic functioning

The role of peers in students’ school well-being, academic engagement, and academic achievement

Mariola Gremmen
Social network processes and academic functioning

The role of peers in students’ school well-being, academic engagement, and academic achievement

Proefschrift

ter verkrijging van de graad van doctor aan de
Rijksuniversiteit Groningen
op gezag van de
rector magnificus prof. dr. E. Sterken
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
donderdag 1 november 2018 om 14.30 uur

door

Mariola Claudia Gremmen

geboren op 8 mei 1992
te Oss
Promotor
Prof. dr. D.R. Veenstra

Copromotores
Dr. J.K. Dijkstra
Dr. C.E.G. Steglich

Beoordelingscommissie
Prof. dr. T.A.B. Snijders
Prof. dr. A.H.N. Cillessen
Prof. dr. R. Crosnoe
CONTENTS

Chapter 1  Introduction  07

Chapter 2  Students’ negative social positions among peers and their academic functioning  23

Chapter 3  The importance of near-seated peers for elementary students’ academic engagement and achievement  47

Chapter 4  First selection, then influence: Developmental differences in friendship dynamics regarding academic achievement  77

Chapter 5  The role of academic status norms in friendship selection and influence processes related to academic achievement  109

Chapter 6  Adolescents’ friendships, academic achievement, and risk behaviors: Same-behavior and cross-behavior selection and influence processes  141

Chapter 7  Conclusion and discussion  173

Nederlandstalige samenvatting (Summary in Dutch)  187

References  201

Dankwoord (Acknowledgements)  221

ICS dissertation series  227

About the author  241
Introduction
Chapter 1

One of the primary tasks for schools is to maximize students’ academic achievement. Academic disengagement and underachievement can have far-reaching consequences for students and society, and particularly for students’ short- and long-term future educational chances and job opportunities. Although academic motivation and achievement largely depend on individual capacities, such as intelligence and persistence, there is huge variability in the extent to which students maximize it (Neisser et al., 1996). Whereas some students are really motivated, work diligently on their school work and achieve well, others show less interest in school and underachieve (e.g., Bissel-Havran & Loken, 2009). It is crucial for schools to understand why and under what conditions these differences emerge, to deal with the challenge to enhance students’ academic development as much as possible.

Teachers and parents play an important role in stimulating pro-school behaviors and stressing the importance of school. By motivating students to work on school assignments and helping them in case of questions, they can function as positive role models. However, students’ academic development is also intertwined with their social development. A school is a developmental context for students that focuses on teaching and learning, but also promotes well-being across developmental domains. Students’ relationships at school and their connectedness with other students influence their academic success as well as their social and emotional development.

Students spend a lot of time at school surrounded by peers (Altermatt & Pomerantz, 2003). Feeling part of this peer group is crucial to enjoy school and it is important that students feel safe at school. Also, peers can distance students from school work during breaks by for example talking about hobbies, but also by receiving help with school-related questions. When students are part of the peer group and feel accepted by peers, they are more motivated for school and achieve better than when they are rejected or considered unpopular. Moreover, being victimized often results in a lower academic motivation and achievement. Within students’ peer group, especially friends can provide support and resources and either promote or discourage attitudes and behaviors that contribute to school success (e.g., Eccles et al., 1993; Lynch, Lerner, & Leventhal, 2013; for a review see Crosnoe & Brenner, 2015).

Friendship relations are often formed with peers who have similar academic behaviors and students are also influenced by these friends regarding their motivation (Molloy, Gest, & Rulison, 2010), academic engagement in school (Kindermann & Skinner, 2009), and academic
achievement (Lynch et al., 2013; Ryan, 2001). Academic engagement refers to students’ involvement in the classroom and at school, which manifests in their behaviors, such as their effort, concentration, motivation, and posture during school hours. Engagement is influenced by peers through encouragement or discouragement of participation in the classroom. Also, academic achievement, cognitive and intellectual capacities that are assessed by performance tests, are influenced by friends (Flashman, 2012). Academic and social support through interactions with friends contributes to students’ educational success (Ryan, 2001). Associations with high(er) or low(er) achieving peers can advance students’ academic development, especially when they are already engaged for school and receive academic support. In contrast, socializing with friends can also disrupt academic progress when these friends devalue academic activities or when they socially distract students from school work.

Next to the role of students’ friendships in their academic development, their connectedness with peers in the broader classroom context can have an impact on their engagement and achievement as well. Students who are well liked by their peers in the classroom generally have a higher school well-being and perform better at school. Also, social status (peer popularity) is related to academic progress. On the one hand, being popular can support academic development through increases of school liking and more opportunities to receive social support. On the other hand, especially in adolescence, status might imply engaging in many social activities and feelings of pressure to engage in ‘cool’ behaviors such as alcohol use, which dampens students’ academic functioning (Crosnoe & Brenner, 2015).

Moreover, peers and especially friends are not only important for children’s and adolescents’ academic functioning, but also influence the development of a wide range of behaviors, such as bullying, alcohol use, and smoking behaviors (Brown, Bakken, Ameringer, & Mahon, 2008; Veenstra, Dijkstra, & Kreager, 2018). Especially in the transition from childhood to adolescence, the role of peers becomes more important compared to the role of parents and teachers. Adolescents spend more time with peers and have a tendency to show peer-approved behaviors, which not always match with adult-approved behaviors. Moreover, they look at peers as a source of identity formation and their cognitive development produces greater sensitivity to social comparisons with peers to assess one’s own level. These changes may prompt adolescents to reconsider their behaviors and may increase the salience of peers in academic processes.
Chapter 1

In this dissertation I attempt to gain detailed insights into the role of peers in students’ academic engagement and achievement in order to get a better understanding on students’ academic attitudes and behaviors within their social networks. More specifically, I examine to what extent, under which conditions, and in which directions peers can enhance or dampen students’ academic engagement and achievement. I focus on both primary and secondary school students in the Netherlands, the role of negative peer experiences, direct peers and the broader peer context (i.e., friends, near-seated peers, and peer norms), and the interplay between academic achievement and engagement in risk behaviors.

Peers in school: a social network approach

Most students have different types of direct relationships with their peers, such as friendships or academic helping relations. However, students are part of a broader social network in which they also have more indirect relationships with peers (Gest, Graham-Bermann, & Hartup, 2001). All relationships between individual students are embedded within social networks (e.g., all students in a classroom), and students are sensitive to the dynamics of these networks. The peer group in school is one of the most important settings in which students socialize and spend time with peers (Gifford-Smith & Brownell, 2003; Hallinan, 1980). Among peers, students feel connected, accepted, and can find social support.

Research on the role of peers in class and school has been steadily increasing, leading to insights in the formation of relationships as well as the positive and negative impact of peers on each other’s behaviors. Peers seem to influence students’ academic achievement (e.g., Bissel-Havran & Loken, 2009; Witkow and Fuligni, 2010), but previous studies face important shortcomings that limit conclusions about the extent to which peer influence processes account for changes in academic achievement rather than selection processes. In order to examine the role of peers in students’ academic development, it is crucial to take a social network perspective. Similarity between peers can be due to peer influence, similarity between students being the result of students influencing each other, and peer selection, similarity between students being the result of students selecting friends that are similar to themselves (Snijders, 2001; Veenstra, Dijkstra, & Kreager, 2018; Veenstra, Dijkstra, Steglich, & Van Zalk, 2013).
Methodological advances (RSiena) allow examination of peer processes in a statistically suitable way, by disentangling peer selection and influence processes when analyzing social networks in classes and schools. Stochastic actor-based models are used to longitudinally examine social network processes, by analyzing the interplay between individual’s relationships, characteristics, attitudes, and behaviors. It is not only important to examine whether and under which conditions these processes play a role in students’ academic engagement and achievement, but also to take a closer look at how and why this interplay between friendship and behaviors dynamics might exist.

Several underlying mechanisms of peer influence have been proposed. In general, students are likely to behave in desirable ways in order to find a place where they belong and to increase the likelihood of acceptance by peers and decrease the chance of being socially rejected (Cohen, 1977). Through interaction with others, conformity can occur unconsciously or more consciously via overt, active social pressure. The social learning theory holds that students observe their peers and imitate their behaviors, resulting in social rewards or sanctions (Bandura, 1977). The prototype willingness model posits that students first determine the norms of valued peers and subsequently behave in ways that are approved by these peers (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008). Other proposed mechanisms are for example social reinforcement, behaving according to social norms, conformity pressures, and modeling (Brechwald & Prinstein, 2011; Ryan, 2001).

Another reason for similarity between peers over time in particularly academic functioning can be information sharing (Flashman, 2014). Especially friends may help each other with their homework assignments and share information regarding the school contents. These resources (social capital) might promote academic achievement and motivate students, underlining the importance of schooling (Crosnoe, Cavanagh, & Elder, 2003). However, social influence might occur in different directions. On the one hand, influence can be upwards by stimulating pro-school behavior and improving grades of lower-achieving peers. On the other hand, students can become less motivated by their peers, which may result in lower grades over time.

Moreover, physical proximity can play a role in social influence processes, as interaction between students increases as a result of physical propinquity (Rivera, Soderstrom, & Uzzi, 2010). Interactions between students who sit close to each other are encouraged, which might
Chapter 1

also influence their behaviors over time, as students want to be liked, to belong to a group, and seek approval by peers (Cialdini & Goldstein, 2004). Again, this can positively influence students’ engagement and achievement, but also negatively. The Big Fish Little Pond Effect (BFLPE) stresses that students compare their academic abilities with peers and base their academic self-concept on this comparison (e.g., Marsh & Craven, 1997). This could entail that low-achieving students, when surrounded by high-achieving students, become less motivated over time. Conversely, when surrounded by lower-achieving peers, it can bolster a student’s self-confidence and academic engagement and achievement. This is also in line with the mechanism of social contrast, suggesting that relative achievements in reference to peers determine students’ ambitions (Rosenqvist, 2018).

However, next to influence processes, proximity can also affect selection processes, by encouraging interactions and in that way leading to the formation and maintenance of friendship relationships (Gest & Rodkin, 2011). The main idea of friendship selection processes is that people tend to pick similar other as friends. This principle of ‘homophily’ can be explained by the fact that similar people on average understand each other better, which increases predictability and trustworthiness between them and results in less effortful communications (McPherson, Smith-Lovin, & Cook, 2011). Another theory explaining selection processes regarding academic functioning is the social comparisons theory. This theory holds that individuals tend to compare themselves to similar achieving peers in order to gain an accurate self-evaluation of their own abilities (Festinger, 1954). Consequently, they like to hang out together and become friends.

Additionally, similarity-based friendship selection and influence processes may especially play a role when a behavior is salient and important to adolescents (Fortuin et al., 2016). As obtaining status is an important goal in adolescence, similarity among friends mainly occurs for behaviors that improve students’ social reputation (Hartup, 1996). Status related to academic achievement might be different across classrooms, which can be assessed by examining status norms, also known as norm salience (Henry, Guerra, Huesmann, Tolan, Van Acker, & Eron, 2000). In other words, it can be examined whether academic achievement is a positively or negatively valued behavior within a classroom, due to its associations with a higher or low social peer status, respectively.
Current gaps in knowledge on the role of peers in academic functioning

An increasing body of social network research has acknowledged that peers are important socializing agents who shape students’ attitudes and behaviors (Brechwald & Prinstein, 2011; Veenstra et al., 2018). A few studies focused on selection and influence processes in academic functioning using appropriate longitudinal social network modeling, with some of these studies only published very recently (Flashman, 2012; Geven, Weesie, & Van Tubergen, 2013; Lomi, Snijders, Steglich, & Torló, 2011; Rambaran et al., 2017; Shin & Ryan, 2014a; Shin & Ryan, 2014b).

Lately, both selection and influence processes were found in ninth grade students’ academic achievement and truancy (Rambaran et al., 2017). Especially low-achieving students and students with high truancy levels formed and maintained friendships with each other. Also, friends were found to influence adolescents’ academic achievement in sixth grade, as well as selected each other as friends based on similarities in academic achievement (Shin & Ryan, 2014b). In seventh through twelfth grade students, evidence was also found for both selection and influence processes in academic performance, particularly in large schools (Flashman, 2012). Moreover, high-achieving students mostly formed friendships with other high-achieving students and were positively influenced, whereas low-achieving students associated with low-achieving students and were negatively influenced. Furthermore, in a small sample of 75 Italian university students (aged between 24 and 40), evidence was found for both selection and influence processes in academic achievement (Lomi et al., 2011).

With regard to academic engagement (homework activity and paying attention in class), results also showed more similarity between friends over time and friendships between peers who are similar (Geven, Weesie, & Van Tubergen, 2013). Students’ achievement goals are also part of peer dynamics, with both selection and influence effects for mastery goals (i.e., a focus on developing academic competence), only influence effects for performance-approach goals (i.e., a focus on demonstrating high competence to others), and no selection and influence effects for performance-avoidance goals (i.e., a focus on avoiding demonstration of incompetence to others) (Shin & Ryan, 2014a).

Overall, these studies show that both friendship selection and influence processes can play a role in adolescents’ academic functioning. Although this provides a first step in disentangling the role of friends in academic achievement using a social network approach,
much more insights can be gained. Social network studies focus on three aspects, that is, students’ behaviors, relationships, and their proximity, but interactions between these mechanisms are less well understood (Rivera, Soderstrom, & Uzzi, 2010) as well as more specific insights on students’ types of relationships and behaviors.

More specifically, an addition to previous studies would be to distinguish between different contexts in which peer dynamics take place. Friendship selection and influence processes seem to co-occur regarding students’ academic functioning, but most studies were conducted in the US (four out of the six), which limits generalizability to other contexts. Furthermore, students are part of a large social network in the classroom and this social context needs to be examined more deeply. Even though friendships are important, the role of specific groups of peers who students often see and interact with at school need to be acknowledged as well. For example, what is the role of proximity to specific peers in the classroom, such as physical proximity to near-seated peers in primary school? Also, besides students’ direct friendship relationships with peers, acceptance or rejection by peers, and (un)popularity within the entire peer network might be of importance for students’ academic functioning.

Next to the need to focus more on students’ peer contexts at school, knowledge is also scarce on the timing of peer processes in students’ academic development. First, the structure of primary and secondary education differs a lot. Whereas students in primary school mostly sit in fixed, teacher-determined seating arrangements during all school lessons, students in secondary school often have the freedom to choose where they sit in the classroom. Second, with increasing age, students’ attitudes regarding schooling change. Although academic engagement and achievement are important for students’ future chances, there are differences in values and attitudes regarding school in primary school compared to secondary school. Students in primary school are generally still eager to meet the expectations of teachers and parents to achieve well. For that reason, high academic achievement might be more valued and appreciated by peers than low academic achievement. High-achieving students might set norms as frames of reference for younger students, and positively contribute to academic achievement of their younger peers.

This might be different for students in secondary school, which includes a new developmental phase, adolescence. Adolescence reflects a transitional phase between childhood and adulthood. Adolescents attempt to explore their own identities and position
within the peer group. Whereas children often look at significant adults (e.g., parents and teachers) for guidance, adolescents often distance themselves more from these persons and try to find acceptance and support from peers. Adolescents spend more time with peers than in any other time period in the life course (Witkow & Fuligni, 2010). Consequently, the behaviors that parents and teachers preferably see, is not always normative anymore. Particularly behaviors that relate to status among peers are highly attractive for adolescents and they encourage each other to engage in these behaviors and conform to their norms. Thus, adolescents’ behaviors and emotional and social development might be more guided by their peer context than by their parents and teachers.

Furthermore, adolescence is a time period in which academic achievement is often less appraised, whereas norm-breaking, deviant behavior becomes more valued (Allen, Weissberg, & Hawkins, 1995). Within the school context with older peers, who signal their evolving maturity by involvement in antisocial behaviors rather than academic achievement, older peers might function as role models to the younger peers, and thereby negatively influence their academic achievement (Moffitt, 1993). In addition, at this age the social status of antisocial behaviors tends to rise, which might be counterproductive for the development of academic achievement.

Third, differences in peer processes might be found between school years. At the end of primary school, most students already know each other for a few years, so main selection and influence processes might already have taken place. In contrary, when students transition to secondary education, they enter an entire new peer context and have to find their social position among these peers in the classroom. Especially in the first year of secondary education, this may result in a more dynamic friendship network than in later school years.

Another important addition to current knowledge would be to examine the strength and directions of selection and influence processes more thoroughly. When students achieve well in school, this can lead to increased or decreased attractiveness for affiliation. Hence, selection processes might be stronger or weaker for low-achieving students compared to high-achieving students. Moreover, influence processes regarding academic engagement and achievement can work upwards or downwards. High performing students might enhance academic achievement of lower achieving peers, but it may also be possible that low performing students have a deleterious effect on higher performing students. Perhaps,
Chapter 1

academic norms in the classrooms play a role in these strengths and directions of selection and influence processes, indicating whether academic achievement is related to status in the classroom.

Finally, it would be interesting to explore the interplay between different behaviors and peer experiences in the classroom. Although positive peer relations are important for a positive social and academic development, more insights can be gained concerning the role of more direct negative peer relations (such as victimization and being friendless) compared to students’ more indirect social positions within the larger peer network (such as their status). Furthermore, a limitation of previous social network studies is to take into account only one type of behavior and in this way ignoring the complexity of the variety of students’ behaviors. Students display many types of behaviors next to their academic behaviors and insights are needed concerning the interplay of students’ and their friends’ behaviors. Particularly adolescents generally increasingly engage in risk behaviors and show decreasing interest in and engagement for school.

Concluding, I aim to gain more insights in the role of peers in students’ academic engagement and achievement. By exploring more deeply the interactions between students’ behaviors, relationships, and their proximity, important gaps in the literature can be filled. Moreover, limitations of previous studies can be overcome by taking into account the role of the context in which peer processes take place, the timing of peer dynamic processes, the strength and direction of selection and influence processes, and the interplay between academic achievement and emerging risk behaviors in adolescence.

THIS DISSERTATION

This dissertation focuses on social network processes in students’ academic engagement and academic achievement. The five empirical studies aim to address various gaps in current research. Why do some students underachieve whereas others do not? What is the role of peers? With the knowledge from these studies, I aim to contribute to our understanding how academic engagement and academic achievement shape students’ peer relations (selection processes) and how peer relations shape students’ academic achievement (influence processes) by looking at the strength and direction of these processes (see Figure 1.1 for a global overview). Implications of this dissertation pertain to the importance of interactions
between near-seated peers, between friends, the role of group norms, and the interplay between risk behaviors and academic achievement, expecting that underachievement of students can be explained by peer processes in the classroom and school.

In the first part (Chapter 2 and 3), I focus on primary school students. Chapter 2 concerns the role of negative social positions among peers (i.e., victimization, friendlessness, peer rejection, and a lack of popularity) on students’ school well-being and academic achievement by means of multilevel analyses. In all subsequent studies, I use longitudinal social network analyses (RSiena). In Chapter 3, I investigate the role of near-seated peers and friends in primary school students’ academic engagement and academic achievement.

The second part (Chapter 4-6) focuses on secondary school students. The study in Chapter 4 is about friendship selection and influence processes regarding academic achievement in the first two years of secondary school. Both students’ average school grades and cluster-specific grades are examined. The next chapter focuses on the role of peer norms in the strength and direction of friendship processes regarding adolescents’ academic achievement (Chapter 5; second author). Lastly, next to same-behavior selection and influence processes, cross-behavior processes between adolescents’ academic achievement and risk behaviors (alcohol use and delinquency) are analyzed in Chapter 6.

I will elaborate more on the data and research methods used in the different chapters in the following paragraphs. Finally, the introduction includes a brief overview of all studies.
**Figure 1.1:** Overview of the main selection and influence model and several additions to this model.

**Dutch educational system**

In the Netherlands, children go to primary school around the age of four. Primary school has a duration of eighth years and within a school year students are educated in classes of on average 20-25 students. Each class only has one or two teachers who teach all subjects, such as language, mathematics, and history.

Secondary school starts at the age of 12 (i.e., seventh grade; high school in the US) and is compulsory until obtaining a ‘starting qualification’ around the age of 17 or 18. The first year of secondary education is considered a transitional year and especially in this year, old relationships dissolve and new relationships are formed. Secondary schools are organized by a tracked system. Depending on students’ performance on a national test (‘Citotoets’), recommendations from the primary school (which holds records of students’ academic development over time) and personal preferences, students enter one of the three possible tracks.
The majority of students enters pre-vocational education, which has a duration of four years (called ‘VMBO’). It covers four sectors, technology, health and personal care, economics, and agriculture. Four different tracks are distinguished, of which three have a practical orientation and one a theoretical orientation. General secondary education (called ‘HAVO’) is a five-year program that prepares students for universities of applied science. Finally, pre-university education has a duration of six years (called ‘VWO’).

Notwithstanding some exceptions, teaching in secondary schools takes place in track-homogeneous classes of 20-25 students who are educated together for all school subjects during the whole school year. Some schools offer all academic tracks, whereas others only offer specific tracks. When students have insufficient grades, they cannot pass the year and repeat that year or sometimes go to a lower track. In case of outstanding grades, changing to a higher track is also possible. However, changes between tracks are not common, as it means that students need to change the class of schoolmates.

DATASETS

KiVa data (primary school)

KiVa data is part of a longitudinal project on the effectiveness of the KiVa anti-bullying program in the Netherlands. This program was implemented in the Netherlands in 2011 after translating all teaching materials from Finnish to Dutch and adapting the program to the Dutch educational context. In total, 99 schools participated, of which 64 intervention schools. From October 2012 onwards, students completed an internet-based questionnaire twice per school year (October and May). In my studies, I used data from the 9066 students in fourth to sixth grade in the second wave in KiVa, in October 2012.

Additionally, particularly for this dissertation, I approached the 64 intervention schools that have been using KiVa from the start of the intervention in September 2015. I asked teachers to participate in an extra project regarding students’ academic engagement and academic achievement. From 15 schools, 22 teachers participated and filled out a questionnaire concerning each student’s academic engagement and achievement (October/November 2015). In this way, I was able to match it with the ongoing KiVa data that was collected among students.
Chapter 1

Nijmegen data (primary school)

This data was part of a larger study on seating arrangements and peer affiliations. I collected data among 559 fourth to sixth grade students in primary school and their teachers in 21 classrooms. In Chapter 3, I use teacher-reported data on the classroom’s seating arrangement. Moreover, students reported twice a school year on their friendships and teachers reported both times on students’ academic engagement and academic achievement.

SNARE data (secondary school)

SNARE stands for Social Network Analysis of Risk behavior in Early Adolescence and is a longitudinal project on the social development of early adolescents with a specific focus on adolescents’ involvement in risk behaviors (see for example Dijkstra et al., 2015). Data includes students’ individual characteristics, behaviors, and social networks, assessed via questionnaires. Data collection started in 2011 and two secondary schools were willing to participate in the study: one in the middle and one in the north of the Netherlands (with four distinct location), covering the full range of academic tracks. There were annual measurements in October, December, and April until 2015, including different cohorts of students.

Especially for this dissertation, students’ academic school grades were obtained by asking the school administration for students’ school report cards. On these school report cards, issued four times a year, students’ average grades on all school subjects (e.g., Dutch, English, geography, and mathematics) are displayed, according to the Dutch grading system (i.e., ranging from 1 to 10, with grades of 5.5 and higher corresponding to a pass). The grades from the first three school report cards within a school year match with the timing of data collection, so these grades were matched to students’ reported data that were collected via questionnaires. I examined both students’ average grades over different school subjects (Grade Point Average; GPA) and their GPA’s for specific clusters of school subjects (e.g., languages).

I used data from several cohorts and school years. In Chapter 4, I use data from 601 seventh graders in 2011-2012 and the same students in eighth grade in 2012-2013. In Chapter 5, I focus on 1549 students in their second year of secondary education (i.e., eighth grade), including students in the school years 2011-2012, 2012-2013, and 2013-2014. In Chapter 6, participants are 1219 seventh, eighth, and ninth graders in 2012-2013.
OVERVIEW

The outline of the five empirical studies in this dissertation provides an overview of the research topics, data and samples used, and the analytical strategies (see Table 1.1). The studies in Chapters 2-6 were written for publication in peer-reviewed journals and may be read as standalone research articles. Therefore, some overlap between the chapters (e.g., in data and methods description) is inevitable. Due to different standards between the journals, small differences in terminology may occur. In Chapter 7, the main findings of all studies will be discussed, scientific and practical implications, as well as directions of future research.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Main research aims</th>
<th>Data and sample</th>
<th>Analytical Strategy</th>
</tr>
</thead>
</table>
| 2       | Students’ negative social positions among peers and their academic functioning  
*Cumulative and combined effects of victimization, friendlessness, peer rejection, and a lack of peer popularity* | - Examining the combination of four main negative social positions among peers on primary school students’ school well-being and academic achievement  
- Examining differences in combinations of negative social positions for students’ academic functioning | KIVa  
*4th-6th grade students* | Mixed model approach  
(multilevel) |
| 3       | The importance of near-seated peers for elementary students’ academic engagement and achievement | - Examining the influencing role of near-seated peers in primary school students’ academic engagement and achievement  
- Distinguishing between near-seated peers and friends | Nijmegen data  
*4th-6th grade students* | RSiena  
Bayesian stochastic actor-based models with stable (proximity) and dynamic (friendship) networks |
| 4       | First selection, then influence:  
Developmental differences in friendship dynamics regarding academic achievement | - Examining friendship selection and influence processes in academic achievement  
- Distinguishing between students’ average grades and cluster-specific grades  
- Exploring developmental differences between seventh and eighth grade students | SNARE  
*7th-8th grade students* | RSiena |
| 5       | The role of status norms in friendship selection and influence related to academic achievement | - Examining the role of academic status norms in friendship selection and influence processes  
- Exploring the strength and direction of these processes | SNARE  
*8th grade students* | RSiena |
| 6       | Adolescents’ friendships, academic achievement, and risk behaviors:  
Same-behavior and cross-behavior selection and influence processes | - Examining the interplay between adolescents’ academic achievement and risk behaviors  
- Exploring differences between the first three years of secondary education | SNARE  
*7th-9th grade students* | RSiena  
Both same- and cross-behavior selection and influence effects |
Students’ negative social positions among peers and their academic functioning

Cumulative and combined effects of victimization, friendlessness, peer rejection, and a lack of peer popularity *

* This chapter has been submitted to an international peer-reviewed journal as:

Chapter 2

Abstract
Feeling safe at school and feeling connected to peers are important for students’ social and academic development. The current study focused on the role of four negative social positions among peers (victimization, friendlessness, peer rejection, and a lack of popularity) on students’ school well-being and self-perceived academic achievement (Study 1), and teacher-reported academic engagement and academic achievement (Study 2). Unique and cumulative effects were examined, as well as differences between combinations of negative social positions. Participants were third to sixth grade students (Study 1: $N = 8886$, $Mage = 10.2$; Study 2: $N = 419$, $Mage = 10.9$).

Mixed model analyses showed that each unique negative social position was negatively related to students’ academic functioning, with stronger effects for school well-being and academic engagement than for academic achievement. Also, the total number of negative positions was negatively related to students’ academic functioning. Cumulative effects were particularly found for school well-being. Finally, combinations that included victimization were most negatively related to students’ academic functioning, followed by friendlessness. Our results show the importance of positive social positions among peers for students’ school well-being, academic engagement, and in the end their academic achievement.

Key words: victimization; friendship; rejection; popularity; academic achievement
The primary goal of education is to stimulate students’ academic and social development. It is important that students are engaged with the academic and social aspects of school in order to prevent school dropout and facilitate learning and academic achievement (Appleton, Christenson, & Furlong, 2008). Besides the valuable role of parents and teachers, the peer context in schools also plays an important role in students’ behaviors and their development (Furrer & Skinner, 2003). Peers and friends affect students’ academic outcomes, such as their goals, engagement, values, and achievement (e.g., Altermatt & Pomerantz, 2003; Gremmen, Dijkstra, Steglich, & Veenstra, 2017; Ryan, 2001; Shin & Ryan, 2014). Further, feeling safe at school and being connected to peers are acknowledged as prerequisites for healthy development (Eisenberg, Neurnark-Sztainer, & Perry, 2003; Ponzo, 2013).

The desire for interpersonal connectedness and positive interactions with others reflects a fundamental need to belong (Baumeister & Leary, 1995). In order to feel good and motivated, students need to receive social and emotional support, as this can lead to more constructive behaviors when faced with difficulties or challenges (Social Determination Theory; SDT). Relatedness is a main factor for optimal functioning, healthy social development, and high well-being (Ryan & Deci, 2000). A sense of classroom belonging and peer support (e.g., being liked, respected, and valued by fellow peers) can fulfill students’ social goals and stimulate academic outcomes, including engagement, success expectations, goals, school marks, and self-concept (Furrer & Skinner, 2003; Goodenow, 1993). For instance, when students like going to school and feel safe at school, they can concentrate better on school work and feel more motivated for school, which also results in a higher academic achievement (Dieterich, 2015). However, when they do not feel well-connected to peers, students may become disaffected from academic activities, experience a lower well-being, and might have a lower desire to be in school, and thereby also miss the benefits of academic advancement (Eisenberg, 2003; Ryan, 2001). Hence, feeling unconnected to classmates can be detrimental for students’ school well-being, academic engagement, and academic achievement.

Four crucial aspects of peer relatedness have been distinguished in previous studies, that is, peer victimization, having no friends, peer rejection, and a lack of peer popularity. Together, these four factors indicate the lack of positive and the presence of negative relatedness with classmates, hereafter referred to as ‘negative social positions’. Previous studies mostly focused on one single aspect of negative social positions within a study.
Chapter 2

However, it is less well understood how the *cumulation* of several negative social positions among peers affects academic functioning. Are students with an increasing number of negative social positions worse off? Moreover, it is unclear to what extent specific *combinations* of negative social positions are particularly detrimental. These questions are relevant, as they may help identifying children who are especially at risk for negative consequences of negative social positions on their academic functioning. Hence, specific insights might provide a step towards designing interventions that increase students’ school well-being and academic outcomes via their peer relations.

Therefore, in this study we exploratory examine four negative social positions among classmates, that is, being victimized, a lack of reciprocal friendships, being rejected, and not being considered popular. We focus on the *unique, combined, and cumulative* effects of these negative social positions on students’ school well-being and self-perceived academic achievement (Study 1) and teacher-perceived academic engagement and academic achievement (Study 2). Whereas the cumulation of negative social positions indicates whether each additive negative social position has an extra effect on students’ outcomes, the combination of negative social positions concerns whether specific combinations are more detrimental than others.

**NEGATIVE SOCIAL POSITIONS RELATED TO ACADEMIC FUNCTIONING**

**Peer victimization.** Much research has focused on the consequences of being victimized for students’ academic adjustment (see Nakamoto & Schwartz, 2010 for a meta-analytic review). Students who experience bullying at school have a lower academic achievement than their peers who are not victimized (Ponzo, 2013). Self-reported victimization is longitudinally related to lower grades and lower teacher-rated academic engagement across middle-school years (Espelage, Sung Hong, Rao, & Low, 2013; Juvonen, Wang, & Espinoza, 2011). Victimization may be related to a low academic achievement because of the psychological consequences of victimization that can inhibit students’ participation in the classroom and decrease students’ self-esteem (Ladd & Troop-Gordon, 2003), which in turn lowers their motivation and academic grades. Also, recent person-centered analyses on specific victimization trajectories and their association with academic outcomes and adjustment show a clear link between peer victimization and academic outcomes (Ladd, Ettekal, & Kochenderfer-Ladd, 2017). Therefore,
we expect that peer victimization is negatively associated with students’ academic well-being, engagement, and achievement (H1a).

Friendlessness. Friends in school and particularly in the classroom are crucial for students’ school and peer connectedness (Altermatt & Pomerantz, 2003). Friends can provide social support to students, help with school-related questions, increase students’ motivation to go to school, and enhance their academic self-competence (Bissel-Havran & Loken, 2009). More specifically, friends can be academic and social resources for students (i.e., social capital) by modeling pro-social behaviors, benefitting from each other’s knowledge and they can elevate the importance of schooling and encourage involvement at school (e.g., Crosnoe, Cavanagh, & Elder, 2003; Gremmen et al., 2017). Especially reciprocated friends often have regular contact, share resources, and feel connected in the peer group, compared to unilateral friendship nominations that are more related to liking (Witkow & Fuligni, 2010). Hence, we focus on students’ reciprocated friendships. We hypothesize that friendlessness is negatively related to students’ academic well-being, engagement and achievement (H1b).

Peer rejection. Peer rejection, being disliked by classmates, has been consistently linked to students’ school disengagement (e.g., avoidance of school and negative attitudes towards school) and low academic achievement (Buhs, Ladd, & Herald, 2006). Exclusion from the peer group is associated with less participation in the classroom and also adverse school adjustment outcomes over time, due to restriction of students’ access to social resources in classroom activities (Buhs, Ladd, & Herald, 2006). Students generally have a strong preference for interactions with members of their own sex and friendship dyads and playgroups mostly consist of same-sex peers (Bellmore & Cillessen, 2003), making same-sex peers the relevant peer group. Hence, we focus on disliking by same-sex peers and hypothesize that peer rejection is negatively associated with students’ academic well-being, engagement, and achievement (H1c).

A lack of peer popularity. Students’ social status can be assessed by their perceived popularity in the classroom, that is, a shared recognition (reputation) among peers regarding a student’s visibility, status, or power (Schwartz et al., 2006). Popularity is associated with a higher well-being and a more positive individual and interpersonal functioning (Östberg, 2003). As
perceived popularity can be the result of both positive (e.g., prosocial) or negative (e.g., aggressive) behaviors, mixed results have been found with regard to its relationship with academic outcomes (Meijs, Cillessen, Scholte, Segers, & Spijkerman, 2010; Schwartz et al., 2006). Although this relationship is ambiguous, status is an important goal for students (LaFontana & Cillessen, 2009) and when they fail to reach this goal, it can be considered a negative experience. Thus, we expect that a lack of peer popularity is negatively related to students’ academic well-being, engagement, and achievement (H1d).

**CUMULATION AND COMBINATION OF NEGATIVE SOCIAL POSITIONS**

Students differ in their total number of negative social positions. As of yet, previous studies have not examined whether an increasing number of negative social positions is more negatively associated with academic functioning. We argue that the sum of these negative aspects might not be associated to academic functioning in a linear way, but rather that the added negative effect of an extra negative peer relation might be stronger than the added effect of a previous one. For example, being victimized can be buffered to some extent by other social resources, such as friendships. This implies that the more negative social positions students have, the less buffering peer relations they have, thus the more negative each additional negative social position will be on their academic functioning. Based on this idea, our second hypothesis (H2) is that more negative social positions are also related to a more negative school well-being, academic engagement, and academic achievement, with stronger additional negative effects of extra negative social positions.

Besides the cumulation of negative social positions, there might be differences between specific combinations of negative social positions. In other words, the four negative social positions might differ in terms of their importance for students and the extent to which they actively experience it negatively. Although they seem to co-occur quite often, there might be specific social positions that explain the negative effects on students’ academic functioning. Students’ reciprocal friendships, peer status, and peer network affiliations (i.e., being liked or disliked) are interrelated but also represent distinct aspects of students’ peer experiences (Gest, Graham-Bermann, & Hartup, 2001; Gifford-Smith and Brownell, 2003). More specifically, these may be ordered based on their importance for students’ feelings of relatedness in the classroom.
Feelings of safety and security are essential and basic human needs (Maslow, 1970). As especially victimization can strongly affect students’ feelings of safety, whether they like going to school and be motivated for school work (e.g., Espelage et. al., 2013), this might be considered the most crucial type of peer relatedness for students’ academic functioning. People’s need for belongingness and social contacts (such as friendships) are also important. Connectedness to peers is considered a basic condition for a positive social and academic development (e.g., Eisenberg, 2003; Furrer & Skinner, 2003). Therefore, students’ friendships might be the second most important type of peer relatedness. Peer rejection by same-sex peers in the classroom also touches upon students’ belongingness needs, but as relationships with classmates are less close compared to relationships with friends, they may be the third most important type of social position. In line with the SDT (Ryan & Deci, 2000), students’ status in social groups is also considered important. This is related to reputation, which is not easy to achieve for all students and less important than being liked or having close relationships, thus will less likely be an active negative experience for students compared to feelings of safety and belonging. Therefore, we expect that students’ perceived popularity is the least important social position.

Based on this order of importance (victimization, friendlessness, rejection, a lack of popularity), several combinations might be more negatively associated with students’ academic functioning than others. We hypothesize (H3) that (a) four negative social positions are most negatively related to students’ academic functioning, followed by (b) being victimized, having no friends, and being rejected as the most detrimental combination in case of three negative social positions. When students have two negative social positions, we expect that (c) being victimized and being friendless is the most negative combination. Finally, (d) victimization is considered to be most negatively associated with students’ academic functioning when a student has one negative social position.

PRESENT STUDY

Our main aim is to examine whether each unique negative social position has a negative effect on students’ school well-being and academic outcomes, whether there is a cumulative effect, and whether specific combinations have a stronger negative association than others. In Study 1, we use a large dataset with students’ self-reported school well-being and self-perceived academic achievement as outcome measures. Besides students’ self-perceived school well-
being and self-perceived academic achievement, we also assessed students’ academic engagement and academic achievement based on teacher reports in a small dataset including different students (Study 2).

STUDY 1

METHOD

PARTICIPANTS AND PROCEDURE
The data for this study is part of a larger project evaluating the effectiveness of the implementation of the KiVa anti-bulling program in the Netherlands. In 2011, elementary schools were recruited for the KiVa program and 99 schools participated, of which 64 intervention schools. Prior to the implementation and also before the actual data collection, the questionnaire was tested in a pilot study (May 2012) to ensure that students would understand all questions. Afterwards, students completed an internet-based questionnaire in the schools’ computer labs during regular school hours, twice per school year (October and May). During the assessments, teachers were present and distributed individual passwords to their students to access the questionnaire, and to answer and assist students with the questionnaire when necessary. Students filled out the questions by themselves and difficult topics were explained in instructional videos. Questionnaires were completed on a voluntary basis and data were anonymized. Parents received information about the study and permission forms from the school. Parents who did not want their child to participate were requested to return the form to the school. Teachers also informed students about the research and asked oral consent. Both parents and students were able to withdraw from participation at any time.

We used data from the second wave of KiVa (October 2012), including 9066 students, with 1871 students in 3rd grade, 2391 students in 4th grade, 2398 students in 5th grade and 2368 students in 6th grade. However, 180 students (2.0%) did not fill out the questionnaire, as they did not receive parental consent or did not want to participate themselves. This left us with 8886 students (49.8% boys; Mage = 10.2 years, SD = 1.2, Range = 7.1-13.8).
MEASURES

Negative social position measures

Peer victimization. An introduction movie was shown in which bullying was defined in the way formulated in the Olweus’ Bully/Victim questionnaire (Olweus, 1996), including several examples concerning the forms of bullying and an explanation that emphasized the intentional and repetitive nature of bullying as well as the power imbalance between bully and victim. Directly after watching this instructional video, the following question was posed: “Now you know what bullying is, can you indicate how often you have been bullied in the past months?”. Students answered on a 5-point scale, with 1= it did not happen, 2= once or twice, 3= two or three times a month, 4= about once a week, 5= several times per week (Solberg & Olweus, 2003). In line with previous studies, students were considered victimized when they indicated that they have been bullied at least twice a month (Oldenburg et al., 2015; Solberg and Olweus 2003). This resulted in a dummy variable with a value of 0 for item scores 1 and 2 (no victimization) and a value of 1 (some victimization) for scores 3, 4, and 5.

Friendlessness. Students’ friendships within the classroom were assessed using a peer nomination procedure. Students were presented the names of their classmates in a random order on a computer screen and were asked to nominate their friends (“Which classmates are your best friends?”). They were able to nominate an unlimited number of same- and cross-sex peers and could also indicate nobody. We calculated students’ reciprocal friendships by counting all outgoing nominations that were also incoming nominations. A dummy variable was created, indicating whether a student had no reciprocal friends (0) or at least 1 reciprocal friend (1).

Peer rejection. Students were asked to nominate classmates they dislike using a similar peer nomination procedure as for friendships, by asking “Which classmates do you dislike?”. We counted per student the number of received nominations by same-sex classmates. For both boys and girls, we recoded this into a dummy variable with 0 (0 or 1 nomination by same-sex peers) or 1 (2 or more nominations by same-sex peers). We decided to treat two or more nominations as a negative social position instead of one nominations due to more realistic prevalence rates (29.8% instead of 54.8% of students being rejected).
A lack of peer popularity. Using a similar peer nomination procedure as for students’ friendships, students indicated which students they perceived as most popular (“Who are the most popular students in your class?”). For each student, we counted the number of received nominations and recoded this into dummy scores, with either 0 (at least one received nomination) or 1 (no received nominations).

Academic measures
School well-being. Students responded to seven items concerning their perceptions of the school and their classroom to assess their school well-being. Examples are “I feel safe at school” and “I feel at ease in the class” and answers were given on a four-point scale (1 =never, 2 =sometimes, 3 =often, 4 =always). Exploratory as well as confirmatory factor analyses showed that the seven items measured one factor (with factor loadings between .62 and .83). Item scores were averaged and formed an internally consistent scale (α = .89).

Self-perceived academic achievement. Students responded to three items concerning their perceptions on their academic performance. These items were “I think I am doing well at school”, “I think I am a smart student”, and “I am one of the best students of the class”. Exploratory and confirmatory factor analyses showed that the three items measured one factor (factor loadings between .59 and .77). Item scores were averaged and formed an internally consistent scale (α = .81).

Control variables
Age was assessed by asking students’ day, month, and year of birth. Age in years on the day of data collection was calculated.

Sex was dummy coded into 0 (girl) and 1 (boy).

ANALYTICAL APPROACH
Each negative social position was coded as a dummy variable, so students either scored a 0 (absence) or a 1 (presence) on victimization, friendlessness, peer rejection and a lack of peer popularity. A total score was also calculated, ranging per student between 0 (no negative social positions) and 4 (all four negative social positions).
Negative social positions among peers and academic functioning

We calculated descriptive statistics to assess the prevalence of all negative social positions and the correlations between these negative social positions and school well-being and self-perceived academic achievement. Also, we calculated the prevalence of all different combinations of negative social positions. Subsequently, we used a mixed model approach in SPSS to analyze several multilevel models with students nested in classrooms. First, a main effects model was estimated to examine the effect of each unique negative social position on all outcome measures (hypothesis 1). Second, a cumulative effects model was estimated, by examining the additional effect of having at least one, at least two, at least three, or at least four negative social positions on the outcome measures (hypothesis 2). Third, we examined the prevalence and means of all different combinations of negative social positions compared to students who did not have any negative social position (hypothesis 3).

As negative social positions and school well-being and academic achievement differ across age groups and between boys and girls, we controlled for students’ age (in years) and sex in all models (e.g., Voyer & Voyer, 2014).

RESULTS

Descriptive statistics. We calculated the number and percentage of students that either had a specific negative social position (1) or not (0). Friendlessness (7.9%) was the least common negative social position, followed by victimization (20.5%), a lack of peer popularity (25.9%), and peer rejection (29.9%).

School well-being ($M = 3.09$, $SD = 0.56$) was on average higher than self-perceived academic achievement ($M = 2.66$, $SD = 0.66$). Both were positively correlated, indicating that school well-being was on average higher when self-perceived academic achievement was also higher ($r = .32$, $p < .001$). Moreover, the more negative social positions (ranging from 0 to 4), the lower students’ school well-being ($r = -.26$, $p < .001$), and to a lesser extent the lower self-perceived academic achievement ($r = -.03$, $p = .011$).

Main effects of negative social positions. To examine unique effects, we estimated a model with the main effects of all negative social positions as a predictor of students’ well-being and self-perceived academic achievement. Significant but small variations between classrooms were found for school well-being (6.9% of variance due to classroom differences, $p < .001$) and self-perceived academic achievement (2.4% of variance due to classroom differences, $p < .001$).
Chapter 2

Results in Table 2.1 show significant negative main effects of each negative peer relation on school well-being (in line with hypothesis 1). However, for self-perceived academic achievement, the negative effect for victimization reached significance, the negative effect for friendlessness was marginally significant, whereas the negative effect for rejection did not reach significance. Moreover, a lack of popularity was positively associated with self-perceived academic achievement. These results are only partially in line with hypothesis 1, as we expected significant negative effects for all negative social positions.

Additional analyses indicated a negative significant effect of the total number of negative social positions on students’ school well-being \( (B = -0.15, p < .001, AIC = 13909.7) \) and a smaller but also negative effect on self-perceived academic achievement \( (B = -0.03, p < .001, AIC = 17224.6) \), when controlling for students’ age and sex. Thus, the more negative social positions, the more negative students’ school well-being and self-perceived academic achievement.

**Table 2.1**

**Main Effects of Negative Social Positions on Students’ School Well-Being and Self-Perceived Academic Achievement (Study 1)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>School well-being</th>
<th></th>
<th></th>
<th>Self-perceived achievement</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( B )</td>
<td>( SE )</td>
<td>95% CI</td>
<td>( B )</td>
<td>( SE )</td>
<td>95% CI</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.531</td>
<td>0.068</td>
<td>[-0.34 -- -0.29]</td>
<td>3.531</td>
<td>0.069</td>
<td>[-0.14 -- -0.08]</td>
</tr>
<tr>
<td>Victimization</td>
<td>-0.316***</td>
<td>0.014</td>
<td>[-0.34 -- -0.29]</td>
<td>-0.110***</td>
<td>0.017</td>
<td>[-0.10 -- 0.00]</td>
</tr>
<tr>
<td>Friendlessness</td>
<td>-0.155***</td>
<td>0.021</td>
<td>[-0.20 -- -0.11]</td>
<td>-0.050</td>
<td>0.026</td>
<td>[-0.01 -- 0.00]</td>
</tr>
<tr>
<td>Rejection</td>
<td>-0.092***</td>
<td>0.013</td>
<td>[-0.12 -- -0.07]</td>
<td>-0.018</td>
<td>0.016</td>
<td>[-0.05 -- 0.01]</td>
</tr>
<tr>
<td>No popularity</td>
<td>-0.050***</td>
<td>0.013</td>
<td>[-0.08 -- -0.02]</td>
<td>0.037***</td>
<td>0.016</td>
<td>[0.01 -- 0.07]</td>
</tr>
<tr>
<td>Sex (1=boy)</td>
<td>-0.056***</td>
<td>0.006</td>
<td>[-0.08 -- -0.03]</td>
<td>0.178***</td>
<td>0.014</td>
<td>[0.15 -- 0.21]</td>
</tr>
<tr>
<td>Age</td>
<td>-0.029***</td>
<td>0.014</td>
<td>[-0.04 -- -0.02]</td>
<td>-0.092***</td>
<td>0.007</td>
<td>[-0.10 -- -0.08]</td>
</tr>
</tbody>
</table>

*Note. \( *p < .05. \) \( **p < .01. \) \( ***p < .001. \) For school well-being \( AIC = 13735.0 \). For self-perceived academic achievement \( AIC = 17203.9 \)

**Cumulative effects of negative social positions.** We estimated cumulative effects of the number of negative social positions on students’ school well-being and self-perceived academic achievement (see Table 2.2). Each effect indicates the additive effect of an extra negative social position on students’ outcome measures (i.e., at least one, at least two, at least three, or at least four negative social positions). In both models, small but significant variations between
classrooms were found (6.8%, $p < .001$ for school well-being and 2.3%, $p < .001$ for self-perceived academic achievement).

With regard to school well-being, each additional negative social position had a significant negative effect. Thus, students with more negative social positions had a lower school well-being. Each additional negative social position affected students’ school well-being between $B = -0.14$ and $B = -0.24$, with the strongest additive negative effect of four negative social positions compared to three. This is in line with hypotheses 2, as we expected a cumulative effect and stronger effects of additive negative social positions. Moreover, girls and younger students had a higher well-being than boys and older children, respectively.

With regard to self-perceived academic achievement, only the effect of one versus zero negative social positions had a significant negative effect, but each additional negative social position beyond the first did not significantly add to self-perceived academic achievement. This is not in line with hypothesis 2. Furthermore, boys and younger students had a higher self-perceived academic achievement than girls and older students, respectively.

**Table 2.2**

**Cumulative Effects of at Least One, Two, Three, and Four Negative Social Positions on Students’ School Well-Being and Self-Perceived Academic Achievement (Study 1)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>School well-being</th>
<th></th>
<th></th>
<th>Self-perceived achievement</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
<td>95% CI</td>
<td>$B$</td>
<td>$SE$</td>
<td>95% CI</td>
</tr>
<tr>
<td>Intercept</td>
<td>3.501</td>
<td>0.072</td>
<td>[-0.14 - -0.12]</td>
<td>3.533</td>
<td>0.071</td>
<td>[-0.09 - -0.03]</td>
</tr>
<tr>
<td>At least one</td>
<td>-0.142***</td>
<td>0.013</td>
<td>[-0.19 - -0.12]</td>
<td>-0.062***</td>
<td>0.016</td>
<td>[-0.05 - -0.04]</td>
</tr>
<tr>
<td>At least two</td>
<td>-0.158***</td>
<td>0.018</td>
<td>[-0.17 - -0.06]</td>
<td>-0.006</td>
<td>0.021</td>
<td>[-0.08 - -0.06]</td>
</tr>
<tr>
<td>At least three</td>
<td>-0.113***</td>
<td>0.029</td>
<td>[-0.34 - -0.13]</td>
<td>-0.013</td>
<td>0.035</td>
<td>[-0.14 - -0.12]</td>
</tr>
<tr>
<td>At least four</td>
<td>-0.236***</td>
<td>0.055</td>
<td>[-0.08 - -0.03]</td>
<td>0.176***</td>
<td>0.014</td>
<td>[0.15 - 0.20]</td>
</tr>
<tr>
<td>Sex (1=boy)</td>
<td>-0.057***</td>
<td>0.011</td>
<td>[0.04 - -0.01]</td>
<td>-0.090***</td>
<td>0.007</td>
<td>[-0.10 - -0.08]</td>
</tr>
</tbody>
</table>

*Note. $^*$ $p < .05$. $^{	ext{**}}$ $p < .01$. $^{	ext{***}}$ $p < .001$. For school well-being AIC = 13921.1. For self-perceived academic achievement AIC = 17232.6*

**Combinations of negative social positions.** We examined to what extent average scores on well-being and academic achievement differed between students with specific combinations of social positions. Figure 2.1 shows that each possible combination of negative social positions was related negatively to students’ average school well-being. Victimization seems to
Chapter 2

contribute most strongly to the negative effects of negative social positions on school well-being and friendlessness seems to contribute second most strongly. Figure 2.2 shows that the relation between all combinations and self-perceived academic achievement was weaker compared to school well-being. Only three combinations reached significance, the combination of victimization and friendlessness, the combination of victimization, friendlessness, and disliking, and the individual effect of victimization.

Thus, results in both Figure 2.1 and 2.2 indicate that especially victimization was negatively associated with students’ school well-being and self-perceived academic achievement, as this negative social position was part of all most negative combinations. Moreover, friendlessness was often involved. This is in line with our third hypothesis that especially victimization would be negatively associated with students’ outcomes, followed by friendlessness.

Finally, an inspection of the model fit indicates that the main effects models reported in Table 1 fit best, followed by the full combinations models of Figures 2.1 and 2.2 and the unreported analyses with “number of negative peer relations” as numerical covariate. The cumulative models reported in Table 2.2 show the worst fit.
Figure 2.1: School well-being means and 95% Confidence Intervals for each possible combination of negative social positions compared to the mean of students without any negative social position (vertical line).

V = Victimization, F = Friendlessness, R = Rejection, P = a lack of Popularity

AIC of full interaction model controlling for sex and age = 13762.2
Chapter 2

Figure 2.2: Self-perceived academic achievement means and 95% Confidence Intervals for each possible combination of negative social positions compared to the mean of students without any negative social position (vertical line).

V = Victimization, F = Friendlessness, R = Rejection, P = a lack of Popularity

AIC of full interaction model controlling for sex and age = 17213.1

STUDY 2

In the second study, we examined the role of the four negative social positions (victimization, friendlessness, peer rejection, and a lack of popularity) on students’ teacher-reported academic engagement and academic achievement.

METHOD

PARTICIPANTS AND PROCEDURE

For this part of the study, we also used data from the KiVa project (see Study 1; Method). In September 2015, we approached the 64 intervention schools that have been using KiVa from the start of the intervention and asked teachers from grade 4 to 6 to participate in this extra project concerning students’ academic outcomes. Twenty-two teachers were willing to participate and filled out a questionnaire concerning each student’s academic engagement and achievement in October/November 2015, around the same time as the KiVa T8 wave for students. We asked teachers to use administrative information on students’ school results and their school report cards when filling out the questionnaire.
Negative social positions among peers and academic functioning

The final dataset contained data from both teachers and students. The mean classroom size of these fourth to sixth grade classrooms was 23.6 (SD = 5.1, Range = 10-32), with a total of 490 students. However, using an active consent procedure, 71 students (14.5%) did not fill out the questionnaire, as they did not receive parental consent, did not want to participate themselves or did not return the consent form. This left us with 419 participants (45.1% boys; Mage = 10.9, SD = 0.8, Range = 8.3-12.9). The participating schools come from several provinces in the Netherlands, from rural as well as (semi-)urban areas.

MEASURES

Negative social position measures
These were measured in the same way as in Study 1.

Academic measures

Academic engagement. Teachers filled out five items concerning academic engagement per student, that is, the student’s working attitudes, concentration, motivation for school, listening, and self-confidence. They responded on a five-point scale, ranging from -2 (insufficient) to 2 (good). Factor analysis showed a low factor loading for self-confidence (.54), but high factor loadings for the other four items (.83 - .92). As the content of self-confidence is less related to the other behavioral engagement items, we decided to calculate academic engagement scores based on the average of the other four items. The internal consistency of this scale was $\alpha = .93$.

Academic achievement. Teachers indicated each student’s scores on five items regarding academic achievement. Scores were measured on a five-point scale, from -2 (insufficient) to 2 (good). Factor analysis indicated two different factors: one for spelling, reading comprehension and arithmetic and another one for the creative subjects (arts) and physical subjects (gymnastics). We decided to focus on students’ main courses, that is, spelling, reading comprehension and arithmetic scores, and calculated an average of these three items (with factor loadings between .76 and .84). The internal consistency of this scale was $\alpha = .81$.

Control variables
We measured age and gender in the same way as in Study 1.
Chapter 2

ANALYTICAL APPROACH

We coded all negative social positions as dummy variables, similar to Study 1. We calculated descriptive statistics to assess the prevalence of all negative social positions and the correlations between these negative social positions and school well-being and self-perceived academic achievement. Subsequently, we used a mixed model approach in SPSS to analyze multilevel models with students nested in classrooms. First, we estimated a main effects model to examine the effect of each unique negative social position on the outcome measures (hypothesis 1). Second, we analyzed cumulative effects of at least one to four negative social positions on the outcome measures (hypothesis 2). Unfortunately, it was not meaningful to examine combinations of negative social positions, due to the small sample size and consequently the small number of students in each category. We controlled for students’ age in years and sex in all models.

RESULTS

Descriptive statistics. We calculated the number and percentage of students that had a specific negative social position (1) or not (0). Victimization (7.9%) was the least common, followed by friendlessness (8.6%), peer rejection (15.8%), and a lack of peer popularity (31.3%).

Academic achievement ($M = 0.79, SD = 0.94$) was on average higher when academic engagement ($M = 0.36, SD = 1.12$) was also higher ($r = .50, p < .001$). Moreover, the higher the total number of negative social positions (ranging from 0 to 4) the lower students’ academic achievement ($r = -.12, p < .001$), but not their academic engagement ($r = -.06, p = .219$).

Main effects of negative social positions. We estimated unique effects of all negative social positions on students’ academic engagement and academic achievement. Results in Table 2.3 show negative main effects of each negative social position on the academic outcomes. The effect of peer rejection on academic engagement only reached significance, the effects of friendlessness ($B = -0.28, p = .081$) and a lack of popularity ($B = 0.17, p = .097$) on academic engagement and the effect of rejection on academic achievement ($B = -0.29, p = .061$) were marginally significant. Thus, although the directions of the effects were in line with hypothesis 1, not all of these effects reached significance. There were significant variations between classrooms for academic engagement (16.2% of variance, $p = .018$), but this variation did not reach significance for academic achievement (1.8% of variance, $p = .447$). Additional analyses
indicated a negative significant effect of the total number of negative social positions on students’ academic engagement ($B = -0.11, p = .025, AIC = 1077.9$) and academic achievement ($B = -0.18, p = .004, AIC = 1275.2$). Thus, students with more negative social positions had a lower academic engagement and achievement.

Table 2.3

Main Effects of Negative Social Positions on Students’ Academic Engagement and Academic Achievement (Study 2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Academic engagement</th>
<th></th>
<th>Academic achievement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>95% CI</td>
<td>B</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.970</td>
<td>0.723</td>
<td>[-0.50 – 0.14]</td>
<td>2.762</td>
</tr>
<tr>
<td>Victimization</td>
<td>-0.179</td>
<td>0.163</td>
<td>[-0.50 – 0.14]</td>
<td>-0.215</td>
</tr>
<tr>
<td>Friendlessness</td>
<td>-0.281</td>
<td>0.161</td>
<td>[-0.50 – 0.04]</td>
<td>-0.009</td>
</tr>
<tr>
<td>Rejection</td>
<td>-0.317**</td>
<td>0.119</td>
<td>[-0.55 – 0.08]</td>
<td>-0.291</td>
</tr>
<tr>
<td>No popularity</td>
<td>-0.167</td>
<td>0.100</td>
<td>[-0.30 – 0.36]</td>
<td>-0.176</td>
</tr>
<tr>
<td>Sex (1=boy)</td>
<td>-0.534***</td>
<td>0.084</td>
<td>[-0.70 – 0.37]</td>
<td>-0.290**</td>
</tr>
<tr>
<td>Age</td>
<td>-0.081</td>
<td>0.066</td>
<td>[-0.21 – 0.05]</td>
<td>-0.197**</td>
</tr>
</tbody>
</table>

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. For academic engagement AIC = 1072.4. For academic achievement AIC = 1277.3

Cumulative effects of negative social positions. We estimated the additive effect of each extra negative social position on students’ academic outcomes (i.e., at least one, at least two, at least three, or at least four negative social positions; see Table 2.4). Significant variations between classrooms were found for academic engagement (13.9% of variance due to classroom differences, $p = .019$), but not for academic achievement (2.2% of variance due to classroom differences, $p = .361$).

For academic engagement, no significant cumulative effects were found. With regard to academic achievement, we only found an additive negative significant effect for having one versus zero negative social position. Girls were more academically engaged than boys. Academic achievement was significantly higher for girls and younger students than for boys and older students, respectively.

These results are not in line with hypothesis 2 that each additive negative social position would have a significant additive negative effect on students’ academic engagement and academic achievement. Having versus not having a negative social position was negatively
related to academic achievement, but our results did not suggest that more negative social positions have an added negative effect.

Goodness of fit considerations for academic engagement give the same result as in Study 1, with the best fit for the main effects model (Table 2.3), followed by the unreported analyses with “number of negative peer relations” as numerical covariate. The cumulative model (Table 2.4) shows the worst fit. For academic achievement, the unreported analyses with “number of negative peer relations” as numerical covariate shows the best fit and the main effects model the worst fit.

Table 2.4
Cumulative Effects of at Least One, Two, Three, and Four Negative Social Positions on Students’ Academic Engagement and Academic Achievement (Study 2)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Academic engagement</th>
<th></th>
<th>Self-perceived achievement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td>95% CI</td>
<td>B</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.056</td>
<td>0.724</td>
<td>2.699</td>
<td>0.789</td>
</tr>
<tr>
<td>At least one</td>
<td>-0.054</td>
<td>0.098</td>
<td>[-0.25 – 0.14]</td>
<td>-0.365*</td>
</tr>
<tr>
<td>At least two</td>
<td>-0.188</td>
<td>0.164</td>
<td>[-0.51 – 0.13]</td>
<td>0.146</td>
</tr>
<tr>
<td>At least three</td>
<td>0.005</td>
<td>0.287</td>
<td>[-0.56 – 0.57]</td>
<td>-0.186</td>
</tr>
<tr>
<td>At least four</td>
<td>-0.421</td>
<td>0.437</td>
<td>[-1.28 – 0.44]</td>
<td>-0.471</td>
</tr>
<tr>
<td>Sex (1=boy)</td>
<td>-0.564**</td>
<td>0.086</td>
<td>[-0.73 – 0.40]</td>
<td>-0.310*</td>
</tr>
<tr>
<td>Age</td>
<td>-0.087</td>
<td>0.066</td>
<td>[-0.22 – 0.04]</td>
<td>-0.187*</td>
</tr>
</tbody>
</table>

Note. * p < .05. ** p < .01. *** p < .001. For academic engagement AIC = 1078.6. For academic achievement AIC = 1271.7

GENERAL DISCUSSION

To understand students’ school well-being, academic engagement, and academic achievement, it is important to take their social embeddedness in the peer group into account (e.g., Espelage et al., 2013; Furrer & Skinner, 2003). Students need to feel connected to their peers (Baumeister & Leary, 1995; Ryan & Deci, 2000) in order to feel good, and a supportive peer context can motivate students and can enhance their academic development. Our studies examined the unique, combined, and cumulative effect of four negative social positions (victimization, friendlessness, peer rejection, and a lack of peer popularity) on students’ school well-being and self-perceived academic achievement (Study 1), and teacher-reported academic engagement and academic achievement (Study 2).
The unique, combined, and cumulative effects of negative social positions

Students often have a lower well-being and achievement when they are victimized (Nakamoto & Schwartz, 2010), friendless (Bissel-Havran & Loken, 2009), rejected (Buhs et al., 2006), or lack popularity (Östberg, 2003). Our results are in line with these findings and hypothesis 1, as we found negative effects of all negative social relations on school well-being and academic outcomes, with exception of the effect of a lack of popularity on students’ self-perceived academic achievement. However, not all effects are equally important and stronger effects were found for school well-being and academic engagement than for self-perceived and teacher-reported academic achievement.

Thus, social positions among peers seem to matter more for how students feel in class and whether they are motivated compared to their academic achievement. This could indicate that school well-being and engagement are first affected by students’ social positions, with later consequences for their academic achievement. In other words, students might achieve lower over time when they have more negative social positions, but it may first negatively influence how they feel. As a consequence of less school engagement, students’ academic achievement can drop as well, for instance by spending less time on homework (Doctoroff & Arnold, 2017; Lynch, Lerner, & Leventhal, 2013). Also, elementary school students generally attach much value to the opinions of teachers and parents, who try to stimulate academic achievement and underscore the importance of schooling (Hill & Tyson, 2009). Possibly, peer relatedness is more closely related to academic achievement in secondary school, when students spend even more time with peers and are more inclined to behave according to their norms (Witkow & Fuligni, 2010).

Furthermore, results regarding the cumulative effect of negative social positions (hypothesis 2) indicated mixed results. Each additive negative social position had a significantly additive negative effect on students’ school well-being. However, only one negative social position was significantly related to students’ self-perceived and teacher-perceived academic achievement and no significant effects were found regarding academic engagement. This is in line with the weaker effects for academic achievement compared to school well-being.

Moreover, in both Study 1 and Study 2, negative significant correlations were found between students’ total number of negative social positions and all academic outcome measures. We also compared the goodness of fit between the models with the total number
of negative social positions and the cumulative effects. Results show that in both studies, except for academic achievement, the effect of negative social positions is cumulative in a very simple sense (i.e., proportional to the number of negative social positions), and that it does not add to our understanding when we investigate steps in the cumulation separately (i.e., there are no non-linearity’s or thresholds). Hence, the more negative social positions students have, the more negative their outcomes.

Finally, in Study 1 we were able to examine whether specific combinations of negative social positions were related to lower scores on students’ school well-being and self-perceived academic achievement (hypothesis 3). We expected that feelings of safety (no victimization) would be most important for students, then feelings of affection (friendships) and acceptance in the peer group (no peer rejection), followed by status in the peer group (popularity). In line with our expectations, we found that especially victimization was often part of the combinations of negative social positions with lower well-being and achievement for students. Stronger effects were found for school well-being than for academic achievement. Results showed particularly lower means for students who were victimized and also when they had no friends. Peer relations within dyads, such as bullying and friendships, indeed turned out to be closer related to students’ well-being and self-perceived academic achievement than when students were not nominated by peers as being liked or popular. This is related to the idea that feelings of safety and affection are most important and that connections with other peers are basic needs for a positive academic and social development (Eisenberg, 2003; Espelage et al., 2013; Maslow, 1970; Ponzo, 2013).

**Strengths and Limitations**

Strengths of our study were that we not only focused on a specific or a few negative social positions, but on the effects of four main negative social positions in the classroom. We focused on cumulative effects and whether some combinations of negative social positions were more negatively related to students’ outcomes than others. This provides more insights into the role that peer relatedness can play in students’ well-being and academic functioning. Also, our study included self-, peer-, and teacher-reported measures and we examined various academic functioning measures, that is, students’ school well-being, self-perceived academic achievement, and teacher-reported academic engagement and achievement within a large sample of students (Study 1).
However, our study should also be viewed in light of several limitations. First, as this is a cross-sectional study, we were not able to draw conclusions on students’ development. It would be interesting for future studies to follow changes in both students’ social positions and their academic functioning over a longer period of time. Second, there might be influence of shared method variance between victimization levels and school well-being and self-perceived academic achievement in Study 1, as these were all reported by students. A student who is generally negative might indicate high victimization levels as well as a low school well-being and self-perceived academic achievement. Nevertheless, all other negative social positions were assessed by peer nominations.

Third, we focused on a lack of popularity, that is, students who did not receive popularity nominations. However, the absence of popularity does not necessarily mean that students are unpopular. Thus, future studies might also include a direct unpopularity measure. Also, future studies can assess the quality of students’ friendships to examine whether friendships fulfill students’ social needs. Further, this would gain insight in the type of friendship between two students and whether friends motivate or demotivate students for school. When friends demotivate students for school work, a positive social position (having friends) may imply high school well-being but low academic achievement. Moreover, future studies can also take into account other contextual factors, such as teachers and parents who can also play a role in enhancing students’ well-being and academic engagement and achievement (Flook, Repetti, & Ullman, 2005), and in this way function as a buffer.

Finally, a limitation that should be taken into account is that students in our samples were part of the KiVa study. KiVa is an intervention program that focuses on a positive peer environment in the classroom by stressing all students’ roles and responsibilities in achieving this. Especially in Study 2, students had already worked with KiVa for several years, which might explain lower prevalence rates for victimization and friendlessness. Nevertheless, we found negative effects of negative peer relations on students’ outcomes in all KiVa classrooms, so even worse outcomes can be expected in classrooms in which less attention is paid to creating a positive group atmosphere. Thus, in our study we probably underestimate the true impact of negative social positions on students’ academic functioning.
Chapter 2

Conclusions and Implications

Our findings indicate that students’ embeddedness in the peer group and experiences at school contribute to their school well-being, academic engagement, and academic achievement. Especially the number of negative social positions seems to have negative consequences for students’ academic functioning. This is particularly true for students’ school well-being and academic engagement. These results can raise even more concerns about negative social positions as they seem to intensify each other’s effects. Moreover, results suggest that especially being victimized and friendless can be detrimental.

Teachers and parents should recognize and be aware of the role that students’ social positions among peers play in their academic functioning. By fostering a favorable peer climate with positive peer relations, for instance through preventing bullying and promoting friendships in the classroom, students’ academic well-being, engagement, and in the end achievement can be enhanced.
The importance of near-seated peers for elementary students’ academic engagement and achievement

* This chapter is published in the Journal of Applied Developmental Psychology.

Chapter 3

Abstract

Although students are part of a group of classmates, they spend the majority of their time during lessons with students who are seated next or close to them. Therefore, near-seated peers in elementary school classrooms might play a crucial role in students’ academic development. It was hypothesized that near-seated peers influence students’ academic engagement and achievement, especially when they are also friends. Participants were 559 fourth-sixth grade students (21 classrooms; 51.9% boys; Mage = 10.65 years, range = 8-12).

Longitudinal social network analysis (RSiena) showed that friends became more similar over time in academic engagement and achievement, regardless of their physical position in the classroom. In contrast, near-seated peers who were not befriended became less similar over time. These results imply that teachers should consider students’ friendships and academic engagement and academic achievement in designing their seating arrangements. Moreover, it is recommended to actively monitor ongoing peer influence processes.

Key words: academic engagement; academic achievement; seating arrangements; near-seated peers; social networks
Near-seated peers and academic functioning

Studies among (early) adolescents have shown that classmates affect students’ academic outcomes, by either stimulating or demotivating academic engagement and achievement (e.g., Engels et al., 2016; Geven, Weesie, & Van Tubergen, 2013; Gremmen, Dijkstra, Steglich, & Veenstra, 2017; Rambaran et al., 2017; Shin & Ryan, 2014a, 2014b). Particularly friends play a role in students’ academic outcomes, such as their academic achievement, motivation, and involvement in school (e.g., Kindermann & Skinner, 2009; Flashman, 2012; Molloy, Gest, & Rulison, 2010). In response to being in contact with friends, students’ behaviors and attitudes often change, due to social influence processes (Snijders, Steglich, & Schweinberger, 2007; Steglich, Snijders, & West, 2006). Friends can act as role models due to social comparison between friends and can be sources of academic support, and in this way directly affect students’ academic outcomes (Lomi, Snijders, Steglich, & Torló, 2011). They can also more indirectly affect teachers’ judgments of these academic outcomes as teachers tend to cognitively associate students with the group they are part of and consequently judge friends more similar to each other than non-friends (Steglich & Knecht, 2014).

Previous studies mostly focused on the first years of secondary education (e.g., Geven et al., 2013; Gremmen et al., 2017; Rambaran et al., 2017) or adulthood (Lomi et al., 2011). However, students’ academic engagement and achievement in elementary school affect their level of education in secondary school and, subsequently, their future academic and career opportunities (Flashman, 2012; Witkow & Fuligni, 2010). Therefore, research needs to examine determinants of students’ academic development, starting already in elementary school (Gest & Rodkin, 2011).

Schools and classrooms are inherently social places (Ryan, 2000) and students spend much time in the classroom context, together with their teacher, friends, and other classmates (Altermatt & Pomerantz, 2003). In elementary schools, classrooms often have a fixed seating arrangement. For this reason, not only friends, but also physically close peers in the classroom might play an important role in students’ academic development. Students have the opportunity to especially interact with these peers in a classroom when doing school-related tasks.

Therefore, this study includes a broad scope, by not only looking at friends but also peers in close proximity. The aim of our study is to examine to what extent students’ academic engagement and achievement in elementary school are influenced by near-seated peers, while
Chapter 3

taking the role of friends into account. Insights in this potentially influential role of near-seated peers, next to friends, is important for teachers, as it opens opportunities for them to design seating arrangements that promote students’ academic development (Farmer, McAuliffe, & Hamm, 2011).

Classroom environment and academic functioning

Especially in elementary school, teachers have many possibilities for arranging the classroom. They can for example choose for an arrangement in straight rows, in small groups, U-shaped seatings, or a classroom with flexible arrangements (McCorskey & McVetta, 1978; Wannarka & Ruhl, 2008). Additionally, they have the power to decide the exact position of each student within a seating arrangement. Some teachers mainly have academic reasons for their arrangements, by placing similar or dissimilar students close to another. Other teachers for example focus on students’ social relationships, by placing friends or non-friends close to each other (Gest & Rodkin, 2011; Gremmen, Van den Berg, Segers, & Cillessen, 2016; McKeown, Stringer, & Cairns, 2015).

In this way, teachers structure and arrange daily interactions between students in the classroom (Evertson & Weinstein, 2006; Farmer et al., 2011; Hughes, 2012). They can arrange tables in a certain way and assign students to a specific seat (Gremmen et al., 2016; Van den Berg & Cillessen, 2015). Consequently, teachers determine whom children are more frequently exposed to, whom they can easily interact with, and whom they can collaborate with or ask questions to. The subgroup of near-seated peers is a potentially important source of influence on students’ academic outcomes. Yet, research has mostly focused on the consequences of the whole classroom environment on students’ academic outcomes (Barth, Dunlap, Dane, Lochman, & Wells, 2004; Hastings & Schweiso, 1995; Marx, Fuhrer, & Hartig, 1999), whereas influence processes within smaller groups of classmates have not been examined as extensively.

For example, poor classroom environments, characterized by high aggression scores, poor peer relations, and low academic focus by students, led to lower academic engagement and achievement for fifth grade students (Barth et al., 2004). Other studies have also looked at the effect of the lay-out of specific classroom arrangements (e.g., arrangements in rows or small groups) on students’ academic behavior, such as their on-task behavior and question-
Near-seated peers and academic functioning

asking (Hastings & Schweiso, 1995; Marx et al., 1999; Wannarka & Ruhl, 2008). These studies, including 7 to 15-year-old students, showed that seating arrangements in rows stimulated question-asking to teachers more than seating arrangements in small groups, stressing that teachers should consider the importance of the consequences of their physical arrangements. Seating arrangements in rows seem to facilitate individual work, whereas seatings in groups encourage interaction and collaboration.

In addition, some studies focused on the characteristics of within-class groupings of students, particularly temporary groupings for specific courses in elementary school classes. The role of teachers in implementing temporary groupings has been studied across two core curriculum areas, English and mathematics (Kutnick, Blatchford, & Baines, 2002). It was shown that teachers predominantly focused on same-ability groupings, whereas they rarely grouped students by friendships. However, in another study it was examined whether cognitive development could be enhanced by having pairs of same-sex friends working together (Kutnick & Kington, 2005). Especially pairs of female friends facilitated performance, as girls integrated school issues more into friendship compared to boys.

Temporary groupings to complete concrete tasks have also been studied, showing that effective group work within these small groups of students enhanced their academic engagement and progress over time (Blatchford, Galton, Kutnick, & Baines, 2005). Teachers play an important role in the implementation of cooperative learning in the classroom with groupings (Gillies, Asham, & Terwel, 2008). They can facilitate interactions between students and consequently stimulate learning by means of the organizational structure of the classroom. In sum, these studies have shown the importance of the general classroom lay-out and the effects of groupings on students’ interactions, group work, academic engagement, and academic achievement. Although effect sizes were generally small, these were meaningful.

Near-seated peers and academic functioning

Although some research has been conducted on the role of the classroom structure in students’ learning (e.g., Gaskins, Herres, & Kobak, 2012), little is known about the direct interplay between physical proximity of peers in the classroom and students’ academic development. However, children spend a large amount of time in their daily lives in the company of peers
Chapter 3

(Dijkstra & Veenstra, 2011), especially their near-seated peers (Van den Berg, Segers, & Cillessen, 2012).

Previous studies have clearly shown the importance of a social network approach for understanding students’ development concerning a wide range of behaviors, such as alcohol use, bullying, and smoking behaviors (Veenstra, Dijkstra, & Kreager, 2018). With this approach, the interplay between relations and behaviors is taken into account. Moreover, two fundamental processes that can explain similarity between groups of people can be distinguished, that is, selection and influence processes. Selection refers to students selecting peers as friends whereas influence processes refer to similarities between peers as a result of being in contact with each other (Veenstra et al., 2018). Due to methodological advancements regarding stochastic actor-based modelling (RSiena), it is possible to distinguish peer influence and selection in a statistically sound way (Ripley, Snijders, Boda, Vörös, & Preciado, 2016). For this study, an extra effect has even been developed to examine both static networks (i.e., seatings) as well as changing networks (i.e., friendships) simultaneously.

In social network studies, the main focus is on three aspects, that is, students’ behaviors, their relationships, and their proximity (Rivera, Soderstrom, & Uzzi, 2010). As suggested by Rivera and colleagues, a promising avenue is to explore more deeply the interactions between these three mechanisms. The main mechanism behind proximity is that interaction between students increases due to physical propinquity. This is related to students’ relationships, as being proximate to each other encourages interaction and is in this way associated with the formation and maintenance of friendship relationships (Gest & Rodkin, 2011). Moreover, proximity can influence students’ behavior. When students see each other and interact, social influence can occur (Webb, 1989). Students want to be liked, to belong to a group, and seek social approval by their peers (Cialdini & Goldstein, 2004; Gifford-Smith & Brownell, 2003). In order to achieve this and avoid rejection, they are susceptible to behaviors of peers and often adjust their behaviors to those of the peer group. This influence can be explained by various theories and mechanisms.

According to the social learning theory, students learn by observing peers (Bandura, 1977). When students are close to certain peers, they regularly observe their academic engagement and achievement (Evertson & Weinstein, 2006). They likely imitate behaviors by peers and get reinforced by valued peers through social rewards or social sanctions. Influence
Near-seated peers and academic functioning

processes in academic achievement and engagement can also be explained by social capital (Crosnoe, Cavanagh, & Elder, 2003). Through contact with specific peers, students can gain access to their resources, such as their knowledge and skills with regard to schooling and academic subjects. These resources can promote both students’ involvement in school and their achievement. In this way, peers who have contact with each other will become more similar over time concerning academic outcomes.

Physically close peers have direct opportunities to motivate students to pay attention to class and to get good grades. This can be, among others, by asking and receiving help, by cooperation in academic tasks, and by showing pro-school behavior with a positive working attitude and posture. In contrast, students can also demotivate near-seated peers, by showing distracting behavior or by being negative role models through getting low grades (Dieterich, 2015). For example, when near-seated peers keep on talking during lessons, it can hamper a student’s concentration. In this regard, near-seated peers might be potentially important contributors to a student’s academic outcomes, with more similarity between peers due to influence either upwards or downwards.

However, near-seated peers can be defined in different ways. First, near-seated peers can be defined as all students that are part of the same subgroup in the classroom, as determined by the seating arrangement. Second, near-seated peers can also be defined as the students that sit directly next and opposite to a student. These are students’ neighbors, the peers a student directly sees and most likely interacts the most with during the school day. In this study, we use both definitions to study near-seated peers (see Figure 3.1). In the first model, all peers in the subgroup are considered near-seated peers (referred to as ‘groupmates’). In the second model, near-seated peers are the students who sit directly opposite to a student (in case of groups) and his/her neighbor(s) (in case of both groups and rows). In this paper, the general term near-seated peers is used to refer to both ways of measuring.

We investigate students’ proximity, their friendship relationships, and peer influence processes in academic engagement and achievement, without specifying directions. Therefore, we hypothesize that near-seated peers influence students’ academic engagement and achievement in elementary school, that is students adjust their academic engagement and achievement to the behaviors of near-seated peers.
Chapter 3

**Figure 3.1:** Examples of seatings networks ("near-seated peers"), derived from teacher-drawn seating arrangements. Model 1 with the entire subgroup as near-seated peers. Model 2 with visually close peers (direct neighbors) as near-seated peers.

<table>
<thead>
<tr>
<th>Arrangement</th>
<th>Groups</th>
<th>Rows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seating</td>
<td><img src="image" alt="Seating Diagram" /></td>
<td><img src="image" alt="Seating Rows Diagram" /></td>
</tr>
<tr>
<td>Model 1: entire subgroup ('groupmates')</td>
<td><img src="image" alt="Model 1 Groups Diagram" /></td>
<td><img src="image" alt="Model 1 Rows Diagram" /></td>
</tr>
<tr>
<td>Model 2: direct neighbors</td>
<td><img src="image" alt="Model 2 Groups Diagram" /></td>
<td><img src="image" alt="Model 2 Rows Diagram" /></td>
</tr>
</tbody>
</table>

**Near-seated peers who are friends**

But what happens if near-seated peers are friends? It seems reasonable that students attach more importance to the opinions and behaviors of near-seated friends compared to other peers, as friends have been found to play an important role in students academics (e.g., Shin & Ryan, 2014a, 2014b). Also, students probably have more daily interactions with their near-seated friends than with other near-seated peers or other friends and consequently observe their behavior even more. For example, students may be more likely to ask near-seated friends questions about academic tasks than other peers. Based on that reasoning, we hypothesize that the influential effect of near-seated peers on students’ academic engagement and achievement is stronger when these peers are friends.
PRESENT STUDY
Previous studies have limited their focus on students’ friends when examining influence processes in their academic functioning. Moreover, these studies have examined adolescents, mostly in the first years of secondary education. Furthermore, changes in academic outcomes have been studied on a classroom level instead of a relationship level, missing social network information. With our study, we aim to respond to the call for examining the interaction between students’ relationships, their behaviors, and their proximity with social network analysis (Rivera et al., 2010). Studying proximity is especially interesting in elementary school, where students spend the majority of the day in the classroom, seated near to only some peers. This proximity between students might lead to influence, due to contact with each other and social learning processes. Nevertheless, to our knowledge no study has investigated the direct influence of near-seated peers on students’ academic engagement and achievement over time.

Therefore, we examine whether students’ near-seated peers influence their academic achievement and engagement. As near-seated peers might also be students’ friends, we also aim to study whether influence is stronger in case of near-seated friends. In order to study influence processes, it is important to control for selection processes, as near-seated peers can become friends. Selection processes refer to affiliations with specific peers. By selecting friends who then can exert influence over them, students can bolster their own academic development in an indirect way (Mercken, Sleddens, de Vries, & Steglich, 2013; Osgood et al., 2013).

METHOD
PARTICIPANTS AND PROCEDURE
This study was part of a larger study on seating arrangements and peer affiliations. Participants were 559 students and their teachers in 21 classrooms (51.9% boys; Mage = 10.65 years, SD = 0.93, range 8-12; 96.4% of participants were born in the Netherlands). They were in fourth to sixth grade at seven regular elementary schools in the Netherlands, located in middle-class communities in the south-eastern Netherlands. The mean classroom size was 26.62 (SD = 4.42), ranging from 17 to 37 students per classroom. For 88.6% of students, both parents were born in the Netherlands, 6.6% of the students had one parent that was born outside of the Netherlands, and 4.8% had parents who were both born outside of the Netherlands.
Chapter 3

Schools were recruited with a letter explaining the study and by follow-up phone calls. After these calls, 21 teachers were willing to participate. The parents or guardians of all students in these classrooms received a letter in which the study and students’ tasks were explained. They could indicate if they did not want their child to participate. Five parents called for extra information and eventually participation was refused for two children.

Participating teachers and students were visited twice in their own classroom, in October/November 2013 and in January 2014. These moments were specifically chosen, as these were right after a holiday break, when teachers changed the seating arrangements. In this way, we ensured that the seating arrangements were just made by the teacher at Time 1 (pre-assessment) and remained the same until Time 2 (post-assessment). At both time points, students were placed separately in the classroom with partitions between the tables. They filled in sociometric questions on netbooks and were informed about their anonymity as well as the possibility to withdraw from the study at any time. Simultaneously, teachers filled in questionnaires for all students concerning their academic engagement and academic achievement. When students were not present during the assessment, they had the possibility to provide their answers at a later time point. The response rate was very high (97.7% at Time 1 and 97.1% at Time 2). Teachers as well as students received a small present to thank them for their participation.

MEASURES

**Academic achievement** was measured using a questionnaire for teachers. This questionnaire was especially designed for this study and was based on the main school subjects in Dutch elementary schools, with rating categories similar to the categories on school report cards. For each student, teachers had to indicate how well a student performed on seven academic items, using information from students’ school tests and tasks. They answered on a seven-point Likert scale (ranging from ‘-3 = very weak’ to ‘3 = very good’). For example: “How does .... (name) perform on the subject – language”. The questionnaire consisted of the items ‘language’, ‘mathematics’, ‘biology’, ‘geography’, ‘history’, ‘art’, and ‘gymnastics’.

A Principal Component Analysis extracted two components. The factor loadings of the first component ranged from .83-.95, except for arts (.52) and gymnastics (.42). These items loaded high on a second component (.63 and .76), which makes sense as those subjects are
less related to cognitive abilities and more to creative and athletic abilities compared to the other school subjects. Therefore, arts and gymnastics were omitted from further analyses. A reliability analysis indicated high internal consistency ($\alpha = .94$), so a mean score was computed of students’ scores on language, mathematics, biology, geography, and history.

Because our analysis method requires ordinal dependent variables, we categorized students’ academic achievement into six categories for the analyses, with a distribution that is sufficiently subtle to capture observed changes between students and has a bell-shaped distribution. Table 3.1 shows the categories as well as the number of students that fall within specific categories.

**Academic engagement** was measured within the same teacher questionnaire. For each student, teachers had to indicate how well a student performed on ten aspects of academic engagement, using a seven-point Likert scale (ranging from ‘-3 = very weak’ to ‘3 = very good’). Academic engagement was assessed by the items ‘posture’, ‘working according to plan’, ‘self-confidence’, ‘social behavior’, ‘motivation for school’, ‘concentration’, ‘understanding of contents’, ‘speed’, ‘listening’, and ‘eagerness to learn’.

A Principal Component Analysis showed that all items loaded high on one component (loadings between .66 and .90), so a mean score was made of all items. A reliability analysis indicated high internal consistency ($\alpha = .94$).

In Table 3.1, the categorization of students’ academic engagement is displayed, as well as the number of students that fall within specific categories. Again, six categories were created for the RSiena analyses reported below, following a bell-shaped distribution.
Chapter 3

Table 3.1

Category specification for academic achievement and engagement and the number of students that fall within specific categories.

<table>
<thead>
<tr>
<th>Category</th>
<th>Scores (x)</th>
<th>Achievement T1</th>
<th>Achievement T2</th>
<th>Engagement T1</th>
<th>Engagement T2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (very low)</td>
<td>-3 ≤ x ≤ -1.5</td>
<td>20</td>
<td>12</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>-1.5 &lt; x ≤ -0.5</td>
<td>56</td>
<td>70</td>
<td>72</td>
<td>58</td>
</tr>
<tr>
<td>3</td>
<td>-0.5 &lt; x ≤ 0.1</td>
<td>119</td>
<td>112</td>
<td>103</td>
<td>114</td>
</tr>
<tr>
<td>4</td>
<td>0.1 &lt; x ≤ 1.5</td>
<td>179</td>
<td>166</td>
<td>219</td>
<td>238</td>
</tr>
<tr>
<td>5</td>
<td>1.5 &lt; x ≤ 2.5</td>
<td>121</td>
<td>107</td>
<td>113</td>
<td>101</td>
</tr>
<tr>
<td>6 (very high)</td>
<td>2.5 &lt; x ≤ 3.0</td>
<td>60</td>
<td>57</td>
<td>38</td>
<td>37</td>
</tr>
</tbody>
</table>

Friendships were measured with peer nominations. All students were provided with an individual laptop. A roster appeared on the screen with the first names of all class members in random order. Each child had a different order, but the same order for each sociometric question. The questions appeared on the screen and students could select or deselect class members by clicking on those students’ first names. Children were first asked ‘who is your number one best friend in your classroom’. After nominating one of their classmates, children were asked ‘who are your other best friends in your classroom?’. For this question, participants could name as many or as few classmates as they wanted, allowing both same-sex and cross-sex choices. Students could not name themselves or students outside of their class. All friends (number one best friend and other best friends) were selected for the analyses. Answers from students who nominated all their peers were treated as being missing, which applied to two students in the first wave and two students in the second wave.

Near-seated peers were determined by asking teachers to draw a map of their (self-chosen) classroom’s default seating arrangement as accurately and precisely as possible. The default seating arrangement was defined as the arrangement where students sat for the majority of the school day, regardless of potential temporary rearrangements for certain activities (Van den Berg & Cillessen, 2015). The received maps (seating arrangements) from the teachers corresponded with the actual layout of the classroom as observed during data collection. Furthermore, teachers were explicitly asked not to change their seating arrangement between the two measurements. They received a logbook to indicate whether some changes had been
made anyway. Teachers hardly made any changes in between the two measurements, that is, maximally one switch of two students. Therefore, the seating arrangements could be considered as stable between the two time points.

Two types of seating arrangements were used, seating arrangements in small groups and in rows. Of the 21 classrooms, 15 classrooms were organized in small groups, with the size of the groups ranging from 3 to 6 students. In six classrooms, teachers chose for a seating arrangement in rows, with 2 or 3 tables next to each other.

**Sex** was coded 0 for boys and 1 for girls.

**Age** was assessed by asking students their day and month of birth, next to their current age. Combining this information with the date on which each student filled out the questionnaire, a standardized age of the student was calculated.

**ANALYTICAL STRATEGY**

**RSiena**

In order to answer the research questions, we applied stochastic actor-based network-behavior co-evolution models (Steglich, Snijders & Pearson, 2010), facilitated in the Simulation Investigation for Empirical Network Analysis (SIENA) software package in R (Ripley et al., 2016). More specifically, we used RSienaTest, the custom-made version including a custom-made dyadic covariate influence effect to estimate effects for a constant network. We analyzed the co-evolution of students’ friendship networks with either their academic engagement or their academic achievement. We specifically addressed the effects of seating networks on these outcomes.

Two models were estimated, one with academic engagement and one with academic achievement as the student’s outcome measure. Academic achievement data was missing for two classrooms at Time 2, so models with academic achievement were analyzed for 19 instead of 21 classrooms. Selection effects were included in the friendship part of the models, while influence effects were included in the behavior part. To achieve high statistical power while sufficiently accounting for potential between-class heterogeneity, a random effects model was estimated (i.e., Bayesian longitudinal social network analyses; see Section 11.3 of Ripley et al., 2016).
The parameters of the models are explained in the following subparagraph (model specification). Under a Bayesian approach, a prior probability distribution over the parameters is assigned, which is updated to a posterior probability distribution based on the data. All control variables are included as random coefficients varying over classrooms, while hypothesized effects are included as non-varying coefficients. In this way, we ensure sufficient freedom to model heterogeneity of classes while retaining high statistical power for testing our hypotheses. For all coefficients, we used weakly informative prior distributions, based on prior analysis results obtained for similar data sets.

**MODEL SPECIFICATION**

**Friendship dynamics.** To model changes in friendship networks, the occurrence rate and the nature of these changes are specified as follows. Rate parameters reflect the average number of change opportunities in friendship ties per actor between the two time points. Because relationships between students are not independent of one another, the most common structural network effects are also included (Veenstra, Dijkstra, Steglich, & Van Zalk, 2013). The outdegree (density) parameter models the tendency of students to nominate others as friends. Reciprocity refers to the tendency to reciprocate received friendship nominations. Transitive triplets and transitive reciprocated triplets represent the transitive closure of friends (‘friends of friends become friends’), and whether it is reciprocated, respectively (Block, 2015). Three cycles reflect nonhierarchical cycles of generalized reciprocity (i.e., student A nominates student B, student B nominates student C, and student C nominates student A). The same sex effect indicates whether friendships are more common among same-sex students. Furthermore, ego (sender) effects (given nominations), and alter (receiver) effects (received nominations) were included for sex. Sex ego and alter indicate whether girls or boys give and receive more nominations, respectively. In order to account for classroom heterogeneity, all of the above parameters were allowed to vary over classrooms, referring to that they were included as random effects.

In order to obtain a powerful statistical test, the effects related to our hypotheses were not allowed to vary over classrooms but estimated as fixed effects. The seating effect indicates whether a near-seated peers is also chosen as a friend. The achievement/engagement ego and alter effects express to what extent students’ academics affect the number of nominations
given and received, respectively. Also, we estimated the *achievement/engagement similarity* effect, which measures whether students with high (or low) academic scores selected others who also scored high (or low). This indicates whether similarity between ego and alter increases the probability of a friendship between them.

**Behavior dynamics.** The behavior dynamics part of the model concerns changes in students’ academic engagement and achievement. As random parameters, the following effects were included. *Rate parameters* indicate per student the average number of change opportunities between the two time points with respect to lowering or raising their academic. Influence processes by near-seated peers and friends were estimated while controlling for the overall tendencies of academic achievement/engagement (*linear* and *quadratic* shape). Moreover, we controlled in the academic achievement model for students’ engagement and in the academic achievement model for their engagement. Finally, we controlled in both models for students’ sex and age. Again, all controls were included as random effects.

The following three average alter (influence) effects were included as fixed parameters in the behavior dynamics part of the model. First, the *average alter of friends* effect was included, estimating whether students’ academic achievement/engagement was higher/lower for students whose friends’ scores were also higher/lower. This effect thus concerns the main effect of friends, regardless of their seating. Second, the *average alter of groupmates / neighbors* effect was estimated, indicating whether students’ academic achievement/engagement was higher/lower for students whose near-seated peers (regardless friendship) also scored higher/lower. This effect thus concerns all groupmates / neighbors. Third, the *average alter of friends who are groupmates / neighbors* effect was estimated, to investigate whether a student over time tended to get higher academic achievement or engagement scores when their near-seated friends also scored higher. This effect thus concerns all groupmates / neighbors that were also friends: the net effect for this group of peers can be calculated by adding up the three influence effects.
Chapter 3

RESULTS

Descriptive statistics of network variables

Descriptions of network and individual variables are presented in Table 3.2. The average number of friendships per students was 6.32 (Time 1) and 7.43 (Time 2). The friendship network was characterized by high reciprocity, with participants reciprocating about 66% of the friendship ties. Transitivity was also high (on average 59%), indicating a tendency for friends of friends to be friends. Most friendship nominations were between the same sex (about 87%), which is in accordance with previous studies (Veenstra & Steglich, 2012).

The Geary’s C network autocorrelation coefficient was used to indicate the degree to which friends differ from their near-seated peers in terms of academic achievement and engagement scores (Steglich et al., 2010). The values of Geary’s C lie between 0 and 2. Values lower (higher) than 1 indicate that students who are friends/near-seated peers are closer to (more distant from) each other than expected under randomness, in terms of their academic achievement and engagement scores. In the present study, the index was on average .93 for friendships and .92 for seatings, with comparable coefficients for academic achievement and engagement. This indicates that both the friendship and the seating network were not strongly structured on achievement and engagement. When separating students’ group mates who were friends or not friends, we see less closeness in academic outcomes between non-friends who are near-seated than friends who are near-seated, especially at T2, where these near-seated non-friends are even more distant than expected under randomness (Geary’s c above 1).

The Hamming Distance (85.3) indicates an on average sufficient number of changes in friendship ties to identify the parameters. The Jaccard index shows the amount of stability in friendship ties and is 61%. In order to conduct longitudinal network analysis in RSiena with adequate statistical power for detecting and controlling for endogenous effects (reciprocity, transitivity, etc.), this index should be higher than 30% and lower than 70% (see Veenstra et al., 2013).
Table 3.2
Sample and sample change descriptives per class (N=21).

<table>
<thead>
<tr>
<th>Sample</th>
<th>T1</th>
<th>T2</th>
<th>Sample change</th>
<th>T1-T2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Friendship indicators</td>
<td></td>
</tr>
<tr>
<td>Network density indicators</td>
<td></td>
<td></td>
<td>Jaccard index; stability</td>
<td>61% (7%)</td>
</tr>
<tr>
<td>Average degree</td>
<td>6.32 (.29)</td>
<td>7.43 (.54)</td>
<td>Hamming distance; change</td>
<td>85.33 (36.52)</td>
</tr>
<tr>
<td>Response</td>
<td>97.7%</td>
<td>97.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other network indicators</td>
<td></td>
<td></td>
<td>No. of ties dissolved</td>
<td>628</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>65% (9%)</td>
<td>67% (8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transitivity</td>
<td>58% (7%)</td>
<td>60% (7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same sex</td>
<td>88% (6%)</td>
<td>85% (7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friendship network autocorrelation</td>
<td></td>
<td></td>
<td>No. of ties emerges</td>
<td>1177</td>
</tr>
<tr>
<td>Geary’s C achievement</td>
<td>.97 (.18)</td>
<td>.92 (.19)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geary’s C engagement</td>
<td>.96 (.13)</td>
<td>.90 (.13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seating arrangement autocorrelation</td>
<td></td>
<td></td>
<td>No. of ties maintained</td>
<td>2747</td>
</tr>
<tr>
<td>Geary’s C achievement</td>
<td>.89 (.25)</td>
<td>.92 (.23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geary’s C engagement</td>
<td>.90 (.24)</td>
<td>.98 (.23)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groupmates but not friends</td>
<td></td>
<td></td>
<td>Changes in engagement</td>
<td></td>
</tr>
<tr>
<td>Geary’s C achievement</td>
<td>.94 (.30)</td>
<td>1.15 (.74)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geary’s C engagement</td>
<td>.91 (.27)</td>
<td>1.24 (1.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groupmates and friends</td>
<td></td>
<td></td>
<td>Changes in engagement</td>
<td></td>
</tr>
<tr>
<td>Geary’s C achievement</td>
<td>.75 (.39)</td>
<td>.80 (.33)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geary’s C engagement</td>
<td>.86 (.48)</td>
<td>.88 (.45)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Standard deviations are placed between brackets. Reciprocity was calculated as $2M/2M+A$, where $M$ = mutual ties and $A$ = asymmetric ties; Transitivity was calculated as $N$ of transitive triplets divided by $N$ of 2-paths (potentially transitive triplets); See for more information on the calculation of the different network indices Veenstra and Steglich (2012).
Chapter 3

Additionally, we calculated the overlap between the friendship and seating network at both Time 1 and Time 2, as seatings remained the same across waves whereas friendships changed. We assessed how many groupmates were also friends, the percentages of friends that were also a groupmate, and the percentages of groupmates that were also friends. At Time 1, there were in total 374 friendship relationships between groupmates over all classrooms, which is 36.4% of all groupmates (1029). Of all students’ friends (3475), 3101 (89.2%) were not groupmates. Most students within a classroom were not friends nor groupmates (72.2%). At Time 2, there were 514 friendship relationships between groupmates, which is 52.0% of all groupmates (988). Of all students’ friends (7235), 6721 (92.9%) were not groupmates. Finally, 46.9% of all students was not friends and were also not groupmates.

RSiena Analyses

Table 3.3 and 3.4 show the results of the RSiena Bayesian estimation regarding students’ academic achievement and academic engagement when measured near-seated peers as all groupmates respectively. In Table 3.5 and 3.6 the results are shown with only students’ direct neighbors as near-seated peers. The tables include the posterior means and standard deviations for the fixed parameters $\eta$ and the random parameters $\mu$. Estimates can be interpreted as log odds for a tie to exist (friendship part of the model) or for academic achievement or engagement to increase (achievement / engagement part; Ripley et al., 2016). Significance is indicated by so-called Bayesian p-values, which give the percentile of the value zero in the posterior (for $\eta$ parameters) or in the posterior mean (for parameters) distribution. They indicate the posterior probability for a right-sided alternative hypothesis to be true. Accordingly, if we formulated a right-sided hypothesis, a Bayesian p-value close to zero is what we count as supportive evidence, while we count Bayesian p-value close to one as supportive evidence for left-sided hypotheses. Moreover, the tables show the posterior variation between classrooms for the random parameters, indicated by $\tau^2$ and $\text{sd}(\tau^2)$.

Results indicate that there was indeed variation (heterogeneity) between classrooms in the control variables in all models, which justifies the decision to include random effects for these parameters. Moreover, results were quite similar for both ways of measuring near-seated peers, with effects in the same directions, but weaker effects for direct neighbors compared to
Near-seated peers and academic functioning

all groupmates. Therefore, we only discuss the results from Table 3.3 and Table 3.4, in which near-seated peers were defined as all groupmates.

**ACADEMIC ACHIEVEMENT**

Table 3.3 shows the results of the RSiena Bayesian estimation regarding students’ academic achievement.

**Friendship dynamics.** A negative significant effect for outdegree was found (Est. = -2.22), indicating that participants on average selected few peers as friends (less than half of the classroom). Moreover, students tended to reciprocate friendships (Est. = 1.57) and were likely to be friends with their friends’ friends (Est. = 0.34). Also, students were more likely to select same-sex peers as friends (Est. = 0.83). A positive effect was found of seatings on friendship (Est. = 0.17), indicating that near-seated peers were often friends. No significant three-cycle or transitive reciprocated triplets effects were found. Because in adolescents’ networks, these effects typically indicate hidden hierarchies in the friendship network, we tentatively conclude that compared to adolescents, our younger students were befriended in a more egalitarian way. Also, girls or boys were not more likely to give or receive nominations. Moreover, students’ academic achievement did not affect the amount of incoming and outgoing friendship nominations. Finally, no selection effects were found for academic achievement.

**Behavior dynamics.** The quadratic shape effect was negatively significant (Est. = -0.59), indicating regression to the mean. Also, a marginal negative significant average alter effect for near-seated peers who are not friends was found (Est. = -0.11). This effect indicates that when the teachers consider the near-seated non-friends of a student to be high achievers, (s)he will judge the student’s own grades more negatively (and, vice versa, if near-seated non-friends are considered to have low grades, this has a positive effect on the teacher’s assessment of the student’s own grades). The average alter effects of friends and friends who are near-seated peers were positive but not significant. As indicated in the note of Table 3, the net mean influence effect of groupmates who are friends was 0.30 (posterior standard deviation = 0.89). So, the net effect was positive and not significant. Moreover, a positive effect of engagement on achievement was found (Est. = 0.80), which indicates that a higher engagement leads to a higher achievement. Finally, a negative effect of students’ age was found (Est. = -0.62),
indicating that older students had worse academic achievement than younger students. No significant effect of sex was found.

**ACADEMIC ENGAGEMENT**

Table 3.4 shows the results of the RSiena Bayesian estimation regarding students’ academic engagement. All random effects, such as density, reciprocity, and same-sex friendship selection, were more or less similar with regard to directions and significance to the academic achievement results (see Table 3.3). For example, density was negative and students reciprocated friendships, were often friends with friends’ friends, and had a tendency to select same-sex peers as friends. Below, we will focus on the results for the fixed effects, as those pertain to our research questions.

**Friendship dynamics.** Again, a positive effect was found of seatings on friendship (Est. = 0.13), indicating that near-seated peers were often friends. Moreover, students’ academic engagement positively affected the amount of incoming and outgoing friendship nominations. Finally, no selection effects were found for academic engagement.

**Behavior dynamics.** A negative significant average alter effect for near-seated peers who are not friends was found (Est. = -0.17), indicating that students’ engagement got worse when peer scored better, and vice versa. The average alter effects of friends was marginally significant and positive (Est. = 0.48), indicating that students’ engagement got better, the better their friends’ academic engagement was. The influence effect of near-seated friends was also positive, but not significant. The net mean influence effect of groupmates who are friends was 0.55, with a posterior standard deviation of 1.13 (see note of Table 3.4 for calculation). Thus, this net effect was more positive, but still not significant and with a high standard deviation.
Table 3.3

Bayesian RSiena results on friendships, near-seated peers (entire subgroup), and academic achievement (N=19 classrooms)

<table>
<thead>
<tr>
<th></th>
<th>Random</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\mu$</td>
<td>$sd(\mu)$</td>
</tr>
<tr>
<td><strong>Network dynamics: Friendship</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of change</td>
<td>5.66***</td>
<td>0.68</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.22***</td>
<td>0.31</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.57***</td>
<td>0.35</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.34</td>
<td>0.21</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.11</td>
<td>0.23</td>
</tr>
<tr>
<td>3-cycles</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>Seating</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement alter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement ego</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement similarity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex alter</td>
<td>0.14</td>
<td>0.23</td>
</tr>
<tr>
<td>Sex ego</td>
<td>0.17</td>
<td>0.26</td>
</tr>
<tr>
<td>Same sex</td>
<td>0.83***</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Behavior dynamics: Academic Achievement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of change</td>
<td>1.11***</td>
<td>0.26</td>
</tr>
<tr>
<td>Linear shape</td>
<td>-0.24</td>
<td>0.35</td>
</tr>
<tr>
<td>Quadratic shape</td>
<td>-0.59***</td>
<td>0.22</td>
</tr>
<tr>
<td>Average achievement of friends</td>
<td>0.39</td>
<td>0.38</td>
</tr>
<tr>
<td>Average achievement of groupmates</td>
<td>-0.11*</td>
<td>0.07</td>
</tr>
<tr>
<td>Average achievement of friends who are groupmates</td>
<td>0.02*</td>
<td>0.20</td>
</tr>
<tr>
<td>Engagement</td>
<td>0.80***</td>
<td>0.28</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.26</td>
<td>0.35</td>
</tr>
<tr>
<td>Age</td>
<td>-0.62*</td>
<td>0.34</td>
</tr>
</tbody>
</table>

Note. Posterior means and standard deviations for the fixed parameters $\eta$ and the random parameters $\mu$; posterior means and standard deviations of the variances of random parameters $\tau$. * p-value = .05 * p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). ^: The net effect of 'average achievement of friends who are groupmates' is calculated in the results section, with the following formulas: posterior mean = sum of three posterior means = 0.39-0.11+0.02= +0.30, posterior standard deviation = $\sqrt{(\text{sum of three squared standard deviations}) + (2 \times \text{sum of three posterior covariances})} = +0.35.$
### Table 3.4
Bayesian RSiena results on friendships, near-seated peers (entire subgroup), and academic engagement (N=21 classrooms)

<table>
<thead>
<tr>
<th></th>
<th>Random</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \mu )</td>
<td>( sd(\mu) )</td>
</tr>
<tr>
<td><strong>Network dynamics: Friendship</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of change</td>
<td>5.54***</td>
<td>0.67</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.24***</td>
<td>0.32</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.56***</td>
<td>0.31</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.33</td>
<td>0.19</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.11</td>
<td>0.21</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-0.17</td>
<td>0.20</td>
</tr>
<tr>
<td>Seating</td>
<td></td>
<td>0.13^*</td>
</tr>
<tr>
<td>Engagement alter</td>
<td></td>
<td>0.08***</td>
</tr>
<tr>
<td>Engagement ego</td>
<td></td>
<td>-0.05^*</td>
</tr>
<tr>
<td>Engagement similarity</td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>Sex alter</td>
<td>0.06</td>
<td>0.22</td>
</tr>
<tr>
<td>Sex ego</td>
<td>0.21</td>
<td>0.23</td>
</tr>
<tr>
<td>Same sex</td>
<td>0.88^**</td>
<td>0.29</td>
</tr>
<tr>
<td><strong>Behavior dynamics: Academic Engagement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of change</td>
<td>1.09***</td>
<td>0.30</td>
</tr>
<tr>
<td>Linear shape</td>
<td>0.15</td>
<td>0.34</td>
</tr>
<tr>
<td>Quadratic shape</td>
<td>-0.91***</td>
<td>0.26</td>
</tr>
<tr>
<td>Average engagement of friends</td>
<td></td>
<td>0.48^*</td>
</tr>
<tr>
<td>Average engagement of groupmates</td>
<td></td>
<td>-0.17^*</td>
</tr>
<tr>
<td>Average achievement of friends who are groupmates</td>
<td></td>
<td>0.24^*</td>
</tr>
<tr>
<td>Achievement</td>
<td>0.58***</td>
<td>0.34</td>
</tr>
<tr>
<td>Sex</td>
<td>0.30</td>
<td>0.29</td>
</tr>
<tr>
<td>Age</td>
<td>-0.51^*</td>
<td>0.28</td>
</tr>
</tbody>
</table>

*Note: Posterior means and standard deviations for the fixed parameters \( \eta \) and the random parameters \( \mu \); posterior means and standard deviations of the variances of random parameters \( r^2 \); *p-value =.05 *p-value <.05. **p-value <.01. ***p-value <.001 (one-tailed tests). ^: The net effect of 'average achievement of friends who are groupmates' is calculated in the results section, with the following formulas: posterior mean = sum of three posterior means = 0.48-0.17+0.24= +0.55, posterior standard deviation = \( \sqrt{((sum\ of\ three\ squared\ standard\ deviations) + (2x\ sum\ of\ three\ posterior\ covariances))} = +0.34. \)
### Table 3.5
Bayesian RSiena results on friendships, near-seated peers (direct neighbors), and academic achievement (N=19 classrooms)

<table>
<thead>
<tr>
<th>Network dynamics: Friendship</th>
<th>Random</th>
<th></th>
<th></th>
<th></th>
<th>Fixed</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of change</td>
<td>μ</td>
<td>sd(μ)</td>
<td>p</td>
<td>η</td>
<td>sd(η)</td>
<td>p</td>
<td>τ²</td>
<td>sd(τ²)</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.21***</td>
<td>0.33</td>
<td>&lt; .01</td>
<td>2.09</td>
<td>0.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.57***</td>
<td>0.35</td>
<td>&gt; .99</td>
<td>2.29</td>
<td>0.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.33*</td>
<td>0.20</td>
<td>0.95</td>
<td>0.89</td>
<td>0.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.12</td>
<td>0.22</td>
<td>0.29</td>
<td>0.92</td>
<td>0.30</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-cycles</td>
<td>-0.21</td>
<td>0.22</td>
<td>0.17</td>
<td>0.90</td>
<td>0.35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seating</td>
<td></td>
<td></td>
<td></td>
<td>0.17*</td>
<td>0.09</td>
<td>0.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement alter</td>
<td></td>
<td></td>
<td></td>
<td>0.00</td>
<td>0.02</td>
<td>0.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement ego</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.13</td>
<td>0.10</td>
<td>0.13</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement similarity</td>
<td></td>
<td></td>
<td></td>
<td>0.12</td>
<td>0.25</td>
<td>0.70</td>
<td>1.05</td>
<td>0.33</td>
</tr>
<tr>
<td>Sex alter</td>
<td>0.17</td>
<td>0.23</td>
<td>0.77</td>
<td>1.07</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex ego</td>
<td>0.85***</td>
<td>0.30</td>
<td>&gt; .99</td>
<td>1.96</td>
<td>0.66</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavior dynamics: Academic Achievement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate of change</td>
<td>1.13***</td>
<td>0.27</td>
<td></td>
<td>0.18</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear shape</td>
<td>-0.14</td>
<td>0.30</td>
<td>0.33</td>
<td>1.36</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quadratic shape</td>
<td>-0.56***</td>
<td>0.21</td>
<td>&lt; .01</td>
<td>0.69</td>
<td>0.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average achievement of friends</td>
<td></td>
<td></td>
<td></td>
<td>0.35</td>
<td>0.33</td>
<td>0.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average achievement of neighbors</td>
<td></td>
<td></td>
<td></td>
<td>-0.05</td>
<td>0.10</td>
<td>0.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average achievement of friends who are neighbors</td>
<td></td>
<td></td>
<td></td>
<td>0.02 A</td>
<td>0.20</td>
<td>0.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engagement</td>
<td>0.76***</td>
<td>0.28</td>
<td>&gt; .99</td>
<td>1.08</td>
<td>0.55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>-0.28</td>
<td>0.30</td>
<td>0.17</td>
<td>1.02</td>
<td>0.44</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.62</td>
<td>0.33</td>
<td>0.03</td>
<td>1.19</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Posterior means and standard deviations for the fixed parameters η and the random parameters μ; posterior means and standard deviations of the variances of random parameters τ². * p-value = .05 * p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). ^: The net effect of 'average achievement of friends who are groupmates' is calculated in the results section, with the following formulas: posterior mean = sum of three posterior means = 0.35-0.05+0.02 = +0.32, posterior standard deviation = √(sum of three squared standard deviations) + (2x sum of three posterior covariances)) = +0.34.
### Table 3.6
Bayesian RSiena results on friendships, near-seated peers (direct neighbors), and academic engagement (N=21 classrooms)

<table>
<thead>
<tr>
<th>Network dynamics: Friendship</th>
<th>Random</th>
<th>Fixed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of change</td>
<td>5.51***</td>
<td>2.04</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.27**</td>
<td>1.95</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.61***</td>
<td>2.09</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.33**</td>
<td>0.81</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.11</td>
<td>0.84</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-0.19</td>
<td>0.83</td>
</tr>
<tr>
<td>Seating</td>
<td>0.15^</td>
<td>0.96</td>
</tr>
<tr>
<td>Engagement alter</td>
<td>0.08***</td>
<td>&gt; .99</td>
</tr>
<tr>
<td>Engagement ego</td>
<td>-0.05^</td>
<td>0.03</td>
</tr>
<tr>
<td>Engagement similarity</td>
<td>0.08</td>
<td>0.72</td>
</tr>
<tr>
<td>Sex alter</td>
<td>0.09</td>
<td>1.01</td>
</tr>
<tr>
<td>Sex ego</td>
<td>0.20</td>
<td>1.01</td>
</tr>
<tr>
<td>Same sex</td>
<td>0.88***</td>
<td>1.80</td>
</tr>
</tbody>
</table>

#### Behavior dynamics: Academic Engagement

| Rate of change | 1.08*** | 0.16  |
| Linear shape   | 0.11    | 1.37  |
| Quadratic shape| -0.92***| 0.98  |
| Average engagement of friends | 0.56^  | 0.94  |
| Average engagement of neighbors | -0.18^ | 0.06  |
| Average engagement of friends who are neighbors | 0.17^   | 0.76  |
| Achievement    | 0.57*** | 0.97  |
| Sex            | 0.30    | 0.87  |
| Age            | -0.49^  | 1.00  |

Note. Posterior means and standard deviations for the fixed parameters $\eta$ and the random parameters $\mu$; posterior means and standard deviations of the variances of random parameters $\tau^2$. ^ p-value = .05 * p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). ^ The net effect of ‘average achievement of friends who are groupmates’ is calculated in the results section, with the following formulas: posterior mean = sum of three posterior means = 0.56-0.18+0.17 = +0.55, posterior standard deviation = $\sqrt{(\text{sum of three squared standard deviations} + (2\times \text{sum of three posterior covariances}))}$ = +0.36
DISCUSSION

Teachers have the possibility to actively manage students’ social networks, by fostering social meeting opportunities between peers in the classroom through seating arrangements (Farmer et al., 2011). Previous studies have shown the social benefits of carefully designed seating arrangements, as it can influence the way classmates perceive and behave towards each other (Gest & Rodkin, 2011; Van den Berg & Cillessen, 2015; Van den Berg, Segers, & Cillessen, 2012). Thus, seating arrangements can affect students’ social relationships, but do they also affect students’ and their peers’ academic development?

The aim of our study was to examine the importance of three types of peers for students’ academic engagement and academic achievement, that is, friends, near-seated peers, and near-seated peers who are friends. Results for academic achievement show that (1) students got worse (better) scores when their near-seated non-friends got better (worse) (negative, significant effect), (2) students got better (worse) scores when their friends also scored better (worse) (positive, non-significant effect), and (3) students got better (worse) scores when near-seated friends also scored better (worse) (positive, non-significant effect). For academic engagement, the results indicate that (1) students got worse (better) scores when their near-seated non-friends got better (worse) (negative, significant effect), (2) students got better (worse) scores when their friends also scored better (worse) (positive, marginally significant effect), and (3) students got better (worse) scores when near-seated friends also scored better (worse) (positive, non-significant effect).

The importance of near-seated peers and especially friends

Overall, results showed a sometimes non-significant and sometimes marginal positive effect of students’ friends on their academic achievement and engagement, regardless of being a near-seated peer or not. The positive effects mean that students’ grades and engagement became higher (lower) when friends’ scores were also higher (lower), indicating conformity to their norms. Also, we found a negative influence effect of near-seated peers who were not friends, indicating less similarity in academic outcomes between them over time. In sum, results do not only indicate that friends play an important role in students’ academic engagement and achievement, but also that peers who are not friends but sit closely to each other influence one another. Our hypotheses were that near-seated peers would influence students’ academic engagement and achievement, in the sense of becoming more similar to each other, and that
these effects would be stronger for near-seated friends. We indeed found a positive effect of friends and near-seated friends (more similarity), but a negative influence effect (more dissimilarity) of near-seated peers who were not friends.

The increasing dissimilarity of near-seated peers who are not friends (negative influence effect) is in line with the big-fish-little-pond effect (BFLPE). The BFLPE is a frame of reference model, stressing that students compare their academic abilities with peers and, subsequently, form their own academic self-concept based on this social comparison (Marsh & Craven, 1997; Marsh & Parker, 1984). In our study, the BFLPE could entail that low-achieving students, when surrounded by high-achieving peers, will become more demotivated, resulting in a decrease in academic engagement and achievement. Conversely, if students have a reference group of lower-achieving peers, this might bolster their self-confidence and motivation, which can increase their academic engagement and achievement. This is also in line with the mechanism of social contrast, suggesting that students’ behaviors are influenced by relative achievements in reference to peers. When students achieve relatively low compared to peers, it might decrease their ambitions and motivations (Rosenqvist, 2018).

Interestingly, this discouragement due to comparisons with higher- or lower-achieving peers only seems to hold for students who are not befriended. In contrast, friends tend to become more similar over time in academic engagement and achievement. It might be that the positive relationship with friends supports empathy for and learning of each other. Although students observe the behaviors of all their near-seated peers (Evertson & Weinstein, 2006), the idea of the social learning theory that students become more similar to each other over time through observing each other only seems to apply to friends (Bandura, 1977). Near-seated peers who are not friends also observe each other’s behaviors, but this results in more dissimilarity. This is probably due to social comparison, including willingness to be part of an ingroup by showing similar behaviors to some peers, whereas reacting against peers in the outgroup and showing less similar behaviors to those peers (Dasgupta, 2004). These explanations for the reversed effects for friends (more similarity) and non-friends who are near-seated (less similarity) seem to be explained by conscious processes but it should be noted that it might also be the result of more unconscious or implicit attitudes and behaviors.

Moreover, the findings of our study suggest somewhat stronger effects for academic engagement than academic achievement. The BFLPE and social contrast mechanism might be
more applicable to academic engagement than academic achievement, as engagement is more directly related to students’ actual behaviors whereas achievement is an outcome measure (grades). Academic achievement is also more stable, and although students might be motivated to get higher grades this can be limited, for instance by their intelligence (Neisser et al., 1996).

Furthermore, no friendship selection effects were found for academic engagement and academic achievement. Our study included fourth to sixth grade students, who were often already classmates for one or more years. Selection processes particularly take place when students enter a new peer environment. The reason for not finding significant selection effects in the studied time period might thus be partly due to the fact that students’ main friendships were already formed before this time period.

Finally, we compared two ways of measuring near-seated peers. We first defined near-seated peers as all groupmates within the classroom. Secondly, we ran models in which only students’ direct neighbors were considered near-seated peers. The effects were a bit stronger, but in the same direction, when considering all groupmates as near-seated peers compared to only students’ direct neighbors. This difference between all groupmates and only direct neighbors indicates that near-seated peers in the same subgroup might matter more than immediate neighbors. However, it might also be explained by higher statistical power in the models including all groupmates as near-seated peers, as students have more near-seated peers in these models than in the models with only direct neighbors.

**Strengths, limitations, and future directions**

Our study has several strengths. First, we used a social network approach to study subgroups within a classroom, as determined by the teacher’s seating arrangement. Second, this study advanced previous studies by extending the single focus on the influence of friends in students’ behaviors, that is, students’ self-chosen networks (Flashman, 2012; Geven et al., 2013; Shin & Ryan, 2014a, 2014b) to examining a constant proximity network, the seating arrangement, which is determined by the teacher. We examine the direct interplay between physical proximity of students in the classroom and their academic achievement as well as academic engagement, above and beyond their friendships. Third, we study elementary school students instead of (early) adolescents, as investigated in previous studies.

However, our study should be viewed in light of its limitations. First, although we used two waves to detect changes in academic engagement and achievement, the time period in
Chapter 3

between waves was relatively short (October/November and January within a school year). Although, this is the normal duration for seating arrangements (Gremmen et al., 2016), peer influence processes in academic engagement and academic achievement may take more time to unfold. Especially academic achievement is quite a stable academic outcome, as students’ behaviors, attitudes, and strategies may not always be reflected in their scores on school tests (Farrington et al., 2012). Nevertheless, results showed that even in a relatively short time period peers exert influence on student’s academic engagement and achievement. Moreover, the advantage is that the seating arrangement remained stable in between the measurements and is in line with the duration. Still, it would be interesting for future studies to study influence effects of near-seated peers over a longer time period.

A second limitation is that academic engagement and academic achievement are closely related to each other, in the sense that changes in academic achievement (e.g., higher or lower grades) often occur as a result of changes in academic engagement (e.g., more or less motivation) (Doctoroff & Arnold, 2017; Farrington et al., 2012; Lynch, Lerner, & Leventhal, 2013). We therefore controlled for the main effect of academic engagement in the achievement models and vice versa. However, it would be interesting for future studies to examine cross-over effects between academic engagement and achievement of students’ and their friends as well. For example, a student with high-achieving friends might increase in academic engagement and achievement over time.

A third limitation is the way of measuring academic engagement and academic achievement. As students in elementary schools often do not receive school report cards, teachers were asked to indicate each student’s academic engagement and achievement. Although it was explicitly mentioned that teachers should rely on objective outcomes on school work and tests as much as possible when filling out the questionnaire, it is still possible that teachers were unconsciously biased. Teachers sometimes have a tendency to overestimate similarity in behaviors between friends, while at the same time they often perceive friendship relationships incorrectly (Steglich & Knecht, 2014). We used Bayesian models to take differences between classrooms into account, by including fixed and random effects. For future studies, it would still be interesting to study students’ academic engagement and achievement with more objective measures, but this is difficult to achieve in elementary schools as there are often no school report cards.
Moreover, future research including more classrooms can focus on specific characteristics of the seating arrangement, such as differences between classroom layouts (rows and groups), differences in sizes between subgroups in the classroom and the actual frequency of contact between a student and all his groupmates. This detailed information can lead to more insights in the daily interactions between near-seated peers and their influencing effects on each other’s behaviors within a classroom. Additionally, it would be interesting to gain more insights in teachers’ strategies for their seating arrangements (Gremmen et al., 2016) and to relate these strategies to the (changing) relationships and (changing) behaviors in their classrooms. For example, if a teacher indicates to seat friends closely together who are low-and high-achieving in order to promote pro-school behaviors, it can be tested whether this goal is also met. Finally, future studies can gain more insights concerning the mechanisms behind influence effects, such as an explicit test on the BPFLE. More insights can be gained by classroom observations or by more explicitly asking students about who they ask for help with school work (helping networks; Van Rijsewijk, Dijkstra, Pattisalanno, Steglich, & Veenstra, 2016).

**Conclusion and practical implications**

This study contributes to our understanding of the role of physically close peers in the classroom in students’ academic development, as students have direct opportunities to interact with these peers during a school day. We advanced current knowledge by investigating not only students’ friendship networks, but also the classroom’s seating arrangement. To our knowledge, this study is the first to assess the dynamics of seating arrangements and friendships with stochastic actor-based models.

Overall, we showed that friends became more similar to each other in terms of their academic engagement and achievement, irrespective of their seating in the classroom. In contrast, near-seated peers who were not friends became more dissimilar to each other. Teachers can use these results in their daily practice, starting with awareness of the importance of their seating arrangement as a tool to foster students’ social and academic development. It is a difficult task to optimally seat all students, especially due to all specific characteristics of the students, but some guidelines can be provided based on our results. If teachers for example seat low-achieving students together with high-achieving non-friends, this might increase dissimilarity between them, especially when they are not friends. In
contrast, if these peers are friends or become friends, the low-achieving students might get higher grades over time. Also, next to deciding on students’ seatings based on their friendships and their academic behaviors, it is most important to actively monitor the ongoing processes. Many teachers change their seating arrangement a few times a year. However, by monitoring the effects of their seating arrangement closely, it might not even be necessary to change a seating arrangement in case it is an effective seating arrangement and teachers’ goals are being met. In sum, teachers can use the results of the present study in their daily practice through more awareness of the interplay between students’ friendships, their seatings in the classroom, and peer influence processes with regard to academic engagement and academic achievement.
First selection, then influence: Developmental differences in friendship dynamics regarding academic achievement*

* This chapter is published in *Developmental Psychology.*

Abstract

This study concerns peer selection and influence dynamics in early adolescents’ friendships regarding academic achievement. Using longitudinal social network analysis (RSiena), both selection and influence processes were investigated for students’ average grades and their cluster-specific grades (i.e., language, exact, and social cluster). Data were derived from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study, using six waves ($N = 601$; $Mage = 12.66$, 48.9% boys at first wave). Results showed developmental differences between the first and second year of secondary school (seventh and eighth grade). Whereas selection processes were found in the first year on students’ cluster-specific grades, influence processes were found in the second year, on both students’ average and cluster-specific grades. These results suggest that students initially tend to select friends on the basis of similar cluster-based grades (first year), showing that similarity in achievement is attractive for friendships. Especially for low-achieving students, similar-achieving students were highly attractive as friends, whereas they were mostly avoided by high-achieving students. Influence processes on academic achievement take place later on (second year), when students know each other better, indicating that students’ grades become more similar over time in response to their connectedness. Concluding, this study shows the importance of developmental differences and specific school subjects for understanding peer selection and influence processes in adolescents’ academic achievement.

Keywords: academic achievement; peer dynamics; early adolescence; social networks; RSiena
Selection and influence processes in academic achievement

Academic achievement in adolescence is a key determinant of future educational chances and occupational success. Hence, it is important that adolescents maximize their performance in accordance with their own abilities (Flashman, 2012; Lubinski, Webb, Morelock, & Benbow, 2001; Shin & Ryan, 2014a; Witkow & Fuligni, 2010). However, there is huge variability in the extent to which adolescents do so and set a path towards academic success. Whereas some students enjoy academics a lot, work diligently on their school work, attend school every day, and get good grades, others show less interest in school, potentially leading to underachievement (Bandura, Barbaranelli, Capra, & Pastorelli, 2001; Bissell-Havran & Loken, 2009).

Several factors affect students’ academic performance. First, individual factors are important, such as students’ intelligence, interest in school, persistence, and willingness to study (Neisser et al., 1996). Second, environmental factors such as the capabilities and practices of teachers and parents, affect students’ academic achievement (Farmer, McAuliffe, & Hamm, 2011). The mean level of achievement in a classroom can also affect students’ academic achievement, as indicated by studies on classroom composition effects (e.g., Barth et al., 2004). However, many previous studies have shown that particularly friends in classrooms play an important role in adolescents’ academic behaviors, as students spend a large amount of time with them (Altermatt & Pomerantz, 2003; for a review see Crosnoe & Brenner, 2015). Friends provide support and resources and either promote or discourage attitudes and behaviors that contribute to school success (Anderman & Maehr, 1994; Brown, Eicher, & Petrie, 1986; Eccles et al., 1993; Lynch, Lerner, & Leventhal, 2013). Therefore, the goal of the present study is to examine the role of adolescents’ friendships in their academic achievement.

BACKGROUND
Adolescents tend to associate and form relationships with peers who are similar regarding their involvement in school (Kindermann & Skinner, 2009), motivation (Molloy, Gest, & Rulison, 2010), and academic achievement (Blansky et al., 2013; Lynch, Lerner, & Leventhal, 2013; Ryan, 2001; Witkow & Fuligni, 2010). Together, these studies clearly demonstrate similarities in academic adjustment between friends. There are two fundamental processes capturing friendship dynamics that can explain similarity between (sub)groups of people in academic outcomes: selection and influence (Snijders, 2001; Veenstra, Dijkstra, Steglich, & Van Zalk, 2013).
Chapter 4

Selection processes refer to mechanisms by which individuals choose to hang out or become friends with each other, whereas influence processes refer to changes in behavior or attitudes in response to relationships with peers (Veenstra et al., 2013). Stochastic actor-based modeling (RSiena) makes it possible to disentangle influence from selection processes by examining changes in relationships and behaviors simultaneously (Ripley, Snijders, Boda, Vörös, & Preciado, 2015; Snijders, Van de Bunt, & Steglich, 2010). Currently, this approach has been used to examine the role of peers in different domains, varying from internalizing to externalizing behaviors (Veenstra et al., 2013). To date, however, there is only limited information about these processes for academic outcomes, let alone academic achievement.

A study by Geven, Weesie, and Van Tubergen (2013) showed that students became more similar to their friends over time with respect to school engagement (homework activity and paying attention in class), but also selected friends who are similar to them in these outcomes. Shin and Ryan (2014a) examined students’ achievement goals, showing both selection and influence effects for mastery goals (i.e., a focus on developing academic competence), only influence effects for performance-approach goals (i.e., a focus on demonstrating high competence to others), and no selection and influence effects for performance-avoidance goals (i.e., a focus on avoiding demonstration of incompetence to others).

More specifically, a few studies have focused on selection and influence processes in academic achievement. Lomi and colleagues (2011) found evidence for both selection and influence processes in a small sample of 75 Italian university students (aged between 24 and 40). Flashman (2012) showed that adolescents’ academic performance was influenced by their peers (seventh through twelfth grade students), but also functioned as a sorting mechanism for friendship formation, particularly in large schools (selection). Further, it appeared that high-achieving students mostly formed relationships with other high-achieving students and were positively influenced, whereas low-achieving students associated with other low-achieving students and were negatively influenced. Also, Shin and Ryan (2014b) found influence effects on early adolescents’ academic achievement and (marginal) selection effects in sixth grade. Finally, a study by Rambaran et al. (2017) revealed both selection and influence processes in ninth grade students’ school achievement and truancy. Friendships were particularly formed and maintained between low-achieving students and students with high truancy levels.
These findings raise several issues. First, although previous studies indicate that both selection and influence play a role in students’ academic achievement, it is important to understand how these processes develop and when they unfold. Previous studies mainly focused on the development of peer relationships and academic achievement within one specific school year (Geven et al., 2013; Shin & Ryan, 2014a, 2014b) or combined information from several school years, leaving potential developmental differences invisible (Flashman, 2012; Rambaran et al., 2017). Second, previous studies relied on the GPA (Grade Point Average) as a measure of academic achievement (e.g., Flashman, 2012; Lomi et al., 2011; Rambaran et al., 2017; Shin & Ryan, 2014a). By using GPA, differences in grades between school subjects are not taken into account, losing the variability between grades and potentially leading to more heterogeneous findings than making content-related clusters of school subjects (Voyer & Voyer, 2014). For example, an average grade of seven out of ten can indicate a seven on all school subjects, or high scores on some subjects and low scores on others. Moreover, previous studies have shown that students’ motivation and goals differ across school subjects (Bong, 2001).

Therefore, the aim of the present study is to examine adolescents’ friendship selection and influence processes for academic achievement in the first two years of secondary school (i.e., seventh and eighth grade). This developmental period is chosen as it is at the start of secondary education, with students entering a new peer environment. Consequently, many students have to form new friendships and to find their place in the larger peer ecology. Hence, this context is ideal for testing selection and influence processes (Altermatt & Pomerantz, 2003).

Furthermore, we examine students’ average grades and their grades on three clusters of subjects, that is, languages (Dutch and English), exact/science subjects (mathematics and biology), and social subjects (history and geography). As these grades are assessed within classrooms, friendship networks were also assessed on a classroom level, which is the main context for social interaction in the Dutch school system.

In further untangling selection and influence processes we are also interested in the directions of these processes. We aim to study the general dynamics more specifically for low-achieving and high-achieving students. That is, whether there are differences between low- and high-achieving students in their preference for having low- or high-achieving friends.
respectively, how this relates to their own achievement (selection), and whether high performing students enhance academic achievement of their lower achieving peers or whether low achieving students drag higher achieving peers down (influence).

**FRIENDSHIP DYNAMICS**

During adolescence, one of the main developmental tasks is to establish friendships with peers (Witkow & Fuligni, 2010), reflecting the need to belong as a fundamental human motivation (Baumeister & Leary, 1995). Especially in the first year of secondary education, students are in a new peer context in which friendships have to be formed. Through affiliation with others, adolescents try to achieve important social goals (Steverink & Lindenberg, 2006). They want to belong to the group, be liked, seek social approval and try to avoid rejection from peers (Cialdini & Goldstein, 2004; Gifford-Smith & Brownell, 2003), which students can achieve through selection and influence processes.

**Selection**

*Selection* is an important process that can explain similarities between adolescents’ academic achievement. A core principle driving selection is ‘homophily’, which holds that people tend to pick similar others as friends. One reason for this strong empirical regularity is that similar people on average understand one another better, which increases trustworthiness and predictability, resulting in less effortful communications and shared feelings of understanding (McPherson, Smith-Lovin, & Cook, 2001). Hence, relationships between similar people tend to be more rewarding, stable, and with less conflict (Hallinan, 1980; Veenstra et al., 2013).

Moreover, adolescence is marked by increasing academic comparisons between peers (Schunk & Pajares, 2002). The social comparisons theory holds that individuals tend to compare themselves to similar peers to gain an accurate self-evaluation for their own abilities (Festinger, 1954). Likewise, these comparisons may affect adolescent friendships by befriending similar others with regard to academic abilities. Also, adolescents might be motivated to befriend others in the classroom with a high academic achievement to benefit from these friendships by receiving help while studying (Dieterich, 2015).

Based on these ideas, *we hypothesize that the more similar the academic achievement of a peer is to a student’s academic achievement, the more probable it is that this peer is nominated as a friend (hypothesis 1)*. Going beyond the overall similarity effect, we are also
interested in differences between low-achieving and high-achieving students. Therefore, we will examine whether high- or low-achieving peers are most attractive for affiliations, and whether they are equally attracted to each other as friends. For example, are there mainly friendships between low-achieving students or between high-achieving students? And are high-achieving students attractive as friends, whereas low-achieving students are mostly avoided by their peers?

**Influence**

_Influence_ is another process that can explain similarities between students’ academic achievement. Social influence occurs when people see and interact with each other (Webb, 1989). Conformity can occur as a result of subtle, unconscious, passive influences and behaviors, or directly via overt, active social pressure (Harakeh & Vollebergh, 2012). Unwillingness to conform to expectations and behaviors can have negative consequences, as it carries the risk of social rejection by peers (Cohen, 1977). These norms are often implicit rules, which are shared by a group of individuals, and guide their interactions with others.

With regard to peer influence, many mechanisms are put forward to explain these processes (Brechwald & Prinstein, 2011), such as social reinforcement, social norms, conformity pressures (Cohen, 1977), and modeling (Ryan, 2001). According to the prototype willingness model adolescents first determine the norms of valued peers and then establish behaviors that would be approved by these peers (Gerrard, Gibbons, Houlihan, Stock, & Pomery, 2008). The social learning theory of Bandura (1977) indicates that people learn by observing peers (imitation), as well as through reinforcement by valued peers (e.g., social rewards or rejection). This influence can work upwards by stimulating pro-school behavior and improving the grades of lower-achieving peers. However, it can also work downwards by lowering a friends’ grades. In this way, peers in classrooms can play critical roles in students’ development (Barth, Dunlap, Dane, Lochman, & Wells, 2004).

Friends can also become more similar in academic achievement over time due to information sharing (Crosnoe, Cavanagh, & Elder, 2003; Flashman, 2014). Friends may help each other with homework and share information concerning course contents and teachers. These resources can promote achievement by motivating students, encouraging involvement at school, and underlining the importance of schooling (Crosnoe et al., 2003), leading to higher grades among friends.
Based on the aforementioned reasoning, we hypothesize that adolescents’ academic achievement is influenced by their friends, indicating that their grades become more similar over time in response to their friends (hypothesis 2). As influence mechanisms can either motivate or demotivate adolescents for school work, we will examine whether influence processes in academic achievement work upwards or downwards. Do high-achieving friends enhance the academic achievement of lower achieving peers or do low-achieving friends drag higher achieving peers down?

**Structural network effects**
Friendships may emerge not only as a result of similarity in particular characteristics or behaviors, but also as a result of structure-based effects. For this reason, it is necessary to control for structural network effects (Veenstra & Steglich, 2012). To overcome the bias of overestimating the effects of individual characteristics in changing relationships, the most common structural network effects are included. First, we included the outdegree, the general tendency of students to nominate peers as friends. Second, reciprocity is included, the tendency to reciprocate friendship nominations. We also accounted for group formation tendencies (transitivity and three cycles). Finally, the variation in the extent to which students nominate peers as friends (ego effects) as well as receive nominations as friends (alter effects) have been taken into account (Geven et al., 2013; Shin & Ryan, 2014b; Van Rijsewijk, Dijkstra, Pattiselanno, Steglich, & Veenstra, 2016; Veenstra et al., 2013). These effects as well as other effects in the model are explained in more detail in both the method section and Table 4.1.
### Table 4.1

**Explanation of Some Basic Parameters in the RSiena Model**

<table>
<thead>
<tr>
<th>Effect</th>
<th>RSiena effect name</th>
<th>Explanation</th>
<th>Graphical representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdegree</td>
<td>density</td>
<td>The basis tendency to form relationships (nominate others)</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Reciprocity</td>
<td>recip</td>
<td>The tendency toward reciprocation of received nominations</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>transTrip</td>
<td>Transitive closure (i \rightarrow h \rightarrow j; i \rightarrow j): Intermediary (h) adds proportionally to the tendency to form relation (i \rightarrow j). (Friends of friends become friends)</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>3-cycles</td>
<td>cycle3</td>
<td>Nonhierarchical cycles of generalized reciprocity</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Same gender</td>
<td>sameX</td>
<td>Relations occur more often between actors with the same gender</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Grade alter (alter effect)</td>
<td>altX</td>
<td>Actors with higher grades have a higher indegree (more received nominations)</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Grade ego (ego effect)</td>
<td>egoX</td>
<td>Actors with higher grades have a higher outdegree (more given nominations)</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Grade ego * Grade alter (selection effect)</td>
<td>egoX * altX</td>
<td>Relations occur more often between students with the same grades</td>
<td><img src="" alt="Diag" /></td>
</tr>
<tr>
<td>Average alter (influence effect)</td>
<td>avAlt</td>
<td>The tendency of students to get grades similar to those of friends</td>
<td><img src="" alt="Diag" /></td>
</tr>
</tbody>
</table>
Chapter 4

PRESENT STUDY

In the present study we examine friendship selection and influence processes in adolescents’ academic achievement over time. We focus on different school years, that is, the first and second year of secondary school, on students’ average grades and their grades on specific clusters of subjects, and on the strengths and directions of selection and influence processes for low-achieving and high-achieving students. Within a school year, we focus on friendships within a classroom as students follow all courses with the same classmates and are thus surrounded by them for the entire day.

Gender has also been included in the model, as a review study by Crosnoe and Brenner (2015) showed that girls on average outperform boys in all school subjects. Finally, we include time spent on homework and satisfaction with school as control variables, as those factors can influence students’ connectedness with school and peer influences in school. It has been found that students who are more engaged and put more effort in their school work, achieve better (Carbonaro, 2005). Reviews on homework research provide consistent evidence for a positive influence of time spent on homework on students’ academic achievement (Cooper, 1989; Cooper, Robinson, & Patall, 2006). Furthermore, previous studies showed that feeling at ease in school is often associated with less mistreatments, more connectedness, and less harassments which benefits students’ academic achievement (Brook & Willoughty, 2015; Eisenberg, Neumark-Sztainer, & Perry, 2003; Russel & Topham, 2012).

METHOD

PARTICIPANTS AND PROCEDURE

Data stem from the SNARE (Social Network Analysis of Risk behavior in Early adolescence) study, which is a longitudinal project on the social development of early adolescents with a specific focus on adolescents’ involvement in risk behavior (Dijkstra et al., 2015; Franken et al., 2015). Two secondary schools in rural areas were asked and willing to participate: one in the middle (one location) and one in the north of the Netherlands (with four distinct locations), covering the full range of academic tracks.

All students received an information letter for themselves and their parents, in which they were asked to participate. If students wished to refrain from participation, or if their parents disagreed with their children’s participation, they were requested to send a reply card
or email within ten days. This procedure is in accordance with the Dutch law, and has been used in previous social network studies among children and adolescents (Osgood et al., 2013; Shin & Ryan, 2014a). During every assessment, it was emphasized that participation was confidential and could be terminated at any point in time. The study was approved by the Internal Review Board (IRB) of one of the participating universities.

During the assessments, a teacher and research assistants were present. The research assistants gave a brief introduction followed by the students filling in a questionnaire on an individual computer during class, containing both self-reports and peer nominations. Data were collected via questionnaires using ‘Cloud Solutions Socio Software’ (www.sociometric-study.com). This software was developed for SNARE and allowed students to answer peer nomination questions easily by looking up and selecting their class- or grademates’ names from a database. The assessment of the questionnaires took place during regular lessons within approximately 45 minutes. The students that were absent that day were, if possible, assessed within a month.

The present study includes all first year students (seventh graders) in 2011-2012 (N = 614) residing in 27 classes and the same students in 2012-2013 (N = 604) residing in 26 classes from both participating schools. From two classrooms in the second year no information about students’ school grades was received. Therefore, 24 out of the 26 classrooms were analyzed (N = 556) (see Appendix for more specific information on the attrition and number of students per wave). Based on the available information, students had on average less than two classmates in secondary school who attended the same elementary school. Hence, the vast majority of students enter a new peer context when they make the transition to secondary education. Note that students in their first years of secondary school in the Netherlands follow the same courses with the same classmates every school day.

The two school years include the first six waves of the SNARE study: October 2011 (Wave 1; Mage = 12.66; 48.9% boys), December 2011 (Wave 2; Mage = 12.83; 48.9% boys), April 2012 (Wave 3; Mage = 13.16; 48.9% boys), October 2012 (Wave 4; Mage = 13.66; 49.6% boys), December 2012 (Wave 5; Mage = 13.83; 49.6% boys), and April 2013 (Wave 6; Mage = 14.17; 49.3% boys). Of the participants, 97.5% were born in the Netherlands, and 87.1% of their fathers and 87.7% of their mothers.
Chapter 4

Tracked system

In The Netherlands, secondary schools are organized by a tracked system. At the end of
elementary school, in sixth grade (at age 12), students select a secondary school, and the track
plays a crucial role in this selection. A student’s track is based on a combination of
recommendations from his or her elementary school (which holds records of students’
academic development over time), a national test known as ‘Citotoets’, and their own
preferences. The three tracks are: pre-university education (with a duration of six years, called
‘VWO’), general secondary education (five years, called ‘HAVO’; preparation for applied
universities), and pre-vocational education (four years, called ‘VMBO’). Pre-vocational
education covers four sectors (i.e., technology, health and personal care and welfare,
economics, and agriculture) and four learning tracks. Three of these tracks have a practical
orientation and one has a theoretical orientation.

Some exceptions notwithstanding, teaching takes places in track-homogeneous classes
of 20-25 students who are educated together for a whole year. Academic grades obtained in
this tracked system have a meaning only within tracks, and cannot be compared across tracks.
Some secondary schools offer classes at all academic tracks, whereas others only offer classes
at specific tracks.

Students rarely change tracks, and when they do, this means they need to change the
class of schoolmates they meet on a daily basis. When they have insufficient grades and cannot
pass the year, they will repeat a year. Alternatively, they can go to a lower track and not repeat
the year. Changes to a higher track are only possible when students have outstanding grades.

Of the respondents, 17.8% followed a pre-vocational education track with a practical
orientation; 25.9% followed a pre-vocational track with a theoretical orientation; and 56.3%
followed a pre-university/general education track.

MEASURES

Academic achievement was derived from administrative data, the school report cards. On these
school report cards, which are issued four times per year, students’ average grades on all school
subjects are displayed, according to the Dutch grading system (i.e., ranging between 1 and 10,
with grades of 5.5 or higher corresponding to a pass). The grades from the first three school
report cards match with the waves of data collection (i.e., October, December, and April), so
we could match the grades obtained for the period preceding data collection with the data collected by the questionnaire.

We also calculated the average grades over six school subjects per student: Dutch, English, mathematics, biology, history, and geography. Subsequently, average grades for the language cluster (Dutch and English), exact/science cluster (mathematics and biology), and social cluster (history and geography) were calculated (see Table 4.2) Because RSiena requires dependent variables to be measured on a discrete, ordinal scale, students’ grades were categorized into eight subcategories that optimally differentiate the students (see Table 4.2).

**Table 4.2**

*Categories for school grades and per wave the number of students that have average grades falling into a specific category.*

<table>
<thead>
<tr>
<th>Category</th>
<th>Grades</th>
<th>First year</th>
<th>Second year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>W1</td>
<td>W2</td>
</tr>
<tr>
<td>1</td>
<td>&lt; 5.0</td>
<td>7</td>
<td>53</td>
</tr>
<tr>
<td>2</td>
<td>5.0 – 5.4</td>
<td>4</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>5.5 – 5.9</td>
<td>24</td>
<td>55</td>
</tr>
<tr>
<td>4</td>
<td>6.0 – 6.4</td>
<td>84</td>
<td>105</td>
</tr>
<tr>
<td>5</td>
<td>6.5 – 6.9</td>
<td>126</td>
<td>121</td>
</tr>
<tr>
<td>6</td>
<td>7.0 – 7.4</td>
<td>147</td>
<td>80</td>
</tr>
<tr>
<td>7</td>
<td>7.5 – 7.9</td>
<td>122</td>
<td>77</td>
</tr>
<tr>
<td>8</td>
<td>≥ 8.0</td>
<td>73</td>
<td>56</td>
</tr>
</tbody>
</table>

*Note.* School grades below 5.5 (categories 1 and 2) are considered unsatisfactory. Students get grades for about 13 subjects. For transition to the next year/grade, an overall maximum of three unsatisfactory grade points on these 13 subjects is allowed.

**Friendships** within classrooms were assessed using a peer nomination procedure. Participants were presented with the names of their classmates on a computer screen in alphabetical order, starting at a random name and asked to nominate their friends (‘Who are your best friends?’). Participants could nominate an unlimited number of same- and cross-gender classmates. Based on these nominations, we constructed an adjacency matrix for each classroom at all waves containing all friendship nominations, with 0 and 1 representing absence and presence of a nomination between actors i and j, respectively.

**Doing homework** was assessed by asking the average time spent doing homework in a regular week (from Monday until Sunday). Students could indicate “the number of hours per day out
of school spending on doing homework or on learning for a test” on a 10-point scale, with the following options: 1 (no time), 2 (less than half an hour per day), 3 (half an hour per day), 4 (one hour per day), 5 (two hours per day), 6 (three hours per day), 7 (four hours per day), 8 (five hours per day), 9 (six hours per day), and 10 (7 hours per day or more).

**Satisfaction** with school was measured, using the item “How do you feel about school at present?”. Answers were measured on a four-point scale, with the following options: 1 (do not like it at all), 2 (do not like it much), 3 (do like it a bit), and 4 (like it a lot) (see also Harakeh, De Looze, Schrijvers, Van Dorsselaer, & Vollebergh, 2012).

**Gender** was coded 0 for girls and 1 for boys.

**ANALYTICAL STRATEGY**

**RSiena**

Adolescents’ development of academic achievement was examined using the Simulation Investigation for Empirical Network Analysis (Siena) software package in R (Ripley, Snijders, & Preciado, 2015; Snijders et al., 2010), package version 1.1.282. RSiena facilitates the estimation of stochastic actor-based simulation models to analyze the co-evolution of networks and behavior. With these models, we are able to assess the contributions of selection and influence processes to friends’ similarity in achievement as well as the directions of these processes (Steglich, Snijders, & Pearson, 2010). Similarity is understood here in a correlational sense: two students are similar to the degree that their achievement scores differ in the same direction from the average student’s achievement in the classroom.

Students are assumed, based on individual preferences, to change both their friendships and behaviors continuously between observation moments. Model convergence is only possible when there is enough stability as well as change between time points. Friendships may change (i.e., creating a new friendships or dropping an existing one) as well as behaviors (i.e., by going one or more steps up or down in behavior) in response to the current network structure and the ‘behavior’ of other students in the network. It is thus a dynamic process where the model controls for changes in friendships and behaviors as well as structural and individual effects on changes in friendships and academic achievement.
The changes in friendships and academic achievement are modeled as the result of students’ decisions, revealing an underlying preference measure (‘objective function’) indicating how ‘satisfied’ the students are with their local network neighborhood configuration.

In the present study, we estimated friendship dynamics (including selection parameters) and the behavioral dynamics (including influence parameters) for academic achievement. The parameters in the model are explained in the following subparagraph (model specification) and are tested using t-ratios (parameter estimate divided by its standard error), just like in other generalized linear models. The estimates are obtained by MCMC maximum likelihood estimation (Snijders, Koskinen, & Schweinberger, 2010).

**Model Specification**

Analyses in RSiena yield parameter estimates related to both network dynamics (structural network and attribute-dependent selection dynamics) and behavior dynamics (behavior tendencies and influence effects). The parameter estimates are derived from iterative simulations using the Robbins-Monro stochastic approximation algorithm (see Ripley et al., 2015). We explain the effects that are of interest in more detail in Table 1. Most of the included effects are control effects to more accurately assess the selection and influence effects with regard to academic achievement.

The network dynamics part of the model consists of the following effects. *Rate parameters* refer to the rate of change in friendships between time points, indicating whether there is enough change in the network (friendships). The most common *structural network effects* were also included in the model (Veenstra et al., 2013). *Density* reflects the tendency of individuals to nominate others. *Reciprocity* reflects the tendency to reciprocate received nominations. *Transitive triplets* and *reciprocated transitive triplets* refer to the transitive closure of individuals (‘friends of friends become friends’) and its iteration with reciprocity, respectively (Block, 2015). *Three cycles* represent nonhierarchical cycles of generalized reciprocity (i.e., student A nominates student B, student B nominates student C, and student C nominates student A). Furthermore, *ego* (sender) effects, referring to given nominations, and *alter* (receiver) effects, referring to received nominations, were included for grade. *Grade ego* and *grade alter* show to what extent academic achievement affects the number of nominations given and received, respectively.
Also, we estimated the grade ego * grade alter effect (selection effect), which measures whether students with high (low) academic achievement selected others who also scored high (low) in similarity, showing whether similarity between ego and alter increases the probability of a friendship between them. For gender, we measured the same gender effect, indicating whether girls nominate more girls and boys nominate more boys as friends. Additional analyses (unreported) revealed that boys and girls did not significantly differ in terms of how many friendship nominations they sent or received, so we did not include ego and alter effects of gender in the reported model specification.

The behavior dynamics part of the model includes the following effects. Rate parameters indicate the rate of change in students’ school grades between time points. The average alter effect (influence effect) estimates whether students’ academic achievement was higher for students whose friends’ average grades were also higher, indicating whether a student over time tends to get grades similar to those of his friends. Hence, it indicates the tendency of students to change their academic achievement to closely resemble their friends’ average academic achievement. We controlled for the overall mean and variance of academic achievement by including the linear shape effect (overall tendency) and the quadratic shape effect (a negative parameter indicates regression to the mean effect, whereas a positive parameter indicates polarization). Finally, we controlled for gender, time spent on homework, and satisfaction with school on changes in academic achievement.

All aforementioned effects were first estimated per classroom for the first year and second year students, using the MCMC Maximum Likelihood method. Then, meta-analyses were conducted per school year to estimate the overall effect over the classrooms for each of the four outcome measures (dependent variables): students’ average grades and their grades on the three different clusters.

Finally, based on our estimates, we calculated ego-alter selection effects in order to gain more insights in whether low-achieving and high-achieving students (represented by the lines for each of ego’s scores in the figures) differ in their preference for low-achieving and high-achieving friends (on the x-axis). The effects in the ego-alter selection figures give a comprehensive interpretation of the ego, alter, and ego * alter (selection) parameters as they integrate these effects. The values represent the combined log odds that students of the line-specific achievement category nominate students of the x-axis-specific achievement category.
as friends (Ripley et al., 2015). In a similar way we also calculated the ego-alter influence effects, based on the influence estimate in combination with the linear and quadratic shape effect. This allows a closer examination of how peer influence effects vary by an individuals’ level of academic achievement.

RESULTS

DESCRIPTIVE STATISTICS

Students’ grades. In Table 4.3, students’ average grades and standard deviations in both the first and second year are shown. The means are displayed for all school subjects separately, for the average grades, and for students’ grades on the three clusters. Also, the table shows that students’ mean grades are between 6.30 and 7.37 (out of 10) and that these grades decline somewhat over time.

Network variables. Descriptions of network and individual variables are presented in Table 4.4. The average number of friendship nominations given varied between 4.67 and 5.68 across the six waves. The friendship network was characterized by a high reciprocity index with participants reciprocating about 60% of the friendship nominations. There was also a tendency for friendships to occur in cohesive subgroups, indicated by a high transitivity index in the network (on average 63%). Similar to previous studies, most friendship nominations were same sex (about 82%).

The Geary’s C network autocorrelation coefficient was used to indicate the degree to which there is closeness of friends in terms of academic achievement (Steglich et al., 2010). The values of Geary’s C lie between 0 and 2. Values lower than 1 demonstrate positive network autocorrelation, indicating that students who are friends are also close to each other in terms of their academic achievement. In the present study, the index was on average .94, which indicates that the network was not strongly structured on achievement. The Jaccard index indicates the amount of stability in friendship nominations and is on average 53%. In order to conduct longitudinal network analysis in RSiena with adequate statistical power, this index should be higher than 30% (see Veenstra et al., 2013).
Table 4.3

Descriptive statistics of students’ school grades in their first and second year, the averages of these school grades, and the averages per cluster (N=600).

<table>
<thead>
<tr>
<th></th>
<th>First year</th>
<th></th>
<th></th>
<th>Second year</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W1</td>
<td>W2</td>
<td>W3</td>
<td>W4</td>
<td>W5</td>
<td>W6</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Dutch</td>
<td>7.16</td>
<td>.93</td>
<td>7.10</td>
<td>.84</td>
<td>6.99</td>
<td>.95</td>
</tr>
<tr>
<td>English</td>
<td>7.37</td>
<td>1.28</td>
<td>7.00</td>
<td>1.23</td>
<td>6.93</td>
<td>1.24</td>
</tr>
<tr>
<td>history</td>
<td>6.77</td>
<td>1.12</td>
<td>6.30</td>
<td>1.23</td>
<td>6.52</td>
<td>1.15</td>
</tr>
<tr>
<td>geography</td>
<td>6.91</td>
<td>1.12</td>
<td>6.47</td>
<td>1.15</td>
<td>6.47</td>
<td>1.03</td>
</tr>
<tr>
<td>mathematics</td>
<td>7.01</td>
<td>1.20</td>
<td>6.84</td>
<td>1.24</td>
<td>6.83</td>
<td>1.33</td>
</tr>
<tr>
<td>biology</td>
<td>7.21</td>
<td>1.03</td>
<td>7.08</td>
<td>1.06</td>
<td>6.81</td>
<td>1.21</td>
</tr>
<tr>
<td>Average total (GPA)</td>
<td>7.00</td>
<td>.74</td>
<td>6.75</td>
<td>.82</td>
<td>6.68</td>
<td>.89</td>
</tr>
<tr>
<td>Average languages</td>
<td>7.26</td>
<td>.92</td>
<td>7.05</td>
<td>.88</td>
<td>6.96</td>
<td>.97</td>
</tr>
<tr>
<td>Average social</td>
<td>6.84</td>
<td>.92</td>
<td>6.38</td>
<td>1.04</td>
<td>6.49</td>
<td>.92</td>
</tr>
<tr>
<td>Average science</td>
<td>7.11</td>
<td>.95</td>
<td>6.96</td>
<td>.98</td>
<td>6.82</td>
<td>1.12</td>
</tr>
</tbody>
</table>

Note. School grades are measured on a scale from 1 to 10 and grades below 5.5 are considered unsatisfactory.
Time spent on homework. Across the six waves, the mean score (SD) varied between 4.43 (1.45) and 4.69 (1.32), indicating that students spent on average between 1 and 2 hours per day on their homework.

Satisfaction with school. Across the six waves, the mean score (SD) varied between 3.00 (.84) and 3.46 (.68), indicating that students generally liked school a bit to a lot.

RSiena analyses
First year (seventh grade). Table 4.5 shows the results of the RSiena meta-analysis on academic achievement for the first year students, regarding their average grades and their grades on each cluster. The table includes the mean estimate and the standard error for each effect. Estimates can be interpreted as log odds for a relationship to exist (friendship part of the model) or for achievement to increase (achievement part; Ripley et al., 2015). A negative significant effect for outdegree was found (Est. = -2.44), indicating that participants on average selected few peers (less than half of the classroom) as friends. Moreover, adolescents tended to reciprocate friendships (Est. = 1.77) and were likely to become friends with friends’ friends (Est. = 0.37). However, reciprocation was weaker within transitive triplets (Block, 2015). Also, students select same-gender peers as friends (Est. = 0.88) and students with high grades were nominated more by peers as friends (grade alter; Est. = 0.04). No significant effects on grade ego effects were found, indicating that students’ grades did not affect the amount of given friendship nominations.

In line with hypothesis 1 concerning the selection of friends based on academic achievement, a significant positive selection effect for grade on the three different clusters was found (mean estimate was about 0.05). This stands in contrast with the analysis of average grades, where no significant selection effect was found. Adolescents thus tend to nominate friends with similar grades on the same kinds of subjects (GPAs), but not with similar average grades.

For the behavior dynamics no influence effect was found, revealing that adolescents were not affected by the academic performance of their friends. This is in contrast to our second hypothesis, in which we expected social influence effects. Also, time spent on homework, satisfaction with school, and gender did not significantly predict students’ grades.
Table 4.4

Sample and change descriptives for the 27 first year and the 24 second year classes (N=600).

<table>
<thead>
<tr>
<th>Sample</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>Sample</th>
<th>W4</th>
<th>W5</th>
<th>W6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network density indicators</td>
<td></td>
<td></td>
<td></td>
<td>Network density indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average degree</td>
<td>5.25 (1.41)</td>
<td>5.68 (1.21)</td>
<td>5.55 (1.37)</td>
<td>Average degree</td>
<td>5.38 (1.39)</td>
<td>5.25 (1.27)</td>
<td>4.67 (1.18)</td>
</tr>
<tr>
<td>Missing fraction</td>
<td>2.6%</td>
<td>2.2%</td>
<td>2.4%</td>
<td>Missing fraction</td>
<td>1.7%</td>
<td>0.6%</td>
<td>1.7%</td>
</tr>
<tr>
<td>Other network indicators</td>
<td></td>
<td></td>
<td></td>
<td>Other network indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reciprocity</td>
<td>61% (.08)</td>
<td>61% (.09)</td>
<td>61% (.09)</td>
<td>Reciprocity</td>
<td>60% (.11)</td>
<td>58% (.11)</td>
<td>57% (.10)</td>
</tr>
<tr>
<td>Transitivity</td>
<td>63% (.08)</td>
<td>64% (.07)</td>
<td>64% (.08)</td>
<td>Transitivity</td>
<td>63% (.09)</td>
<td>63% (.11)</td>
<td>62% (.11)</td>
</tr>
<tr>
<td>Same sex</td>
<td>86% (.09)</td>
<td>83% (.10)</td>
<td>84% (.09)</td>
<td>Same sex</td>
<td>80% (.10)</td>
<td>79% (.09)</td>
<td>81% (.07)</td>
</tr>
<tr>
<td>Control variables</td>
<td></td>
<td></td>
<td></td>
<td>Control variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homework</td>
<td>4.69 (1.32)</td>
<td>4.45 (1.52)</td>
<td>4.43 (1.45)</td>
<td>Homework</td>
<td>4.58 (1.53)</td>
<td>4.55 (1.64)</td>
<td>4.46 (1.76)</td>
</tr>
<tr>
<td>Satisfaction with school</td>
<td>3.46 (.68)</td>
<td>3.41 (.72)</td>
<td>3.20 (.84)</td>
<td>Satisfaction with school</td>
<td>3.10 (.81)</td>
<td>3.07 (.84)</td>
<td>3.00 (.84)</td>
</tr>
<tr>
<td>Network autocorrelation</td>
<td></td>
<td></td>
<td></td>
<td>Network autocorrelation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geary’s C achievement</td>
<td>.96 (.18)</td>
<td>.94 (.22)</td>
<td>.94 (.19)</td>
<td>Geary’s C achievement</td>
<td>.84 (.11)</td>
<td>1.00 (.13)</td>
<td>.95 (.23)</td>
</tr>
<tr>
<td>Change</td>
<td></td>
<td></td>
<td></td>
<td>Change</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friendship indicators</td>
<td></td>
<td></td>
<td></td>
<td>Friendship indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jaccard index (stability)</td>
<td>50% (.08)</td>
<td>52% (.09)</td>
<td></td>
<td>Jaccard index (stability)</td>
<td>56% (.11)</td>
<td>52% (.09)</td>
<td></td>
</tr>
<tr>
<td>Hamming distance (change)</td>
<td>85.30%</td>
<td>82.59%</td>
<td>(38.35)</td>
<td>Hamming distance (change)</td>
<td>75.8%</td>
<td>79.33%</td>
<td>(42.23)</td>
</tr>
<tr>
<td>No. of friendships dissolved</td>
<td>1013</td>
<td>1296</td>
<td></td>
<td>No. of friendships dissolved</td>
<td>995</td>
<td>1190</td>
<td></td>
</tr>
<tr>
<td>No. of friendships emerged</td>
<td>1316</td>
<td>1202</td>
<td></td>
<td>No. of friendships emerged</td>
<td>940</td>
<td>783</td>
<td></td>
</tr>
<tr>
<td>No. of friendships maintained</td>
<td>2248</td>
<td>2268</td>
<td></td>
<td>No. of friendships maintained</td>
<td>2131</td>
<td>1181</td>
<td></td>
</tr>
<tr>
<td>Changes in achievement (average)</td>
<td></td>
<td></td>
<td></td>
<td>Changes in achievement (average)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of steps down</td>
<td>763</td>
<td>541</td>
<td></td>
<td>No. of steps down</td>
<td>346</td>
<td>529</td>
<td></td>
</tr>
<tr>
<td>No. of steps up</td>
<td>180</td>
<td>667</td>
<td></td>
<td>No. of steps up</td>
<td>401</td>
<td>547</td>
<td></td>
</tr>
<tr>
<td>Actors that remain stable</td>
<td>22.5% (.14)</td>
<td>17.2% (.11)</td>
<td></td>
<td>Actors that remain stable</td>
<td>17.5% (.11)</td>
<td>13.0% (.09)</td>
<td></td>
</tr>
</tbody>
</table>

Note. Standard deviations are placed between brackets. Reciprocity was calculated as $2M/(2M+A)$, where $M =$ mutual friendship and $A =$ asymmetric friendship; Transitivity was calculated as $N$ of transitive triplets divided by $N$ of 2-paths (potentially transitive triplets); See for more information on the calculation of the different network indices Veenstra and Steglich (2012).
Table 4.5
Meta-analysis results on friendship and academic achievement for the 27 first year classes (N=600).

<table>
<thead>
<tr>
<th>Network dynamics: Friendship</th>
<th>Average Mean est.</th>
<th>SE</th>
<th>Language Mean est.</th>
<th>SE</th>
<th>Social Mean est.</th>
<th>SE</th>
<th>Science Mean est.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant friendship rate (period 1)</td>
<td>8.01</td>
<td>.63</td>
<td>8.78</td>
<td>.82</td>
<td>7.69</td>
<td>.47</td>
<td>8.78</td>
<td>.82</td>
</tr>
<tr>
<td>Constant friendship rate (period 2)</td>
<td>8.25</td>
<td>.84</td>
<td>7.67</td>
<td>.66</td>
<td>7.67</td>
<td>.66</td>
<td>7.67</td>
<td>.66</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.44***</td>
<td>.07</td>
<td>-2.65***</td>
<td>.16</td>
<td>-2.58***</td>
<td>.15</td>
<td>-2.65***</td>
<td>.16</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.77***</td>
<td>.12</td>
<td>1.64***</td>
<td>.12</td>
<td>1.64***</td>
<td>.12</td>
<td>1.64***</td>
<td>.12</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>.37***</td>
<td>.03</td>
<td>.37***</td>
<td>.02</td>
<td>.37***</td>
<td>.02</td>
<td>.37***</td>
<td>.02</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-.13***</td>
<td>.03</td>
<td>-.12***</td>
<td>.03</td>
<td>-.12***</td>
<td>.03</td>
<td>-.12***</td>
<td>.03</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-.28**</td>
<td>.03</td>
<td>-.27***</td>
<td>.03</td>
<td>-.27***</td>
<td>.03</td>
<td>-.27***</td>
<td>.03</td>
</tr>
<tr>
<td>Same gender</td>
<td>.88***</td>
<td>.09</td>
<td>.86***</td>
<td>.07</td>
<td>.85***</td>
<td>.07</td>
<td>.86***</td>
<td>.07</td>
</tr>
<tr>
<td>Grade alter</td>
<td>.04**</td>
<td>.02</td>
<td>.07**</td>
<td>.03</td>
<td>.06**</td>
<td>.02</td>
<td>.07**</td>
<td>.03</td>
</tr>
<tr>
<td>Grade ego</td>
<td>-.08</td>
<td>.07</td>
<td>-.07</td>
<td>.07</td>
<td>-.03</td>
<td>.04</td>
<td>-.07</td>
<td>.07</td>
</tr>
<tr>
<td>Grade ego * Grade alter</td>
<td>.07</td>
<td>.06</td>
<td>.05***</td>
<td>.02</td>
<td>.04**</td>
<td>.01</td>
<td>.05**</td>
<td>.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavior dynamics: Achievement</th>
<th>Average Mean est.</th>
<th>SE</th>
<th>Language Mean est.</th>
<th>SE</th>
<th>Social Mean est.</th>
<th>SE</th>
<th>Science Mean est.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate grade (period 1)</td>
<td>9.80</td>
<td>1.70</td>
<td>6.89</td>
<td>.84</td>
<td>6.89</td>
<td>.84</td>
<td>6.89</td>
<td>.84</td>
</tr>
<tr>
<td>Rate grade (period 2)</td>
<td>7.95</td>
<td>1.17</td>
<td>9.91</td>
<td>1.36</td>
<td>9.96</td>
<td>1.44</td>
<td>9.91</td>
<td>1.36</td>
</tr>
<tr>
<td>Linear shape</td>
<td>.02</td>
<td>.03</td>
<td>.00</td>
<td>.05</td>
<td>.04</td>
<td>.04</td>
<td>.00</td>
<td>.05</td>
</tr>
<tr>
<td>Quadratic shape</td>
<td>-.02***</td>
<td>.01</td>
<td>.00</td>
<td>.01</td>
<td>-.01</td>
<td>.01</td>
<td>.00</td>
<td>.01</td>
</tr>
<tr>
<td>Effect of friends' grades (average alter)</td>
<td>.06</td>
<td>.04</td>
<td>-.28</td>
<td>.24</td>
<td>-.01</td>
<td>.04</td>
<td>-.28</td>
<td>.24</td>
</tr>
<tr>
<td>Effect from gender (1=boy)</td>
<td>-.03</td>
<td>.03</td>
<td>-.07</td>
<td>.04</td>
<td>-.07</td>
<td>.04</td>
<td>-.07</td>
<td>.04</td>
</tr>
<tr>
<td>Effect from homework</td>
<td>.02</td>
<td>.01</td>
<td>.00</td>
<td>.02</td>
<td>-.01</td>
<td>.02</td>
<td>.00</td>
<td>.02</td>
</tr>
<tr>
<td>Effect from satisfaction with school</td>
<td>.03</td>
<td>.02</td>
<td>-.02</td>
<td>.03</td>
<td>-.02</td>
<td>.03</td>
<td>-.02</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note: * p-value < .05. ** p-value < .01. *** p-value < .001 (two-tailed tests). Students in the pre-vocational track with practical orientation did not have history and geography courses, so these classrooms were not included in the analyses concerning the social cluster.
**Chapter 4**

**Second year (eighth grade).** Table 4.6 concerns the meta-analysis results on friendship and academic achievement for the second year students. Significant effects were found on all friendship network dynamics, except for transitive reciprocated triplets and grade ego and grade alter scores. These results indicate that most students nominate only few of their classmates as friends (density is -2.50), friendships are often reciprocated (Est. = 1.46), students were likely to befriend friends’ friends (Est. = 0.36), and students mostly select same-gender peers as friends (Est. = 0.81). Also, related to hypothesis 1, only significant selection effects were found on students’ average grades (Est. = 0.11) and their grades on the language cluster (Est. = 0.04).

Results for behavior dynamics showed no significant effects from gender, time spent on homework, and satisfaction with school on students’ grades. However, students were significantly influenced by peers on both their average grades (Est. = 0.09) and their grades on all clusters (mean estimation of clusters was Est. = 0.09), indicating that their grades become more similar over time in response to their connectedness. This is in line with hypothesis 2.

**Further results with regard to selection.** The ego-alter selection figure for the first year students (see Figure 4.1) presents the attractiveness of selecting friends on the basis of academic achievement for the language cluster, which is chosen as an illustrative figure representative for each cluster. On the left part of the figure, it is shown that there are especially strong preferences for low-achieving students to befriend similar achieving peers (attractiveness), whereas high-achieving students are not inclined to nominate low-achieving peers as friends. These attraction and avoidance patterns are weaker for high-achieving peers (see right part of the figure). The ego-alter selection effects in the second year (see Figure 4.2) for students’ average grades show that similar-achieving students mainly select each other as friends. These effects are more polarized than in the first year, that is, strong effects (both attraction and avoidance) were found for low-achieving (see left part of the figure) as well as high-achieving students (see right part of the figure).
Table 4.6
Meta-analysis results on friendship and academic achievement for the 24 second year classes (N=550).

<table>
<thead>
<tr>
<th>Network dynamics: Friendship</th>
<th>Average Mean est.</th>
<th>SE</th>
<th>Language Mean est.</th>
<th>SE</th>
<th>Social Mean est.</th>
<th>SE</th>
<th>Science Mean est.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant friendship rate (period 1)</td>
<td>7.13</td>
<td>.73</td>
<td>6.90</td>
<td>.72</td>
<td>6.38</td>
<td>.63</td>
<td>6.56</td>
<td>.63</td>
</tr>
<tr>
<td>Constant friendship rate (period 2)</td>
<td>6.81</td>
<td>.59</td>
<td>6.82</td>
<td>.67</td>
<td>7.29</td>
<td>.67</td>
<td>8.15</td>
<td>1.08</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-2.50***</td>
<td>.10</td>
<td>-2.41***</td>
<td>.08</td>
<td>-2.72***</td>
<td>.22</td>
<td>-2.28***</td>
<td>.05</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.46***</td>
<td>.11</td>
<td>1.45***</td>
<td>.11</td>
<td>1.52***</td>
<td>.12</td>
<td>1.45***</td>
<td>.09</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>.36***</td>
<td>.03</td>
<td>.38***</td>
<td>.03</td>
<td>.44***</td>
<td>.08</td>
<td>.38***</td>
<td>.04</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-.03</td>
<td>.04</td>
<td>-.02</td>
<td>.05</td>
<td>-.02</td>
<td>.08</td>
<td>-.01</td>
<td>.04</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-.32***</td>
<td>.03</td>
<td>-.35***</td>
<td>.03</td>
<td>-.37***</td>
<td>.05</td>
<td>-.29***</td>
<td>.03</td>
</tr>
<tr>
<td>Same gender</td>
<td>.81***</td>
<td>.10</td>
<td>.72***</td>
<td>.07</td>
<td>.67***</td>
<td>.07</td>
<td>.75***</td>
<td>.08</td>
</tr>
<tr>
<td>Grade alter</td>
<td>.03</td>
<td>.03</td>
<td>.04*</td>
<td>.02</td>
<td>.06</td>
<td>.09</td>
<td>-.02</td>
<td>.02</td>
</tr>
<tr>
<td>Grade ego</td>
<td>.00</td>
<td>.11</td>
<td>-.10</td>
<td>.07</td>
<td>-.10</td>
<td>.11</td>
<td>-.04</td>
<td>.04</td>
</tr>
<tr>
<td>Grade ego * Grade alter</td>
<td>.11*</td>
<td>.06</td>
<td>.04*</td>
<td>.02</td>
<td>.01</td>
<td>.05</td>
<td>.02</td>
<td>.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavior dynamics: Achievement</th>
<th>Average Mean est.</th>
<th>SE</th>
<th>Language Mean est.</th>
<th>SE</th>
<th>Social Mean est.</th>
<th>SE</th>
<th>Science Mean est.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate grade (period 1)</td>
<td>8.97</td>
<td>2.29</td>
<td>11.22</td>
<td>1.72</td>
<td>10.58</td>
<td>3.65</td>
<td>10.32</td>
<td>2.41</td>
</tr>
<tr>
<td>Rate grade (period 2)</td>
<td>7.80</td>
<td>1.36</td>
<td>12.36</td>
<td>1.81</td>
<td>18.68</td>
<td>2.83</td>
<td>13.42</td>
<td>1.68</td>
</tr>
<tr>
<td>Linear shape</td>
<td>.06***</td>
<td>.02</td>
<td>.00</td>
<td>.03</td>
<td>.06**</td>
<td>.02</td>
<td>.13***</td>
<td>.03</td>
</tr>
<tr>
<td>Quadratic shape</td>
<td>-.03**</td>
<td>.01</td>
<td>.00</td>
<td>.01</td>
<td>-.01</td>
<td>.01</td>
<td>.03**</td>
<td>.01</td>
</tr>
<tr>
<td>Effect of friends’ grades (average alter)</td>
<td>.09***</td>
<td>.02</td>
<td>.09***</td>
<td>.03</td>
<td>.09*</td>
<td>.04</td>
<td>.10***</td>
<td>.02</td>
</tr>
<tr>
<td>Effect from gender (1=boy)</td>
<td>-.02</td>
<td>.02</td>
<td>.00</td>
<td>.03</td>
<td>.02</td>
<td>.04</td>
<td>.05</td>
<td>.07</td>
</tr>
<tr>
<td>Effect from homework</td>
<td>-.01</td>
<td>.01</td>
<td>-.02</td>
<td>.01</td>
<td>.01</td>
<td>.01</td>
<td>-.01</td>
<td>.01</td>
</tr>
<tr>
<td>Effect from satisfaction with school</td>
<td>.00</td>
<td>.02</td>
<td>.00</td>
<td>.02</td>
<td>.01</td>
<td>.02</td>
<td>.01</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note: * p-value <.05. ** p-value <.01. *** p-value <.001 (two-tailed tests). Students in the pre-vocational track with practical orientation did not have history and geography courses, so these classrooms were not included in the analyses concerning the social cluster.
Chapter 4

**Figure 4.1:** Ego/alter selection in the first year regarding students’ grades on the language cluster: log odds that ego (an individual) nominate alter (a peer) given the achievement scores of ego and alter.

![Diagram showing log odds vs achievement scores for ego and alter in the first year.](image)

*Note.* Calculations based on Ripley et al. (2015). Ego refers to an individual student (the nominator) whereas alter refers to his/her peers (the nominees).

**Figure 4.2:** Ego/alter selection in the second year regarding students’ average grades: log odds that ego (an individual) nominate alter (a peer) given the achievement scores of ego and alter.

![Diagram showing log odds vs achievement scores for ego and alter in the second year.](image)

*Note.* Calculations based on Ripley et al. (2015). Ego refers to an individual student (the nominator) whereas alter refers to his/her peers (the nominees).
Further results with regard to influence. We only found a significant influence effect in the second year and therefore only calculated ego-alter influence effects for this schoolyear (see Table 4.7). The first column shows the different values of academic achievement of the peers (running from 1 to 8), whereas the values in the rows indicate the relative attractiveness of these behavior for adolescents, varying by their own level of academic achievement (also running from 1 to 8). Comparing the values between rows indicates that the better peers academically achieve, the more likely it is that adolescents will move upwards in their own academic achievement. This is shown by the fact that the attractiveness of peer behaviors, indicated by the values in the rows, turn from negatively to more positive values. However, these effects become weaker for the highest values of academic achievement of peers. This suggests a regression to the mean effect, with low-achieving adolescents who profit from better achieving peers but high achieving adolescents decreasing a bit in their academic achievement.

Table 4.7

Ego-alter influence table in the eighth grade regarding students’ average grades: log odds that ego’s grades (individual student) are influenced by alter’s grades (peers) given the achievement scores of ego and alter.

<table>
<thead>
<tr>
<th>Alter/</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ego</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Calculations based on Ripley et al. (2015). Ego refers to an individual student (the nominator) whereas alter refers to his/her peers (the nominees).
Chapter 4

DISCUSSION

This study contributes to our understanding how friendship relationships affect adolescents’ academic achievement (influence processes) and how academic achievement affects their friendship relationships (selection processes) by looking at these processes in the first two years of secondary school with regard to students’ average grades and their grades on different clusters of subjects. Building on previous studies, we advanced current knowledge by studying the development of selection and influence processes in students’ academic achievement during two years and grades per language, science, and social cluster next to students’ average grades.

Three main conclusions can be derived from the results. First, selection and influence processes develop differently over the years. First year students, who do not know each other in the beginning of the year, tended to select similar others with regard to cluster-specific school grades but were not significantly influenced by their friends’ academic achievement. However, one year later the converse pattern was found. Friends were influenced by each other with regard to their average grades and their grades on different clusters, whereas selection was less prominent. These results suggest that students initially (first year) tend to select friends on the basis of similar grades and that influence processes on academic achievement emerge later on (second year), when the students know each other better.

Influence processes thus seem to take more time to unfold, which might explain non-significant peer influence effects on adolescents’ grades in a previous study regarding sixth graders (Dieterich, 2015). This timing effect may be explained by the fact that influence processes operate through social processes such as imitation (Bandura, 1977). An adolescent may be influenced by a friend’s pro-school behavior, but it takes some time to really improve the grades. Another explanation can be that students first need to know their peers well in order to be influenced by them. Students have to establish friendships in the first year in a new peer context, whereas these friendships are stronger and more stable in the second year (Altermatt & Pomerantz, 2003). Differences in selection and influence processes might also be explained by students’ developmental phases. In the first year, early adolescents are in a new school context in which parents might still be their most important supporters. In the second year these adolescents know the school system and their friends better, leading to more susceptibility to their friends’ behaviors.
A second conclusion is that similarity in achievement seems to facilitate friendship, as low-achieving as well as high-achieving students show mutual attractiveness in the tendency to nominate each other as friends. However, especially high-achieving students seem to have a low tendency to nominate low-achieving peers as friends (avoidance). This finding is in line with the social comparison theory of Festinger (1954), which holds that people tend to move into groups whose abilities are near to their own in order to satisfy their need for a positive self-evaluation. With regard to influence, this study shows that students mainly get higher grades when having high-achieving friends. Friends can thus influence students’ grades upwards by improving the grades. This might be explained by the fact that friends share information and motivate and encourage each other for school involvement (Crosnoe et al., 2003). Also, low-achieving students might be motivated to achieve well due to carrying the risk of not passing in the end of the year and subsequently losing their peers in the classroom and losing frequent contact with friends.

Third, it seems meaningful to distinguish between students’ average grades and their grades on content-related clusters of subjects as this study shows different effects between the average and cluster-specific grades. The different peer selection and influence effects for the average and cluster-specific grades may be explained by the fact that students’ average grades are based on grades on different subjects, with much variability in these grades. Also, selection of similar others with regard to specific grades might indicate that these students share the same, specific interests. As students might attribute more salience to specific subjects than others, they may talk with some classmates about those subjects and work together with them once they see that a specific peer is engaged in that subject. This can be a determinant of an emerging friendship. Moreover, the finding that students select friends on the basis of similar grades in specific clusters might indicate that they have subject-specific academic self-concepts, which is consistent with earlier findings (e.g., Marsh, Walker, & Debus, 1991). Due to knowledge about their own and their peers’ academic abilities in all different school subjects, they compare themselves with their peers in specific clusters (Bong, 2001).

Related to this, it might be that similar achieving students choose their seats close to each other, as students that are highly motivated for specific school subjects often sit in the front and are less motivated students in the back of the classroom. In this way, academic behavior and motivation by surrounding peers, for instance through making notes and paying
attention to the teacher, can unconsciously or consciously affect students’ behavior. This is in line with the idea that teachers in elementary schools determine classroom seating arrangements and subsequently influence social network processes in the classroom (Gest & Rodkin, 2011; Van den Berg, Segers, & Cillessen, 2012). By choosing seats close to each other, these peers see each other more during that specific lesson and have more opportunities to become friends and to be influenced with regard to those specific grades.

These findings have some practical implications. The fact that similar achieving students seem to select each other as friends and that especially high-achieving students show the tendency to avoid befriending low-achieving students, can have negative consequences. It carries the risk of underachievement for low-achieving students as it limits their possibilities of being positively influenced by friends. Stimulating and facilitating contact between low- and high-achieving students might be an important way to increase liking among peers with different academic achievement and to prevent students from exclusion of a network with preschool behavior. This can be accomplished for instance by school assignments including cooperation between students and strategies to manage classroom social dynamics, for example by placing students with different abilities close to one another to get to know each other and to provide each other support with school work (Gest, Madill, Zadzora, Miller, & Rodkin, 2014; Van den Berg et al., 2012).

Limitations and Future Studies

The results of the present study should be interpreted in light with its limitations. First, students have different academic capacities. Although everybody can work hard and might be motivated to achieve well, students can only reach their own maximum. Therefore, students can only be positively influenced regarding their grades within their own capabilities.

However, students in the Netherlands are tracked and students are supposed to be able to achieve well (and reach high grades) within their own educational track. Within each educational track as well as within classrooms there is much variability in students’ grades, so changes in academic achievement can be analyzed by relating it to their friendships. The results of the present study have indeed shown that adolescents’ friendships can contribute to their academic development. The educational systems in the Netherlands, with tracks, differs from many other systems such as the US, where students with different academic abilities attend
the same high school. However, even with this tracked system we find important friendship selection and influence effects, making it plausible that even stronger effects can be found in classrooms with more academic ability differences.

A second limitation is that students’ academic achievement does not always reflect their academic abilities, as non-cognitive skills such as students’ attitudes, behaviors, and strategies are also crucial to their performance (review by Farrington et al., 2012). Especially because students in our study were tracked, grades cannot be compared between tracks. However, we focused on students’ grades within their classroom and whether their friendships with classmates are related to it. We based students’ academic achievement on their report card grades, which is often used in other studies as well (e.g., Rambaran et al., 2017; Shin & Ryan, 2014b) and is supposed to be an objective and thus reliable measure of students’ grades. Moreover, grades are provided by different teachers and for different courses (multiple informants) making them even more reliable. Focusing on students’ actual grades is important as it determines whether a student passes a class and subsequently further educational opportunities (Witkow & Fuligni, 2010).

A third limitation is that the expectation that students become friends with similar achieving peers does not necessarily imply that these students consciously seek out a friend with a particular level of academic achievement (Flashman, 2012). Similarity attraction may also be related to other factors, such as meeting opportunities via the seating arrangement in the class (Gremmen, Van den Berg, Segers, & Cillessen, 2016) or to other personality and character traits that students actively desire in their friends (e.g., motivation, and attitudes). These unobservable individual factors could have played a role as well, and warrant inclusion in further research. Moreover, contextual factors such as peer norms on the class level can also play a role in students’ academic achievement, and the way peer processes either contribute to or deteriorate academic success (cf. Dijkstra & Gest, 2015; Laninga-Wijnen, Harakeh, Dijkstra, Veenstra, & Vollebergh, 2017a; Laninga-Wijnen et al., 2017b).

However, Gest, Domitrovich, and Welsh (2005) have found evidence that peers can influence an individual students’ academic achievement through peer academic evaluations. Peers in classrooms observe each other’s engagement for school and specific school subjects, by first-hand experiences such as working with classmates and noticing their work habits and skills. As a result, classmates have unique information about the academic behavior and grades
Chapter 4

of peers (Gest et al., 2005), besides the fact that they often know their peers’ report card grades as well. Social comparisons with especially friends can predict changes in students’ own reasoning about their achievement and motivation levels (Altermatt & Pomerantz, 2003; Ryan, 2001).

A related issue is that in view of statistical power and related convergence problems due to analyses on the classroom level we could not control for other factors that are potentially relevant for selection processes, such as differences between educational tracks, the classroom size, or the percentage of boys in a classroom.

One avenue for future research is to test on specific mechanisms underlying peer selection and influence processes. For example, friendships can be defined more specifically according to the frequency of contact or the shared intimacy. Some students might indicate to be friends within the classroom, but it is also interesting to know whether they meet each other out of school, how much personal information they share with each other, and what kinds of shared activities they have (e.g., doing homework together). Future studies can also focus more on the interplay between adolescents’ academic achievement and other behaviors, by examining both direct and indirect socialization effects by peers (Giletta, Burk, Scholte, Engels, & Prinstein, 2013). For example, to what extent does the interplay with other behaviors (such as risky and prosocial behaviors) affect students’ preferences for specific friends and the extent to which they adjust their academic achievement to their friends?

Next to this, future studies should take different kinds of subjects, instead of only average grades, into consideration. Results show selection of peers based on different interests in the first year, possibly reflecting different types of students (e.g., more technically oriented students and students who are more interested in languages). In the present study, these selection effects would have remained invisible when only average grades would have been studied. On top of that, it is important to investigate developmental differences on the impact of peer processes on students’ academic achievement. Previous studies mainly included one year in secondary school (Geven et al., 2013; Rambaran et al., 2017; Shin & Ryan, 2014a, 2014b), or did not differentiate in the analyses between school years (Flashman, 2012). However, our study shows different processes in the second compared to the first year.

Frank and colleagues (2008) found that especially girls are responsive to social norms with regard to mathematics. It was beyond the scope of this study, but this calls for a more
detailed investigation of gender differences in peer dynamic studies. Previous studies have found friendship and individual differences between girls and boys concerning academic behavior (Van Houtte, 2004; Warrington, Younger, & Williams, 2000). So it might be the case that selection and influence processes differ between boys and girls. Is selection on languages for example more important for girls, whereas selection on science-related, technical subjects is more important for boys?

Finally, previous studies have found differences between schools and classes in the extent to which selection and influence processes in academic achievement take place (Dieterich, 2015; Flashman, 2014). Therefore, future studies should aim to understand the causes of these differences. Between-class variations might be explained by the classroom context, for instance through peer norms (Dijkstra & Gest, 2015). Peer norms reflect the expected and accepted behavior of a social group, making it interesting to study the role of these norms on peer processes. In some classes pro-school behavior (e.g., helping behavior, concentration) may be the norm and thus be seen as attractive, whereas in other classrooms popular students have low academic scores and promote anti-school behavior (e.g., distracting behavior).

To conclude, this study shows the important role of friendship selection and influence processes in adolescents’ academic achievement. Developmental differences were found, as well as differences between students’ average and cluster-specific grades. The results suggest that students initially tend to select friends on the basis of cluster-specific grades (selection), and that they adjust their academic achievement to friends in the second year (influence).
APPENDIX

Attrition within school year 2011-2012 (first year). Between waves 1 and 2, two students entered school and one student moved to another classroom within the school. Between waves 2 and 3, four students entered school and nine students moved to another classroom within the school. Also, at wave 1, the data of one student was found unreliable and was deleted. Across the school year 2011-2012, a total of seven students had refused to participate in the study. All their data was deleted, including their previously filled out data. In addition, five students did not fill out the questionnaire at wave 1, eight students at wave 2, and 19 students at wave 3. This leaves us with 601, 600, and 591 participants at wave 1, wave 2, and wave 3 respectively.

Attrition between school years (first and second year). Between wave 3 and wave 4, 10 students had to repeat a class.

Attrition within school year 2012-2013 (second year). Between waves 4 and 5, seven students entered school and two students moved to another classroom within the school. Between waves 5 and 6, the number of students remained the same. Across the school year 2012-2013, a total of six students had refused to participate in the study. All their data was deleted, including their previously filled out data. In addition, 13 students did not fill out the questionnaire at wave 1, 19 students at wave 2, and 17 students at wave 3. This leaves us with 550, 551, and 553 participants at wave 4, wave 5, and wave 6 respectively.
The role of academic status norms in friendship selection and influence processes related to academic achievement*

* This chapter is published in *Developmental Psychology.*

Chapter 5

Abstract
This study examined the role of academic status norms in friendship selection and influence processes related to academic achievement across the second year of secondary school (SNARE project, \( N = 1,549 \) students from 70 classes, \( M_{age} = 13.69 \)). Academic status norms were operationalized as the class-level correlation between academic achievement and four types of peer status: popularity, peer acceptance, unpopularity and peer rejection. Longitudinal social network analyses indicated that the unpopularity and popularity norm play a role in friendship selection processes (but not influence processes) related to academic achievement. In line with our hypotheses, the unpopularity norm in the classroom strengthened similarity-based friendship selection among low-achieving adolescents, and predicted greater avoidance of becoming friends with similarly high-achieving adolescents. Also, the popularity norm strengthened friendship selection among similar peers, both among low- and high-achievers. Acceptance and rejection norms did not play a role in friendship processes. Hence, the average achievement of popular and unpopular peers shapes friendship preferences in the classroom, which may have important implications for adolescent academic development.

Keywords: peer norms; friendship selection; friendship influence; academic achievement; popularity; unpopularity
Academic status norms in selection and influence processes

Adolescent academic achievement is a key predictor of future success in education and occupation (Crosnoe & Benner, 2015). Peers may provide a crucial developmental context for adolescents’ academic achievement (Rodkin & Ryan, 2012) and peer relationships may shape students’ academic achievement through friendship selection and influence processes. Friendship selection refers to adolescents selecting similarly achieving peers as friends, as similarity enhances mutual understanding and facilitates communication, for instance when collaborating on academic tasks. This makes a relationship more rewarding and stable (similarity attraction hypothesis; Byrne, 1971). In turn, friendship influence can change individual academic achievement over time through, among others, information exchange, modeling (Kindermann & Gest, 2009), supporting or distracting from learning (Rodkin & Ryan, 2012) and peer tutoring experiences (Gest, Rulison, Davidson, & Welsh, 2008). Both friendship selection and influence processes may result in similarity in achievement among friends, for better or worse: hanging out with high-achieving friends may promote achievement, whereas hanging out with low-achieving friends may dampen achievement over time (Shin & Ryan, 2014).

Some studies examined friendship processes related to achievement, but findings vary considerably with regard to the strength and direction of friendship processes. In regard to the strength (i.e., the extent to which processes take place), most studies found that influence processes take place, whereas friendship selection was found in some (Gremmen, Dijkstra, Steglich, & Veenstra, 2017; Flashman, 2012; for girls; Kretschmer et al., 2018; Rambaran, Hopmeyer, Schwartz, Steglich, Badaly, & Veenstra, 2016) but not in other studies (Fortuin, Van Geel, & Vedder, 2016; for boys; Kretschmer et al., 2018; Shin & Ryan, 2014). In regard to the direction of friendship selection (i.e., whether friendship selection is based on high or low achievement), one study found that adolescents select each other based on similarity in low achievement (Rambaran et al., 2016), whereas two studies found differences between settings in the direction of selection processes. Flashman (2012) found that in one school, high-achieving students mostly formed friendships with other high-achieving students, whereas in another school, similarity-based selection took place equally among low- and high-achieving students. Gremmen and colleagues (2017) indicated that in some classrooms, friendship selection mostly took place based on similarity in low achievement, whereas in other classrooms, similarity-based selection occurred both among low- and high-achieving peers.
Chapter 5

Only two studies examined the direction of friendship influence. One study indicated that friends influenced each other to increase rather than decrease in achievement over time (Rambaran et al., 2016). Another study showed that high-achievers were influenced to decrease in achievement, whereas low-achievers were influenced to increase in achievement over time (Gremmen et al., 2017). In order to promote adolescents’ academic achievement, it is crucial to identify when adolescent’ friendship processes are for better or for worse.

One reason why achievement-based friendship processes may vary across settings, is that different settings may present different peer contexts, which in turn has diverging implications for friendship processes (Kiuru, Salmela-Aro, Nurmi, Zettergren, Anderson, & Bergman, 2012). The peer context can be measured using the concept of peer norms, which represent how specific behaviors (here; academic achievement) are evaluated and appreciated within a specific context and, therefore, may determine the valence of certain behaviors for friendship processes (McCormick & Cappella, 2014). Therefore, the aim of our study is to examine whether peer norms play a role in the strength and direction of selection and influence processes with regard to academic achievement.

The role of peer norms in friendship processes related to academic achievement

Similarity-based friendship selection and influence processes do not take place for just every characteristic or behavior, but may especially occur for characteristics or behaviors that are important and salient to adolescents (Fortuin et al., 2016). According to the reputational salience hypothesis (Hartup, 1996), similarity among friends mainly occurs for “reputationally salient” behaviors: behaviors that are an important tool to improve one’s social reputation. This is in line with the idea that adolescents prioritize achieving status (LaFontana & Cillessen, 2010) and that adolescents actively avoid a low status among peers, as this may put them at risk of peer victimization and exclusion (Hopmeyer Gorman, Schwartz, Nakamoto, & Mayeux, 2011). According to goal-framing theory (Lindenberg, 2006), adolescents may particularly attend to behaviors that could serve their goal of obtaining a higher peer status. Therefore, these behaviors may become valuable and important for similarity-based friendship processes (Hartup, 1996; Haselager, Hartup, Van Liershout & Riksen-Walraven, 1998). Whereas the reputational salience hypothesis is mainly about the general reputational salience of a certain attribute, we argue that previously found inconsistencies in the importance of achievement for friendship processes may indicate that the reputational salience of achievement varies across
settings, such as the classroom (Laninga-Wijnen, Ryan, Harakeh, Shin, & Vollebergh, 2018). One way of measuring the “setting-level” reputational salience of behavior is by examining the concept of status norms, also known as norm salience (Henry, Guerra, Huesmann, Tolan, VanAcker, & Eron, 2000).

Status norms for academic achievement refer to the extent to which academic achievement is positively valued in classrooms because of its associations with high social peer status, or instead, negatively valued because of its associations with low social peer status. Although the original concept of status norms (norm salience) defined peer status by peer rejection and peer acceptance (Henry et al., 2000), recent studies emphasize the need to examine four types of peer status: peer acceptance, popularity, rejection, and unpopularity (Cillessen & Marks, 2011; Hopmeyer Gorman et al., 2011). These four constructs are partly overlapping but also conceptually distinct as they are associated with different behavioral, socio-emotional and academic outcomes, and therefore warrant to be examined separately (Hopmeyer Gorman et al., 2011). Peer popularity (i.e., perceived as most popular) and unpopularity (i.e., perceived as least popular) are reputation-based constructs, representing high or low social power, visibility and prestige in the peer group (Adler, Kless, & Adler, 1992; Cillessen & Borch, 2006). Peer acceptance (i.e., sociometric popularity, being liked) and peer rejection (i.e., being disliked) are dyadic, preference-based constructs that refer to the extent to which someone is accepted or rejected by his or her peers (Cillessen & Marks, 2011; Hopmeyer Gorman et al., 2011). The class-level associations between achievement and these four status constructs represent four types of status norms: popularity norms, acceptance norms, unpopularity norms and rejection norms.

So far, studies have not examined whether status norms play a role in friendship processes related to achievement. Status norms regarding academic achievement may differ between classrooms. In some classrooms low academic achievement might be considered ‘cool’, for instance because students in these classrooms react against adult-approved behaviors to achieve well in school (Moffitt, 1993); whereas in other classrooms, high achievement may be related to high peer status, as students are more occupied with their future education and careers (Ryan & Rodkin, 2012). Also, in line with the original ideas about norm salience (Henry et al., 2000), our focus on four types of status norms enables us to 1) compare the power of social sanctions or social rewards of achievement (Brechwald &
Chapter 5

Prinstein, 2011), and 2) examine the relative impact of reputation-based norms (popularity, unpopularity) versus preference-based norms (acceptance, rejection).

Reputation-based constructs may generally be more relevant than preference-based constructs, as there is assumed to be more consensus about someone’s status for reputation-based constructs, so that people know whom they have to look to when they want to know what the norm is (Adler et al., 1992; Hopmeyer Gorman et al., 2011). Also, reputation-based constructs are assumed to be a more important reward (popularity) or sanction (unpopularity) than preference-based constructs during the developmental period of adolescence. That is, previous work indicated that popularity is prioritized over other social goals (LaFontana & Cillessen, 2010), also over being accepted by peers (Dijkstra, Cillessen, Lindenberg, & Veenstra, 2010). Moreover, unpopularity seems to be a more severe sanction compared to being disliked, as unpopular peers experience more internal distress and are more at risk for victimization compared to disliked peers; and being ‘disliked’ sometimes even seems to be a pay-off of being popular (Hopmeyer Gorman et al., 2011). However, we do not formulate hypotheses on the relative impact of the four status norms, as we are the first to examine these four status norms types and we examine it in a relatively unexplored area (academic achievement). Nevertheless, we expect that status norms play a role in both the strength and direction of friendship processes, which we will explain further below.

Strength of selection and influence processes. It can be argued that selection and influence especially take place based on reputationally salient attributes (Hartup, 1996). Hence, when achievement is positively salient (i.e., strongly associated with popularity or acceptance) or negatively salient (i.e., strongly associated with unpopularity or rejection) in a classroom, students may particularly select peers based on similarity in achievement, and may be more susceptible to be influenced by their friends towards similarity in academic achievement. This is in line with two previous studies that examined the importance of popularity norms for the strength of similarity-based selection and influence processes related to two relatively deviant characteristics: aggressive behaviors (Laniga-Wijnen, Harakeh, Steglich, Dijkstra, Veenstra, & Vollebergh, 2017) and risk attitudes (Rambaran et al., 2013). These studies showed that, in line with the reputational salience hypothesis (Hartup, 1996), friendship selection and influence processes related to aggression (Laniga-Wijnen et al., 2017) and influence processes regarding
risk attitudes (Rambaran et al., 2013) were stronger in classrooms where these behaviors and attitudes were associated with popularity.

**Direction of selection and influence processes.** In classrooms where high academic achievement is *positively salient* (with high popularity or acceptance norms) there may be a stronger tendency for *high*-achieving students to select similarly high-achieving peers as friends compared to *low*-achieving students selecting similarly low-achieving peers as friends (reputational salience hypothesis, Hartup, 1996). Similarity-based selection effects are expected to be weaker among low-achieving students, as for low achieving students another process may occur as well: they may also select attractive high-achieving peers in order to become higher in peer status (goal-framing theory, Lindenberg, 2001; 2006; basking in reflected glory hypothesis, Dijkstra et al., 2010). Hence, in these classrooms low-achieving students may have a higher tendency to select high-achieving peers as friends, than vice versa. With regard to influence, adolescents may become similar to their friends in *high* achievement, as this contributes to a higher peer status in these classrooms (Hartup, 1996).

By contrast, in classrooms where high achievement is *negatively salient* (high unpopularity or rejection norm), there may be a stronger tendency for *low*-achieving students to select similarly low-achieving peers as friends compared to *high*-achieving students selecting similarly high-achieving peers as friends (reputational salience hypothesis, Hartup, 1996; Haseleger et al., 1998). That is, for high-achieving students another process may occur as well: they may also select low-achieving peers as friends to avoid a low peer status in these classrooms (Brechwald & Prinstein, 2011). Hence, high-achieving students may have a higher tendency to select low-achieving students, than vice versa. With regard to influence, adolescents may become similar to their friends in *low* achievement, as this may help to avoid a low peer status in these classrooms (Hartup, 1996).

**PRESENT STUDY**

We examine whether the extent to which achievement is positively or negatively *salient* in a classroom determines the strength and direction of friendship selection and influence processes related to achievement. With regard to the *strength*, we hypothesize stronger similarity-based selection and influence effects in classrooms in which high academic
achievement is related to a positive peer status (i.e., popularity norm and acceptance norm) or a negative peer status (i.e., unpopularity norm and rejection norm).

With regard to the direction, we hypothesize that when high achievement is related to a positive social status (i.e., high popularity or acceptance norms), similarity-based selection processes are stronger between high-achieving peers compared to low-achieving peers. For influence effects, we hypothesize that low-achieving students have a tendency to increase their academic achievement in the direction of high-achieving students. By contrast, we hypothesize that when high achievement is related to a negative social status (i.e., high rejection or unpopularity norms), similarity-based selection effects are stronger between low-achieving than high-achieving peers. For influence effects, we hypothesize that high-achieving students have a tendency to decrease their academic achievement in the direction of low-achieving students.

We use ‘perceived friendship’ as an indicator of friendship. That is, we assess friendships using unlimited peer nominations on the question “who are your best friends in class” and we consider both asymmetrical and reciprocal friendships as ‘friendships’. Hence, strictly speaking, what we study is an index of ‘friendship choice’ or ‘friendship selection’. Even though this is regular practice in social network studies on peer relations (Veenstra & Dijkstra, 2011), friendship reciprocity is of central importance in defining a friendship (Bukowski & Hoza, 1989; Furman, 1996; Degirmencioglu, Urberg, Tolson, & Richard, 1998). However, from a social network perspective, both asymmetrical and reciprocal friendships are important social ties that may influence adolescent’ behavior. That is, even when friendship ties are non-reciprocal, adolescents may become similar to the peers that they perceive to be their best friends. For instance, adolescents may be particularly motivated to behave in the same way as their perceived best friend, to receive a friendship nomination back (Bot, Engels, & Knibbe, 2005). Nevertheless, we consider it important to stress that our measure of friendship may rather be a construct of ‘perceived friendship’.

METHOD

PARTICIPANTS

The SNARE (Social Network Analysis of Risk behavior in Early adolescence) project is a longitudinal study on adolescent social and behavioral development. All first- and second-year
students in two secondary schools (one in the north and one in the middle of the Netherlands) were approached for enrollment in the SNARE project (Cohort 1) at the beginning of the academic year 2011-2012. A second cohort of students entering the first year in these secondary schools was also approached to take part in the project the following academic year 2012-2013 (Cohort 2). We examined friendship selection and influence in the second year of secondary education. This implies that we selected the students of the SNARE study who were in cohort 1 in the second year of secondary education in 2011-2012, students from cohort 1 who were in the second year of secondary education in 2012-2013, and students from cohort 2 who were in the second year in 2013-2014. This yielded a sample of 1,568 students from 70 classes. Of the 1,568 second-year students who were approached, 0.01% (N = 19) declined to participate for various reasons (i.e., the adolescent was dyslectic or the research was perceived to be too time-consuming). This yielded a sample of 1,549 second-year adolescents from 70 classes; 760 (49.1%) girls, with a mean age of $M = 13.69$ ($SD = 0.49$). Each class had 12 to 31 students ($M = 22.13$ students per class). Of the participants, 48.6% were enrolled in lower-level education (including preparatory secondary school for technical and vocational training), and 50.6% were attending higher-level education (including preparatory secondary school for higher professional education and for university). The majority of the sample was native Dutch (around 80.0%). The socioeconomic status of participants was calculated based on the zip codes, using ‘status scores’ of the Social Cultural Planning Office, The Netherlands (e.g., Benson, Nierkens, Willemsen, & Stronks, 2015). Status scores are calculated based on the average income of habitants within an area, the percentage of habitants with lower incomes, the percentage of lowly educated habitants, and the percentage of unemployed habitants. These scores indicated that 55.0% of our participants came from areas with a lower socioeconomic status compared to the average socioeconomic status in the rest of the Netherlands.

PROCEDURE
Students received an information letter for themselves and their parents, in which they were asked to participate. If students or their parents wished to refrain from participation, they were asked to indicate this. During data collection, students were also made aware that they could opt out anytime. For all students, data were collected three times in one academic year, that is, in the fall, winter and spring. The survey was completed during regular lessons in the
classroom by computer (under the supervision of a researcher) using Cloud Solutions socio software (www.sociometric-study.com). Students that were absent that day were, if possible, assessed within a month. The privacy and anonymity of the students were warranted and the study was approved by the Internal Review Board (IRB) of Utrecht University, see also Dijkstra et al., 2015; name of approved project is: “Social network processes and social development of children and adolescents”.

MEASURES

Friendships. Adolescents received a list of all consenting students in their class. They were asked to indicate their ‘best friends’ within their classroom. Participants could select an unlimited number of same-gender and opposite-gender classmates, and there was an option of selecting ‘nobody’, which allowed us to differentiate between missing responses and valid empty responses in the name generators. Based on these nominations, we constructed an adjacency matrix for each classroom at all waves containing all nominations, with 0 and 1 representing absence and presence of a tie between actors $i$ and $j$, respectively.

Academic achievement. Academic achievement was derived from three school report cards with students’ average grades (ranging between 1 and 10) per school subject (GPA; Grade Point Average). We calculated the average grades over at least four out of six school subjects per student: Dutch, English, mathematics, biology, history, and geography. 1 Students’ average school grades were categorized into seven subcategories, as RSiena is not able to handle continuous measures. The categorization was as follows: $1 = \text{GPA} \leq 5.49$; $2 = 5.50 \leq \text{GPA} \leq 5.99$; $3 = 6.00 \leq \text{GPA} \leq 6.49$; $4 = 6.50 \leq \text{GPA} \leq 6.99$; $5 = 7.00 \leq \text{GPA} \leq 7.49$; $6 = 7.50 \leq \text{GPA} \leq 7.99$; $7 = \text{GPA} \geq 8.00$.

Status norms. Similar to the friendship measure, participants received a list of all consenting students in their classroom in a random order. They were asked to indicate “who is most

---

1 From one of the participating schools, we received the grades of students from September to October (representing the grades for T1), from October to December (representing the grades for T2) and from December to April (representing the grades for T3). From the other school, we also received three school report cards; however, the school report card grades on the second and third report card included all grades from previous periods in that specific school year. Hence, for this school, report cards displayed the average grade from September to October (T1), September to December (T2) and September to April (T3). To account for this, we calculated the average grade for T2 by multiplying the grade of T2 times two and subtracting it by the previous average grade of T1. For calculating the grade for the period from December to April (T3) we performed a similar procedure, controlling for the longer time period between assessments.
popular” (popularity), “who is least popular” (unpopularity), “who do you like?” (acceptance), and “who do you not like at all?” (rejection). Based on these nominations, we calculated per student the proportion of nominations. Subsequently, four types of status norms at T1 were calculated: (1) the within-classroom correlation between peer-nominated popularity and achievement (popularity norm), (2) the within-classroom correlation between peer-nominated unpopularity and achievement (unpopularity norm), (3) the within-classroom correlation between peer acceptance and achievement (acceptance norm), and (4) the within-classroom correlation between peer-nominated rejection and achievement (rejection norm).

**Gender.** Gender was coded 0 for girls and 1 for boys.

**ANALYSES**

**Attrition analyses.** Missing values on achievement and peer-nomination data across waves were 3.6%, 3.4% and 3.4% respectively, for instance due to illness and not being able to catch up on the questionnaire, or because they were new at school and not yet in the nomination lists. Hence actual N’s across waves were \( N_{w1} = 1494, N_{w2} = 1500 \) and \( N_{w3} = 1500 \). Attrition analyses on partially missing cases and complete cases showed that students with missing data were on lower educational tracks \( (\chi^2 = 693.32; p < .001) \). No other significant or substantial differences in the research variables of interest between partially missing cases and complete cases. Missing friendship data due to nonresponse were handled using the RSiena missing data method (Huisman & Steglich, 2008) using the “last observation carry forward” method proposed by Huisman and Snijders (LOCF; 2003). The percentage of missing values on achievement was about 2.8% across waves, for instance because adolescents left the school or instead, joined the school year later. Missing data were handled using the Expectation Maximization method. Little’s Missing Completely at Random test produced a normed chi-square \( (\chi^2 / df) \) of 3.52, indicating that the data were likely missing at random and that it was safe to impute missing values (Bollen, 1989). Therefore, to gain statistical power, we estimated missing values for achievement data across waves using the Expectation Maximization procedure, with all study measures as predictors (achievement across waves, as well as the different types of status and gender; see also Van Buuren & Groothuis-Oudshoorn, 2011, p. 22; Gupta & Chen, 2010).
**Chapter 5**

**RSiena analyses.** Analyses were conducted using longitudinal social network analysis (also called ‘stochastic actor-based models’; Snijders, 2005) implemented using the RSiena software program (version 1.1-289 in R 3.2.2). RSiena estimates to what extent similarity among friends is due to friendship selection and influence processes (Snijders, Steglich, & Schweinberger, 2007), while controlling for structural network effects and the general development of a certain behavior in the network. This modeling technique allowed for simultaneously testing effects from wave 1 to wave 2 and wave 2 to wave 3. For a detailed, more technical explanation of longitudinal social network analyses, we refer to Snijders and colleagues (2007) and Veenstra, Dijkstra, Steglich, and Van Zalk (2013).

**Friendship selection based on academic achievement.** In order to examine the extent to which friendship selection related to academic achievement took place, we estimated several effects. We included structural network effects that capture natural tendencies that generally take place in a friendship network, such as the tendency to reciprocate friendships (reciprocity) and to become friends with friends of friends (group formation tendencies). Next, the “effect of achievement on friendship nominations received” refers to which extent high achievement affects being nominated as a best friend (alter effect). Conversely, the “effect of achievement on friendship nominations given” indicates to what extent high achievement affects the number of best friend nominations given to peers (ego effect). The similarity-based selection effect provides an estimate for testing our hypothesis about the extent to which adolescents form new and maintain friendships with others based on similarity in achievement (so-called evaluation effect).

**Friendship influence on achievement.** Friendship influence processes refer to the tendency of adolescents to become similar to their friends in achievement. A positive influence parameter (average similarity parameter) represents the tendency to adopt friends’ achievement over time; this can work in an upward or in a downward direction (or remain similar). Friendship influence processes were estimated while controlling for the linear shape parameter, quadratic shape parameter, and the main effect of gender on achievement. The linear and quadratic shape parameters model the rate of change, and whether change in achievement conforms to linear or quadratic trends.
The role of status norms in the co-evolution of friendships and achievement. The aforementioned effects were first analyzed for each class separately in RSiena, yielding 70 parameters for each effect. To examine the moderating impact of the four types of status norms, we ran a meta-analysis, using Viechtbauer’s (2010) meta-analysis method implemented in the R-package ‘metafor’ to aggregate these results for the total sample of 70 classes, while simultaneously including the four types of status norms as continuous class-level moderators. We adopted this approach in order to determine the unique contribution of all four types of status norms in predicting class-level variation in selection and influence processes on achievement, while controlling for each other. This is necessary because there might be some overlap between for instance low popularity and high unpopularity, even though these constructs are antagonistically distinct concepts, as indicated by previous work (see for instance Hopmeyer Gorman et al., 2011). In order to facilitate the interpretation of the findings, we calculated odds ratios by taking the exponential function of the parameter estimates ($\exp(\beta_k)$; Ripley, Snijders, Boda, Vörös, & Preciado, 2018). For friendship influence, we first divided the estimates by the number of answer categories minus one to reflect the effect of a one-unit increase or decrease on the scale. Odds ratios were not calculated for the quadratic shape terms because these were not linear.

Next, when friendship selection processes were significantly present across classrooms, we calculated ego-alter selection tables (Ripley et al., 2018), to examine whether similarity-based selection especially takes place among high-achieving or low-achieving students, and to examine whether high-achieving students have a higher tendency to select low-achieving students or vice versa. Also, when influence processes were significant, we calculated ego-alter influence tables to investigate whether friends influence each other in an upwards or a downwards direction. For these ego-alter tables, we compared classrooms in the upper and lower 10% of status norms. We chose for this criterion due to the skewed distribution of our popularity norm measure, as there were only few classrooms with a positive association between popularity and achievement. When we would have applied other criterions, classrooms with a neutral or even a negative association between popularity and achievement would have been included in our ‘high popularity norm’ classrooms. For consistency, we applied the 10% criterion to all types of status norms.
We also tested whether differences in the direction of effects were significant by giving weights to these differences and calculating a linear combination and standard deviation for each classroom with a certain status norm. We transformed this to a z-score with the following formula: \( \frac{\sum(lc/se)}{\sqrt{N}} \) where \( lc \) = linear combination in each classroom, \( se \) = standard error in each classroom and \( N \) = number of classrooms. We are the first social network study that applies these method as it was recently developed, so we refer to the newest RSiena manual (Ripley et al., 2018) and https://www.stats.ox.ac.uk/~snijders/siena/ for scripts of this method.

**Goodness of fit of models and sensitivity analysis.** We assessed the Goodness of Fit with indegree distribution, outdegree distribution, triad census and geodesic distances, and the behavior distribution for GPA. For each goodness of fit statistic, we assessed the differences between the observed values in the network (summed across the three waves of data) and the simulated values in the model, using Mahalonobis distance for each classroom network (cf. Ripley et al., 2018). For all fit indices, less than 5% of the Mahalonobis distance values reached statistical significance, indicating an adequate goodness of fit (see also Laninga-Wijnen et al., 2018). Violin plots indicated that in general, values were well represented in all classrooms. Model convergence of our final models was good.

We conducted three sensitivity analyses. First, we removed all adolescents who nominated all peers in the classroom as a best friend from the dataset. This did not affect the interpretability of our results, so we decided to take the model without these adolescents who nominated everyone as a best friend as our final model. Second, we examined whether our pattern of results differed with and without imputed achievement values, which was not the case. Therefore, we chose the model with imputed data as our final model. Third, we included classroom means and variances in GPA as control variables in our analyses, yielding similar results. Results of all sensitivity analyses are available upon request.
RESULTS

DESCRIPTIVE RESULTS

In Table 5.1, the averages and correlations of GPA and different types of status are displayed. In general, at the individual level, having a high GPA is significantly associated with lower levels of popularity, higher levels of unpopularity (except at T2), higher levels of acceptance (except T2), and higher levels of rejection (except T3). However, the strength of correlations between GPA and different types of status is quite weak. There is relative stability in the extent to which students are perceived as popular and unpopular, and are being accepted and rejected by their peers, as indicated with moderate to high correlations across waves. Boys and girls differed significantly but not substantially on academic achievement (effect sizes $D_{11} = 0.26$ and $D_{12} = 0.16$ and $D_{13} = 0.15$).

Table 5.2 presents descriptive statistics and stability coefficients for the status norms. The popularity norm (i.e., the class-level association between being popular and GPA) was negative and the unpopularity norm (i.e., the class-level association between being unpopular and GPA) was positive at all time points. There were large between-classroom differences in status norms, and status norms were relatively stable, as represented by significantly positive inter-correlations between time points.
### Table 5.1

*Correlations between Different Types of Status and Grade Point Average across the School Year (N = 1549)*

<table>
<thead>
<tr>
<th></th>
<th>M(SD)</th>
<th>Range</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>GPA T1</td>
<td>6.57(0.74)</td>
<td>[4.27 - 9.15]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>GPA T2</td>
<td>6.65(0.83)</td>
<td>[3.27 - 9.45]</td>
<td>.60**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>GPA T3</td>
<td>6.58(0.88)</td>
<td>[1.68 - 9.32]</td>
<td>.64**</td>
<td>.52*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Popularity T1</td>
<td>0.14(0.16)</td>
<td>[0.00 - 0.82]</td>
<td>-.17**</td>
<td>-.17**</td>
<td>-.17**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Popularity T2</td>
<td>0.14(0.16)</td>
<td>[0.00 - 0.90]</td>
<td>-.13**</td>
<td>-.13**</td>
<td>-.13**</td>
<td>.81**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Popularity T3</td>
<td>0.13(0.16)</td>
<td>[0.00 - 0.88]</td>
<td>-.10**</td>
<td>-.10**</td>
<td>-.10**</td>
<td>.77**</td>
<td>.79**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Unpopularity T1</td>
<td>0.12(0.18)</td>
<td>[0.00 - 0.83]</td>
<td>.10**</td>
<td>.00</td>
<td>.10**</td>
<td>-.41**</td>
<td>-.38**</td>
<td>-.36**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Unpopularity T2</td>
<td>0.11(0.17)</td>
<td>[0.00 - 1.00]</td>
<td>.11**</td>
<td>.03</td>
<td>.11**</td>
<td>-.37**</td>
<td>-.36**</td>
<td>-.35**</td>
<td>.88**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Unpopularity T3</td>
<td>0.11(0.17)</td>
<td>[0.00 - 0.95]</td>
<td>.12**</td>
<td>.04</td>
<td>.12**</td>
<td>-.38**</td>
<td>-.38**</td>
<td>-.38**</td>
<td>.81**</td>
<td>.86**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Acceptance T1</td>
<td>0.39(0.16)</td>
<td>[0.00 - 0.86]</td>
<td>.10*</td>
<td>.01</td>
<td>.10**</td>
<td>.31**</td>
<td>.29**</td>
<td>.29**</td>
<td>-.43**</td>
<td>-.38**</td>
<td>-.36**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Acceptance T2</td>
<td>0.38(0.18)</td>
<td>[0.00 - 0.83]</td>
<td>.06*</td>
<td>.03</td>
<td>.06*</td>
<td>.25**</td>
<td>.29**</td>
<td>.26*</td>
<td>-.36**</td>
<td>-.36**</td>
<td>-.36**</td>
<td>-.34**</td>
<td>.71**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Acceptance T3</td>
<td>0.36(0.17)</td>
<td>[0.00 - 0.83]</td>
<td>.09*</td>
<td>.01</td>
<td>.09**</td>
<td>.21**</td>
<td>.26**</td>
<td>.32**</td>
<td>-.33**</td>
<td>-.32**</td>
<td>-.32**</td>
<td>.55**</td>
<td>.63**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Rejection T1</td>
<td>0.10(0.12)</td>
<td>[0.00 - 0.90]</td>
<td>-.06*</td>
<td>-.06*</td>
<td>-.06**</td>
<td>-.13**</td>
<td>-.14**</td>
<td>-.10**</td>
<td>.60**</td>
<td>.56**</td>
<td>.50**</td>
<td>-.53**</td>
<td>-.46**</td>
<td>-.39**</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Rejection T2</td>
<td>0.09(0.12)</td>
<td>[0.00 - 0.80]</td>
<td>-.07*</td>
<td>-.09**</td>
<td>-.07**</td>
<td>-.12**</td>
<td>-.13**</td>
<td>-.12**</td>
<td>.54**</td>
<td>.61**</td>
<td>.55**</td>
<td>-.47**</td>
<td>-.48**</td>
<td>-.41**</td>
<td>.74**</td>
</tr>
<tr>
<td>15.</td>
<td>Rejection T3</td>
<td>0.10(0.18)</td>
<td>[0.00 - 0.87]</td>
<td>-.05</td>
<td>-.11**</td>
<td>-.05</td>
<td>-.10**</td>
<td>-.12**</td>
<td>-.12**</td>
<td>.38**</td>
<td>.52**</td>
<td>.54**</td>
<td>-.40**</td>
<td>-.42**</td>
<td>-.45**</td>
<td>.66**</td>
</tr>
</tbody>
</table>

*Note.* GPA = Grade Point Average. T1, T2 and T3 represent the measurement waves in October, December and April. GPA scores reflect report card scores, and all status scores refer to the average proportion of students within the classroom that nominated a particular individual for this characteristic. **p < .01; *p < .05.
### Table 5.2

**Descriptives of Popularity Norms, Unpopularity Norms, Acceptance Norms and Rejection Norms across the School Year (N = 70 classes)**

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>Inter-correlations over time</th>
<th>Correlations at T1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M(SD)</td>
<td>Range</td>
<td>M(SD)</td>
<td>Range</td>
<td>T1 – T2 T2 – T3 1. 2. 3.</td>
</tr>
<tr>
<td>1. Popularity norm</td>
<td>-.21(.24)</td>
<td>[-.85 -.29]</td>
<td>-.15(.22)</td>
<td>[-.66 -.34]</td>
<td>-.14(.26)</td>
</tr>
<tr>
<td>2. Unpopularity norm</td>
<td>.14(.26)</td>
<td>[-.58 -.62]</td>
<td>.06(.26)</td>
<td>[-.54 -.69]</td>
<td>.11(.28)</td>
</tr>
<tr>
<td>3. Acceptance norm</td>
<td>.01(.27)</td>
<td>[-.66 -.86]</td>
<td>.04(.24)</td>
<td>[-.73 -.51]</td>
<td>.05(.26)</td>
</tr>
<tr>
<td>4. Rejection norm</td>
<td>-.06(.25)</td>
<td>[-.58 -.71]</td>
<td>-.08(.23)</td>
<td>[-.60 -.52]</td>
<td>-.05(.27)</td>
</tr>
</tbody>
</table>
Chapter 5

The role of status norms in the co-evolution of friendships and achievement

**Description of network characteristics and academic achievement.** In Table 5.3, a description of the network is provided. On average, adolescents had more than four best friends. The density in the network (outdegree) represents the general tendency of students to have friendship ties. It was relatively low, with 22% to 24% of friendship ties being present in relation to the total amount of friendship ties possible. Also, most friendships were reciprocated and adolescents tended to form triadic relationships. Girls scored significantly higher on academic achievement compared to boys. Friendships were sufficiently stable to conduct social network analyses (Jaccard Index varying from .51 to .56). The Moran’s I represents covariance of achievement in all friendship dyads, and this value was relatively low, in line with previous social network studies on achievement (Dieterich, 2015; Gremmen et al., 2017; Shin & Ryan, 2014). It was significant in 50 out of 70 classrooms across the three waves (as calculated with permutation tests; see also Kretschmer, Leszczensky, & Pink, 2018). Importantly, the fact that Moran’s I was not large or significant in all classrooms does fit in with what we expected to see in the data, as we mostly anticipated an autocorrelation between friends and achievement in classrooms where achievement is reputationally salient, and not necessarily in classrooms where achievement is unrelated to status.

Both friendship selection related to similarity in achievement and influence processes varied significantly across classrooms (selection: $p < .001$, and influence: $p = .049$). We included the four types of status norms (popularity, unpopularity, acceptance, and rejection norms) as moderators to explain this between-classroom variance in friendship selection and influence processes related to achievement.

**The role of status norms in the strength of friendship selection.** The unpopularity and popularity norm played a significant role in the extent to which friendship selection based on similarity in GPA took place [i.e., the strength of selection; $B = 1.56$, $SE = 0.67$, $p = .021$ for unpopularity norm and $B = 1.30$, $SE = 0.66$, $p = .049$ for the popularity norm]; see Table 5.4. In contrast, the other two types of status norms (i.e., the acceptance norm and the rejection norm) did not play a role in the strength of friendship selection processes.
Table 5.3
Description of the Sample, Network Characteristics, and Measures in all Classes (N=70)

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sample</strong></td>
<td>M(SD)</td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td>Average number of friends</td>
<td>4.66(1.21)</td>
<td>4.60(1.14)</td>
<td>4.20(1.10)</td>
</tr>
<tr>
<td>Cohesion in the friendship network</td>
<td>0.24(0.07)</td>
<td>0.24(0.07)</td>
<td>0.22(0.06)</td>
</tr>
<tr>
<td>Proportion reciprocated friendships</td>
<td>0.64(0.11)</td>
<td>0.62(0.11)</td>
<td>0.61(0.13)</td>
</tr>
<tr>
<td>Proportion triadic relationships</td>
<td>0.65(0.10)</td>
<td>0.63(0.11)</td>
<td>0.63(0.14)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Academic Achievement</strong></th>
<th>M(SD)</th>
<th>N</th>
<th>M(SD)</th>
<th>N</th>
<th>M(SD)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average boys</td>
<td>6.47(0.72)</td>
<td>789</td>
<td>6.59(0.82)</td>
<td>789</td>
<td>6.50(0.86)</td>
<td>789</td>
</tr>
<tr>
<td>Average girls</td>
<td>6.67(0.73)</td>
<td>760</td>
<td>6.72(0.84)</td>
<td>760</td>
<td>6.65(0.90)</td>
<td>760</td>
</tr>
<tr>
<td>Respondents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree similarity in</td>
<td>0.03(0.12)</td>
<td>0.03(0.16)</td>
<td>0.03(0.14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>friendship dyads</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friendship and Achievement Change</td>
<td></td>
<td>T1-T2</td>
<td></td>
<td>T2-T3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average number of friendship</td>
<td>59</td>
<td></td>
<td>63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>changes per classroom</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proportion stable friendships</td>
<td>0.56</td>
<td></td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction increasing actors in achievement</td>
<td>31.2%</td>
<td></td>
<td>38.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction decreasing actors in achievement</td>
<td>38.4%</td>
<td></td>
<td>30.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction constant actors in achievement</td>
<td>30.4%</td>
<td></td>
<td>31.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: T1-T3 = Wave 1 - Wave 3. Standard deviations placed between brackets; Density was calculated as N of ties divided by the total number of potential ties (N*(N-1)); Reciprocity was calculated as 2M/(2M+A), where M = mutual ties and A = asymmetric ties; Transitivity was calculated as N of transitive triplets divided by N of 2-paths (potentially transitive triplets); For more information on the calculation of the different network indices, see Veenstra and Steglich (2012). Average achievement for boys and girls, were compared and indicated with different superscripts.
| Table 5.4 | RSiena Meta-analyses of Network and Behavior Dynamics for Academic Achievement with Four Types of Status Norms as Moderators (Nclasses = 70; Nstudents = 1549) |

<table>
<thead>
<tr>
<th></th>
<th>Estimates</th>
<th>Effect of four types of status norms on variations between classrooms in</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B(SE)</td>
<td>OR</td>
</tr>
<tr>
<td>Structural Network Effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tendency to make friends (outdegree)</td>
<td>-2.67(0.12)** 0.07 [2.90 - 2.45]</td>
<td>-0.19(0.70)</td>
</tr>
<tr>
<td>Reciprocated friendships (reciprocity)</td>
<td>1.91(0.08)** 6.75 [1.76 - 2.07]</td>
<td>-0.51(0.42)</td>
</tr>
<tr>
<td>Transitive group formation (triplets)</td>
<td>0.48(0.02)** 1.62 [0.43 - 0.53]</td>
<td>-0.07(0.13)</td>
</tr>
<tr>
<td>Transitive reciprocated group formation</td>
<td>-0.18(0.03)** 0.84 [-0.23 - 0.13]</td>
<td>-0.04(0.16)</td>
</tr>
<tr>
<td>Cyclical group formation (3-cycles)</td>
<td>-0.07(0.02)** 0.93 [-0.12 - 0.02]</td>
<td>-0.04(0.15)</td>
</tr>
<tr>
<td>Outdegree friendship</td>
<td>-0.17(0.01)** 0.84 [-0.20 - 0.15]</td>
<td>0.06(0.06)</td>
</tr>
<tr>
<td>Outdegree activity</td>
<td>0.03(0.00)** 1.03 [0.02 - 0.04]</td>
<td>-0.01(0.03)</td>
</tr>
<tr>
<td>Isolates</td>
<td>0.69(0.07)** 1.99 [0.54 - 0.83]</td>
<td>-0.37(0.44)</td>
</tr>
<tr>
<td>Selection Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Same gender selection</td>
<td>0.55(0.05)** 1.72 [0.44 - 0.65]</td>
<td>0.65(0.28)* 0.38(0.29)</td>
</tr>
<tr>
<td>Effect of achievement on friendship nominations received (alter)</td>
<td>-0.01(0.01) 0.99 [-0.04 - 0.02]</td>
<td>-0.06(0.09)</td>
</tr>
<tr>
<td>Effect of achievement on friendship nominations given (ego)</td>
<td>-0.04(0.02) 0.96 [-0.06 - 0.00]</td>
<td>-0.05(0.11)</td>
</tr>
<tr>
<td>Similarity-based selection of friends in achievement</td>
<td>0.37(0.12)** 1.45 [0.15 - 0.60]</td>
<td>1.30(0.66)* 1.56(0.68)*</td>
</tr>
<tr>
<td>Influence Processes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement linear shape</td>
<td>0.01(0.02) 1.02 [-0.03 - 0.06]</td>
<td>0.15(0.14)</td>
</tr>
<tr>
<td>Achievement quadratic shape</td>
<td>-0.02(0.02) [-0.05 - 0.02]</td>
<td>0.06(0.10)</td>
</tr>
<tr>
<td>Effect of gender (1=boy) on achievement</td>
<td>0.00 (0.04) 1.00 [-0.08 - 0.08]</td>
<td>0.15(0.26)</td>
</tr>
<tr>
<td>Friendship influence on achievement</td>
<td>1.09(0.44)* 1.20 [0.23 - 1.95]</td>
<td>1.88(2.51)</td>
</tr>
</tbody>
</table>

Note. B = the unstandardized multi-nominal logit coefficient. OR = Odds Ratio. † p < .10; * p < .05; ** p < .01; *** p < .001. Due to convergence issues we had to fix the rate effect for numerical stability at 2.5 in all analyses, as well as the gender ego and gender alter effect. In about five classrooms, it was not possible to identify some parameters due to too-high standard errors; these classes were therefore excluded from the meta-analysis. This did not affect the interpretability of the results.
The role of status norms in the direction of friendship selection. We calculated ego-alter tables to test our hypotheses on the direction of friendship selection in classrooms where achievement is negatively salient (high unpopularity norms) and positively salient (high popularity norms). Values in ego-alter tables can be transformed to odds by taking the exponential function. In high unpopularity norm classrooms (i.e., classrooms with a high correlation between academic achievement and unpopularity; Table 5.5, upper part), low-achieving students selected each other based on similarity, whereas high-achieving adolescents were likely to avoid each other as friends. This is indicated by the decrease in strength of effects across the diagonal, running from .36 to -.28, and this difference in log odds was significant \( z = 1.97; p = .049 \). In classrooms with high popularity norms (Table 5.5, lower part), the ego-alter table indicates that high-achieving adolescents were somewhat more likely to select each other as friends based on similarity in achievement than low-achieving adolescents, evidenced by the slight increase of effects across the diagonal (.02 to .13). However, this increase was not significant \( z = .84, p = .40 \).

Next, both in high popularity norm classrooms and in high unpopularity norm classrooms, off-diagonal numbers of ego-alter tables indicate that the tendency of low-achieving adolescents to avoid high-achieving peers as friends was not significantly stronger than vice versa (-.41 versus -.37; \( z = .40, p = .69 \) and -.35 versus -.07; \( z = .80, p = .42 \)).

We included ego-alter tables of low popularity norm classrooms and low unpopularity norm classrooms in supplementary materials (Appendix A) to illustrate patterns of selection processes in these classrooms. There were no significant differences in the direction of selection processes within these classrooms (z-scores available upon request); hence differences were not evident across all values in these tables.

The role of status norms in the strength and direction of friendship influence. In contrast to our hypotheses, status norms did not play a role in the extent to which friends became similar to each other in achievement over time (i.e., influence processes). Due to non-significant selection effects in high and low status norm classrooms, it was not useful to gain insights in the direction of influence processes (higher versus lower achievement) by means of ego-alter influence tables.
**Chapter 5**

**Supplemental analyses.** We performed supplemental analyses (available upon request) to investigate whether there were gender differences in (the role of status norms in) friendship processes, but this was not the case. Also, educational level was initially included as control variable, but it did not affect friendship processes. Therefore, we presented the most parsimonious model without educational level.

**DISCUSSION**

We tested the reputational salience hypothesis (Hartup, 1996) in a context-specific way, by examining whether the class-level relationship between academic achievement and four types of peer status (i.e., popularity, unpopularity, acceptance, and rejection), so called status norms, could explain differences between classrooms in friendship selection and influence processes with regard to academic achievement. In general, adolescents chose their friends based on similar levels of achievement and were influenced by their friends in academic achievement. Importantly, unpopularity and popularity norms within the classroom explained differences in strength and direction of friendship selection processes (but not of influence processes) for academic achievement, whereas acceptance and rejection norms did not. More specifically, in classrooms where popular peers were high on academic achievement, both high- and low-achieving adolescents were most likely to select each other based on similarity in achievement. At the same time, in classrooms where unpopular peers were high on academic achievement, low-achieving adolescents selected friends based on similarity in achievement and high-achieving adolescents avoided similarly-achieving peers as friends. Hence, both popularity norms and unpopularity norms appear to strengthen a ‘friendship selection bias’ within the classroom, in that similar (low-achieving) peers mainly affiliate with each other. This may have important consequences for adolescent academic development. For instance, it may limit opportunities for low-achieving adolescents to learn from their higher achieving peers; or vice versa, as adolescents may also learn from peer tutoring experiences that are most likely to occur when high-achievers explaining academic topics to low-achievers (Gest et al., 2008). As we found that friendship influence processes occur in every classroom, this friendship selection bias may result in a process where similarly low-achieving friends influence each other towards even lower levels of achievement, particularly in high unpopularity norm classrooms. This may negatively impact their academic development over time.
The role of academic status norms in friendship selection processes

The finding that unpopularity and popularity norms strengthened friendship selection processes based on similarity in achievement was in line with our hypotheses. Hence, adolescents’ preference for similarly achieving friends was strongest in classrooms where achievement was a salient and important characteristic due to its associations with popularity or unpopularity (reputational salience hypothesis; Hartup, 1996).

Remarkably, unpopularity norms played a role in the direction of friendship processes, whereas popularity norms did not. That is, in classrooms with high unpopularity norms, low-achieving adolescents selected friends based on similarity, but high-achieving adolescents did not; while in classrooms with high popularity norms, similarity-based friendship selection processes were equally strong among low-achieving and high-achieving adolescents. This latter finding was somewhat in contrast to our hypothesis; we expected that similarity-based selection would mainly take place among high-achieving students. A potential explanation for this finding is that in high popularity norm classrooms, high-achieving students chose each other based on preferential attraction, whereas low-achieving students were ‘stuck with what they could get’ (i.e., default selection, as found in a study on aggression; Sijtsema et al., 2009). Importantly, this ‘default selection’ did not occur among high-achievers in classrooms with high unpopularity norms. Instead, high-achieving peers were avoided as potential friendship partners, even by other high-achieving peers. This may indicate that adolescents’ tendency to avoid unpopularity is stronger than the desire to obtain popularity (Brechwald & Prinstein, 2011; Hopmeyer Gorman et al., 2011). Maybe the consequences to select each other based on similarity in low achievement are less severe in high popularity norm classrooms (missing an opportunity to become more popular), than the consequences of selecting each other based on similarity in high achievement in high unpopularity norm classrooms (risking unpopularity; Hopmeyer Gorman et al., 2011).
### Table 5.5

_Ego-alter Selection Table for Academic Achievement in Classrooms with High Unpopularity Norms (N = 7) and High Popularity Norms (N = 7)_

<table>
<thead>
<tr>
<th>Students’ achievement</th>
<th>Peers’ achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>High unpopularity norm classrooms</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.36</td>
</tr>
<tr>
<td>2</td>
<td>0.24</td>
</tr>
<tr>
<td>3</td>
<td>0.11</td>
</tr>
<tr>
<td>4</td>
<td>-0.02</td>
</tr>
<tr>
<td>5</td>
<td>-0.15</td>
</tr>
<tr>
<td>6</td>
<td>-0.28</td>
</tr>
<tr>
<td>7</td>
<td>-0.41</td>
</tr>
<tr>
<td>High popularity norm classrooms</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.02</td>
</tr>
<tr>
<td>2</td>
<td>-0.04</td>
</tr>
<tr>
<td>3</td>
<td>-0.10</td>
</tr>
<tr>
<td>4</td>
<td>-0.17</td>
</tr>
<tr>
<td>5</td>
<td>-0.23</td>
</tr>
<tr>
<td>6</td>
<td>-0.29</td>
</tr>
<tr>
<td>7</td>
<td>-0.35</td>
</tr>
</tbody>
</table>

Note. Numbers in the table reflect the strength of attraction for students to become friends with certain peers based on their levels of academic achievement (columns dependent on rows). The values in the cells can be transformed to odds by taking the exponential function (\(\exp(\beta)\)). Numbers 1 to 7 reflect to different GPA categories: 1 = GPA \(\leq 5.49\); 2 = 5.50 \(\leq\) GPA \(\leq 5.99\); 3 = 6.00 \(\leq\) GPA \(\leq 6.49\); 4 = 6.50 \(\leq\) GPA \(\leq 6.99\); 5 = 7.00 \(\leq\) GPA \(\leq 7.49\); 6 = 7.50 \(\leq\) GPA \(\leq 7.99\); 7 = GPA \(\geq 8.00\). N= 6 for high popularity norm classrooms as one classroom did not converge properly.
Whereas popularity norms and unpopularity norms played a role in similarity-based friendship processes, both types of status norms seemed to be not powerful enough to encourage bonds among friends who are dissimilar in achievement. We found that, irrespective of the (un)popularity norm, high-achieving students avoided low-achieving peers as friends and low-achieving students avoided high-achieving peers as friends. This was in contrast to our hypothesis, as we expected that adolescents would have a preference for friends that show reputationally salient characteristics (Lindenberg, 2001), for instance to avoid low peer status (Brechwald & Prinstein, 2011) or to bask in reflected glory (Dijkstra et al., 2010). One explanation for this finding is that it may be more important for adolescents to be – to a certain extent – similar to their friends, than to achieve a higher peer status by selecting highly dissimilar peers as friends (i.e., to bask in reflected glory; Dijkstra et al., 2010). That is, high-achieving and low-achieving students often differ largely in the values, aspirations, academic behaviors and principles that they endorse (Ryan, 2001). Therefore, they may be less attracted to each other as a friend (similarity attraction hypothesis; Byrne, 1971), irrespective of the status norm in the classroom.

Next, acceptance and rejection norms did not play a role in the strength and direction of friendship in selection processes in classrooms. This finding might be explained as follows: Even though the original concept of status norms focused on peer acceptance and rejection (Henry et al., 2000), reputation-based constructs such as popularity and unpopularity might be a stronger social reward or social sanction to adolescents. Previous studies indicated that adolescents prioritize popularity over other social and relational domains (LaFontana & Cillessen, 2010), and that they might especially fear unpopularity as a social sanction as this increases their risk of social exclusion and victimization (Brechwald & Prinstein, 2011; Hopmeyer Gorman et al., 2011). Also, the norm of (un)popular peers might be more evident and clear within the classroom. That is, conceptually, popularity and unpopularity are reputation-based constructs, reflecting a certain consensus on which youth achieved power, visibility and prestige within the peer group. In contrast, acceptance and rejection are preference-based constructs reflecting students’ personal appraisals of their interactions with individual peers (Adler et al., 1992; Cillessen & Marks, 2011). Therefore, these preference-based constructs may be more variable on the group level (Hopmeyer Gorman et al., 2011),
and present a less clear norm within the classroom that may be less informative for friendship processes.

**The role of academic status norms in friendship influence processes**

In contrast to our expectations, none of the status norms played a role in the strength and direction of friendship influence processes regarding academic achievement. In other words, we found that friends influenced each other over time in academic achievement, irrespective of the extent to which achievement was related to social sanctions or social rewards. Whereas previous studies found that popularity norms strengthened friendship processes around aggression (Laninga-Wijnen et al., 2017) and risk attitudes (Rambaran et al., 2013), we found that this role of popularity norms (or any other type of status norms) could not be generalized to academic achievement. This may indicate that there is a potential ‘limit’ to the power of high-status peers: their norms may affect friendship influence related to deviant social behaviors or attitudes, but not friendship influence related to academic achievement. There are several possible explanations for this finding.

First of all, academic achievement is not a social behavior that is directed to others, but rather an individual behavior that serves individual goals and aspirations (Ryan & Deci, 2000). Therefore, academic achievement may be a less visible characteristic, and a less strong strategy to gain a higher status in the peer group. Moreover, parents may exert more influence on their child’s academic achievement than on their child’s social behaviors in the classroom, which may be at the cost of the role of (high-status or low-status) peers in achievement (Im, Hughes, & West, 2016). For instance, parents can be highly involved with their children’s academic development, by monitoring school activities, helping them with their homework or by encouraging them to take extra classes. This may affect adolescents’ achievement over time, irrespective of what kind of classroom these children are in (Marion, Laursen, Kiuru, Nurmi, & Salmela-Aro, 2014). Future studies are encouraged to further examine potential buffering effects of parents on the role of peers in academic achievement.

Second, as adolescents *did* become similar to their friends over time, friends can also be seen as important socializers of adolescent academic achievement, irrespective of the status norm in the classroom. Previous studies indicated that adolescents often fulfill their academic tasks in the presence of their friends (Rizzuto, LeDoux, & Hatala, 2009). For instance, adolescents may be especially inclined to make homework, exchange information, and
collaborate on assignments with their friends. Also, friendship influence on achievement might (partly) occur outside the classroom context, for instance at home (Geven, Weesie, & Van Tubergen, 2013). These quite intensively shared experiences among friends, partly outside the classroom context, may result in more similarity between friends in achievement over time, irrespective of status norms within the classroom.

Third, status norms related to objective achievement may not be the strongest indicator of the importance of achievement in the broader peer context, as it may go together with diverging motivational processes or academic endeavors that may have distinct implications for friendship processes. For instance, adolescents may strive for high achievement in order to develop competence (i.e., mastery goal) or in order to outperform others (i.e., performance goal; Poortvliet & Daron, 2010). A previous study indicated that when mastery goals were associated with popularity, there were strong friendship influence processes related to peer-perceived achievement, whereas this was not the case when performance goals were associated with popularity (Laninga-Wijnen et al., 2018). Hence, it might be that the underlying motive why high-status students obtain high grades is more important for friendship processes than the obtained grade itself.

**Strengths, limitations and future directions**

Our study has several strengths. First, our study is strongly theoretically driven by the reputational salience hypothesis (Hartup, 1996) and we are the first to test the importance of status norms regarding friendship processes in academic achievement. Our study indicates that academic achievement is made salient within the classroom by virtue of its associations with social status, but only with regard to selection processes and not influence processes. Besides the fact that our findings on selection processes are generally in line with the reputational salience hypothesis, these might also add new information. Originally, the reputational salience hypothesis (Hartup, 1996) is mainly about the general reputational salience of a certain attribute and does not go into potential contextual variations in this reputational salience. However, our study indicates that the salience of an attribute might vary across different settings (i.e., classrooms) and, in turn, can explain differences in friendship processes between these classrooms. Hence, these found variations in attributes’ reputational salience across different peer contexts (such as the classroom) may present an important addition to the reputational salience hypothesis as formulated by Hartup (1996).
Second, we used a broader concept of status norms compared to previous studies by not only examining the association between achievement and social rewards, that is, popularity and peer acceptance, but also by its relation with social sanctions, that is, unpopularity and peer rejection. As we found an effect for both the popularity and the unpopularity norm on friendship selection processes, this seems a fruitful way for future studies to examine status norms. Apparently, approaching status norms by only examining the social rewards may result in overlooking another – potentially more important - process that might occur as well: avoiding social sanctions (Brechwald & Prinstein, 2011).

Third, we used actual grades of students (instead of for instance academic reputation among peers; Gest et al., 2008), which can be seen as a strong point for several reasons. Most previous social network studies used objective achievement as an attribute, and our aim is to extend upon those studies by examining whether status norms may explain why these previous studies found some inconsistencies. Moreover, particularly for friendship influence processes it is important to examine whether friends may influence each other’s’ actual grade and not the perception of someone’s’ academic functioning. That is, when adolescents hang out with high-achieving peers, it might be that other peers perceive those adolescents also as academically competent, even when this is not the case. Instead, actual academic achievement is a relatively objective measure of students’ academic functioning as they are provided by different teachers, on different courses (multiple informants). Moreover, actual grades determine whether a student passes a class, and influences further educational and occupational opportunities (Crosnoe & Benner, 2015).

However, our study should also be viewed in light of its limitations. First, we included evaluation effects for selection processes, which encompass both the selection (creation) and maintenance (endowment) of friendships based on similarity (or dissolution based on dissimilarity; Ripley et al., 2018), due to convergence issues. As previous studies indicated that maintenance related to achievement occurs as well (Rambaran et al., 2016; Laninga-Wijnen et al., 2018), and that norms may play a distinct role in friendship selection and friendship maintenance (Laninga-Wijnen et al., 2017), we encourage future studies to try to disentangle these two processes.

Second, we only examined friendship selection and influence processes related to a general average grade on six academic subjects. It might also be interesting to examine subject-
Academic status norms in selection and influence processes

specific status norms and friendship processes related to a particular subject. However, all six subjects were negatively linked with popularity and rejection, and positively or neutrally with peer acceptance and unpopularity. Therefore, all school subjects contributed equally to our construct of academic status norms and therefore may play a similar role in friendship selection and influence processes.

Third, as explained in the introduction, we assessed ‘perceived friendship’ rather than friendship in the current study. However, we do control for reciprocity and by asking adolescents about their ‘best friends’ we hope to capture a certain quality of a friendship. Moreover, a previous study indicated that reciprocal best friendships and asymmetric best friendships did not differ with regard to perceived friendship quality (Bowker, 2004). Nevertheless, future studies may profit from taking into account the quality of friendships in explaining the mechanisms by which adolescents become similar to their friends in achievement, for instance by examining ordered networks (Elmer, Boda, & Staitveld, 2017).

Implications

Our study provides insight in the importance of (un)popularity norms for the strength and direction of friendship selection processes. Future studies are encouraged to pay attention to potential implications of these findings. For instance, future studies may examine how the friendship selection bias that is triggered by high popularity and unpopularity norms may influence the (academic) development of both low- and high-achieving students. For instance, when low-achieving adolescents mainly select similarly low-achieving students as friends, this may dampen their academic development over time. Future studies are encouraged to examine not only whether this is the case, but also whether such a situation can be prevented by investigating which factors may contribute to the emergence and development of academic (un)popularity norms. This will enable us to understand why in certain classrooms academic achievement is a valuable characteristic (due to its associations with high status), whereas in other classrooms it is not. Also, it may be an exciting avenue for future studies to investigate which factors (e.g., parents, teachers) may buffer the role of high unpopularity norms. These promising avenues for future studies may provide insights in which factors may predict the value that adolescents attach to their achievement, which may promote their educational and work-related success in later life.
Chapter 5

APPENDIX

Full set of items included:

GPA (Grade point average on three report cards)
Friendship (“Who are your best friends in class”)
Popularity (“Who is popular”)
Unpopularity (“Who is least popular”)
Rejection (“Who do you not like at all”)
Acceptance (“Who do you like”)
Gender
### Table A

**Ego-alter Selection Table for Academic Achievement in Classes with Low Popularity and Unpopularity Norms**

<table>
<thead>
<tr>
<th>Students' achievement</th>
<th>Peers' achievement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low unpopularity norm classrooms</td>
<td></td>
<td>-0.08</td>
<td>0.05</td>
<td>0.01</td>
<td>-0.03</td>
<td>-0.06</td>
<td>-0.10</td>
<td>-0.13</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.03</td>
<td>0.07</td>
<td>0.04</td>
<td>0.00</td>
<td>-0.03</td>
<td>-0.07</td>
<td>-0.11</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>-0.02</td>
<td>0.02</td>
<td>0.07</td>
<td>0.03</td>
<td>-0.01</td>
<td>-0.04</td>
<td>-0.08</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>-0.08</td>
<td>-0.03</td>
<td>0.01</td>
<td>0.06</td>
<td>0.02</td>
<td>0.01</td>
<td>-0.05</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>-0.13</td>
<td>-0.09</td>
<td>-0.04</td>
<td>0.01</td>
<td>0.05</td>
<td>0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>-0.18</td>
<td>-0.14</td>
<td>-0.09</td>
<td>-0.05</td>
<td>0.00</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>-0.24</td>
<td>-0.19</td>
<td>-0.15</td>
<td>-0.11</td>
<td>-0.05</td>
<td>-0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Low popularity norm classrooms</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>0.11</td>
<td>0.05</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.24</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0.08</td>
<td>0.09</td>
<td>0.03</td>
<td>-0.03</td>
<td>-0.09</td>
<td>-0.14</td>
<td>-0.20</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>0.04</td>
<td>0.06</td>
<td>0.07</td>
<td>0.01</td>
<td>-0.05</td>
<td>-0.10</td>
<td>-0.16</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>0.01</td>
<td>0.02</td>
<td>0.04</td>
<td>0.05</td>
<td>-0.01</td>
<td>-0.07</td>
<td>-0.12</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.00</td>
<td>0.02</td>
<td>0.03</td>
<td>-0.03</td>
<td>-0.09</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>-0.05</td>
<td>-0.04</td>
<td>-0.03</td>
<td>-0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>-0.05</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>-0.08</td>
<td>-0.07</td>
<td>-0.07</td>
<td>-0.05</td>
<td>-0.03</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

Note. Numbers in the table reflect the strength of attraction for students to become friends with certain peers based on their levels of academic achievement (columns dependent on rows). The values in the cells in these tables can be transformed to odds by taking the exponential function (exp(θ)). Numbers 1 to 7 reflect to different GPA categories: 1 = GPA ≤ 5.49; 2 = 5.50 ≤ GPA ≤ 5.99; 3 = 6.00 ≤ GPA ≤ 6.49; 4 = 6.50 ≤ GPA ≤ 6.99; 5 = 7.00 ≤ GPA ≤ 7.49; 6 = 7.50 ≤ GPA ≤ 7.99; 7 = GPA ≥ 8.00.
Adolescents’ friendships, academic achievement, and risk behaviors: Same-behavior and cross-behavior selection and influence processes*

* This chapter is published in *Child Development*.

Chapter 6

Abstract
This study examined to what extent adolescents’ and their friends’ risk behaviors (i.e., delinquency and alcohol use) hinder or promote their academic achievement (GPA), and vice versa. Longitudinal data were used ($N=1219$ seventh-ninth grade adolescents; $M_{age}=13.69$). Results showed that risk behaviors negatively affected adolescents’ GPA, whereas GPA protected against engaging in risk behaviors. Moreover, adolescents tended to select friends who have similar behaviors and friends’ behaviors became more similar over time (same-behavior selection and influence). Furthermore, although same-behavior effects seemed to dominate, evidence was found for some cross-behavior selection effects and a tendency in seventh grade for cross-behavior influence effects. Concluding, it is important to investigate the interplay between different behaviors with longitudinal social network analysis.

Keywords: academic achievement; alcohol use; delinquency; early adolescence; RSiena
It is well-documented that academic motivation and academic achievement tend to decline in adolescence (Crosnoe & Benner, 2015; Eccles, 2004; Shin & Ryan, 2014). Simultaneously, adolescence is a sensitive period for the initiation of risk behaviors, such as delinquency and substance use (Steinberg, 2007). Academic achievement and risk behaviors do not develop independently, and previous studies have found a negative association between these behaviors (Hinshaw, 1992; Maguin & Loeber, 1996; McEvoy & Welker, 2000). Adolescents’ educational success is found to be an important buffer for involvement in delinquency (Maguin & Loeber, 1996), and academic remediation trainings have been shown to reduce risk behavior (Patterson, DeBaryshe, & Ramsey, 1990). Risk-behaving students often show academic failure, as they display more off-task behavior in school and have more difficulties completing homework assignments (Jeynes, 2002; Patterson et al., 1990). Adolescents’ friendships can be a potential explanation linking their academic achievement and engagement in risk behaviors.

Establishing friendships is important in adolescence and adolescents spend more time with peers in this period than in any other time in the life course (Allen, Weissberg, & Hawkins, 1989; Witkow & Fuligni, 2010). An increasing body of research using social network analyses focuses on the influencing role of friends in adolescents’ behaviors, showing that they exert powerful influences on adolescents’ social development, by shaping their behaviors, including academic achievement and risk behaviors (Brechwald & Prinstein, 2011; Veenstra, Dijkstra, & Kreager, 2018). At the same time, selection processes can explain similarity of friends’ behaviors, referring to mechanisms by which individuals select peers as friends who are similar to themselves in specific behaviors or attitudes. Selecting similar others as friends (homophily, Lazarsfeld & Merton, 1954) generally makes relationships more rewarding, stable, and with less conflict as similar peers understand each other better, communicate in an easier way, and find each other more trustworthy and predictable (Hallinan, 1980; McPherson, Smith-Lovin, & Cook, 2001; Veenstra, Dijkstra, Steglich, & Van Zalk, 2013).

With a few notable exceptions, almost all prior research on the role of peers has solely focused on peer selection and influence in one type of behavior (same-behavior processes). Same-behavior selection and influence processes refer to studying one behavior in isolation from other behaviors. Such research examines whether an individual selects friends based on the same behavior and whether an individual’s behavior is predicted by the same behavior of friends. However, such a narrow focus might not be sufficient to capture the dynamic and
interwoven nature among friends and their attributes. Friendship selection and influence processes may also be guided by cross-behavior processes, in which individuals choose friends based on the combination with another type of behavior and friends’ behavior influences another behavior in the individual (Brechwald & Prinstein, 2011). Only one study has explicitly tapped into cross-behavior influence processes and showed that friends’ depressive symptoms and friends’ impulsivity predicted changes in adolescents’ nonsuicidal self-injury behaviors (Giletta, Burk, Scholte, Engels, & Prinstein, 2013).

As there is a clear link between the two behaviors (i.e., academic achievement and risk behaviors), we aim to gain more insights in the causes and consequences of these behaviors, by studying the interplay between adolescents’ and their friends’ academic achievement and risk behaviors. In this study we contribute to current research by examining both same-behavior and cross-behavior selection and influence processes in adolescence, for academic achievement and risk behaviors (i.e., delinquency and alcohol use). The main research questions related to cross-behavior selection processes are: To what extent does adolescents’ academic achievement affect friendship selection based on peers’ risk behaviors? And to what extent do adolescents’ risk behaviors affect friendship selection based on peers’ academic achievement? The main research questions related to cross-behavior influence processes are: To what extent do risk behaviors of friends hinder or promote adolescents’ academic achievement? And to what extent does friends’ academic achievement lead to adolescents’ risk behaviors?

THEORETICAL BACKGROUND

Same-Behavior Selection and Influence. It is not surprising that peers and friends play a role in adolescents’ development, as adolescents spend a large part of their time in the company of peers (Brown, Eicher, & Petrie, 1986). Especially after the transition from elementary to secondary school, having friends and being with them is an important aspect of school life for most adolescents (Haynie, 2001). Finding a position within larger peer networks is important for adolescents, resulting in susceptibility for peer influence in these transition years (Altermatt & Pomerantz, 2003). Friends can provide social, emotional, as well as academic support, and often act as role models by setting norms for specific behaviors (Eccles et al., 1993; Lynch, Lerner, & Leventhal, 2013; Rodkin & Ryan, 2012). This includes encouraging or discouraging specific behaviors, such as academic achievement (Gremmen, Dijkstra, Steglich, & Veenstra,
Same- and cross-behavior selection and influence processes

2017). Friends can supply an adolescent with the motivation and attitudes to support specific behaviors, such as risk behaviors or pro-school behaviors. This is related to the social learning theory (Bandura, 1977), which holds that students both learn specific behaviors through observing and imitating peers and through receiving social rewards or sanctions (reinforcement).

Although academic achievement in adolescence is important for future chances and opportunities, adolescence is often associated with a downward trend in academic achievement, indicated by more academic failure and school dropout than in earlier years (Crosnoe & Benner, 2015; Eccles et al., 1993; Shin & Ryan, 2014). Friendship selection and influence processes have been found in previous studies to explain students’ academic achievement (Flashman, 2012; Gremmen et al., 2017; Rambaran et al., 2017; Shin & Ryan, 2014). These studies have indicated that adolescents’ academic achievement functioned as a sorting mechanism for friendships as well as that friends became more similar over time with regard to academic achievement.

Also, friends may pull adolescents toward risk behaviors. Delinquent behaviors and experimentation with alcohol are salient risk factors in early adolescence and considered normative (Franken et al., 2015; Moffitt, 1993). Risk-behaving adolescents get rewarded by their peers in this time period by obtaining a high social status (Franken, Harakeh, Veenstra, Vollebergh, & Dijkstra, 2016). As risk behaviors develop in the peer context, it is important to examine the role of friends in these behaviors (Dodge, Coie, & Lynam, 2008; Osgood, Feinberg, & Ragan, 2015). Indeed, previous studies have found friendship selection and influence effects on adolescents’ alcohol use and delinquency (Burk, van der Vorst, Kerr, & Stattin, 2012; Kiuru, Burk, Laursen, Salmela-Aro, & Nurmi, 2010; Osgood et al., 2015; Steglich, Snijders, & West, 2006). These results indicate that students often select friends based on similarity in risk behaviors as well as become more similar to each other over time.

**Cross-Behavior Selection and Influence.** To understand the negative interplay between adolescents’ academic achievement and risk behaviors, we examine whether the negative association between these behaviors can be explained by friendship selection and influence processes. We align with a relational developmental perspective that highlights the interplay between individual characteristics and the context in affecting development over time (Crosnoe & Benner, 2015; Lerner & Schmid Callina, 2013). Although, in principle, all social
network studies exemplify this perspective, only considering one behavior limits the vision of a relational developmental system perspective, which advocates looking at different behaviors simultaneously. Hence, our study takes a step forward by considering the examination of cross-behavior effects.

We use the “maturity gap” as theoretical starting point for understanding how academic achievement and risk behaviors are related to each other. Adolescents become more vulnerable to engagement in risk behaviors. One explanation is that in Western societies there is often a discrepancy between physical status (i.e., pubertal maturation) and social status (i.e., being acknowledged as mature, for instance by having autonomy in decision making and access to adult privileges), the so-called maturity gap (Dijkstra et al., 2015; Moffitt, 1993). By engaging in risk behaviors, youth try to assert their independence emphasizing their maturity. Risk-behaving adolescents challenge adult rules and parental authority to get a sense of autonomy (Sentse, Dijkstra, Lindenberg, Ormel, & Veenstra, 2010).

Independence can, however, also be asserted by decreasing efforts in school, as low academic achievement also represents a rebellious reaction against the adult norm to achieve well in school. Hence, in adolescence academic achievement represents adult-approved behavior, which is at odds with risk behavior, reflecting more peer-approved behaviors (Hill & Tyson, 2009; Wallace & Fisher, 2007). In support of this, achieving well in school does indeed not go well together with engaging in risk behaviors as a negative association has been found concurrently and over time between individual adolescents’ academic achievement and their risk behaviors (Hinshaw, 1992; McEvoy & Welker, 2000). Moreover, academic achievement generally becomes less positively and risk behaviors more positively associated with social status in the peer group (McEvoy & Welker, 2000).

However, the extent to which adolescents experience the maturity gap differs depending on the timing of biological maturation and adolescents’ social mature status (Moffitt, 1993). As a consequence, some adolescents might be more inclined to engage in risk behaviors and have a low academic achievement, whereas other adolescents comply more with adult-approved behaviors (Allen, Porter, McFarland, Marsh, & McElhaney, 2005). With regard to friendship selection, risk behaviors and academic achievement might form a defining feature in the formation of friendship groups by affecting adolescents’ attraction to and avoidance of certain peers. That is, whether or not adolescents experience the maturity gap affects with
whom adolescents prefer to hang out with. Risk-behaving adolescents might prefer peers as friends who also react against adult norms, and share the same values and frustrations, resulting from the maturity gap. In that sense, it is likely that risk-behaving adolescents are more inclined to select low-achieving peers as friends, whereas adolescents who do not engage in risk behaviors might be more likely to befriend high-achieving adolescents. Friendship selection may also function the other way around, with low-achieving adolescents being more inclined to befriend risk-behaving peers, whereas high-achieving adolescents might be more likely to choose peers as friends who do not engage in risk behaviors.

With regard to influence processes, susceptibility to peer behaviors across behaviors might also be driven by experiencing the maturity gap. That is, adolescents who feel trapped in the maturity gap might be more susceptible to peer behaviors that reflect opposing against adult norms; favoring risk behaviors and rejecting academic achievement. As such, different behaviors might constitute a subculture with clear norms either approving or disapproving behaviors. As adolescents generally have a need for social approval (and the avoidance of social rejection) by peers, they adjust their behaviors to that of their friends to be appreciated by those peers they value and feel most positively about (Brechwald & Prinstein, 2011; Hallinan, 1980). This search for approval by means of meeting peers’ approved behaviors might affect different, sometimes incompatible, behaviors. Adolescents might be influenced by the norms for engaging in adult-approved behaviors (i.e., high academic achievement and no engagement in risk behaviors) or peer-approved behaviors (i.e., low academic achievement and engagement in risk-behaviors).

Moreover, friends also provide opportunities for risk behaviors (Osgood et al., 2015). Spending time with peers and engagement in these behaviors might allocate time away from academic-oriented behaviors, such as doing homework. In reverse, having friends who are focused on academic achievement might protect against risk behaviors as their time spending pattern leaves less room for risk behaviors. Thus, risk behaviors of friends might negatively affect adolescents’ academic achievement, whereas, in reverse, academic achievement of peers might protect against involvement in risk behaviors.
Chapter 6

PRESENT STUDY

We examine the interplay between adolescents’ and their friends’ alcohol use, delinquency, and academic achievement, by focusing on both same-behavior and cross-behavior selection and influence processes using a social network approach. We expect that friends influence adolescents’ academic achievement and risk behaviors both directly (same-behavior processes) and indirectly (cross-behavior processes). As the generative processes responsible for this association can come about in two ways, we are interested in the role of adolescents’ and their friends’ risk behaviors in their academic achievement as well as the role of adolescents’ and their friends’ academic achievement in their engagement in risk behaviors.

We hypothesize that adolescents select similar-achieving peers as friends (same-behavior academic selection hypothesis) and select friends based on similarity in risk behaviors (same-behavior risk selection hypothesis). Moreover, we expect that low-achieving adolescents are more likely to select friends who engage in risk behaviors whereas high-achieving adolescents are more likely to select friends who do not engage in risk behaviors (cross-behavior academic ego by risk alter selection hypothesis). Furthermore, we hypothesize that adolescents with no engagement in risk behaviors are more inclined to select high-achieving peers as friends, whereas adolescents who engage in risk behaviors are more likely to select low-achieving peers as friends (cross-behavior risk ego by academic alter selection hypothesis).

With regard to influence, we hypothesize that adolescents become more similar with regard to academic achievement to their friends (same-behavior academic influence hypothesis) and more similar in risk behaviors to their friends (same-behavior risk influence hypothesis). Additionally, we expect cross-behavior socialization effects, in such a way that friends’ risk behaviors predict adolescents’ academic achievement over time, with friends having high scores on risk behaviors discouraging academic achievement (decreases over time) and those having low scores on risk behaviors promoting academic achievement (increases over time) (cross-behavior risk influence hypothesis). Similarly, we hypothesize that friends’ academic achievement predicts adolescents’ risk behaviors over time, with high-achieving friends discouraging risk behaviors and low-achieving friends promoting risk behaviors (cross-behavior academic influence hypothesis).

We test our hypotheses with SNARE data for seventh, eighth, and ninth graders’ academic achievement, alcohol use, and delinquency, allowing to assess potential differences
between school years. This is particularly relevant in view of the increase of risk behaviors in early adolescence. Partially the same data (the same eighth grade students) has been used to test developmental differences between school years in selection and influence processes with regard to average and cluster-specific academic achievement (Gremmen et al., 2017). Other studies with SNARE data used different subsamples to study the role of parents (Dijkstra et al., 2015), status (Franken, Harakeh, Veenstra, Vollebergh, & Dijkstra, 2017), self-control (Franken, Moffitt, et al., 2016), and biological maturation (Franken, Prinstein, et al., 2016) in friendship and externalizing behavior dynamics.

We apply stochastic actor-based modelling (RSiena) to unravel same-behavior and cross-behavior selection and influence processes for academic achievement and risk behaviors (i.e., alcohol use and delinquency). RSiena makes it possible to disentangle selection from influence processes by examining changes in relationships and behaviors simultaneously as well as cross-selection and cross-influences of different behaviors (Giletta et al., 2013; Ripley, Snijders, Boda, Vörös, & Preciado, 2016; Snijders, Van de Bunt, & Steglich, 2010; Steglich, Snijders, & Pearson, 2010).

**METHOD**

**PARTICIPANTS AND PROCEDURE**

This study used a subsample from the larger longitudinal project SNARE (Social Network Analysis of Risk behavior in Early adolescence), that focuses on early adolescents’ social development and specifically on their involvement in risk behaviors (Dijkstra et al., 2015; Franken et al., 2016). Two secondary schools in rural areas participated, one in the middle (one location) and one in the north of the Netherlands (with four distinct locations). In 2011-2012, all first- and second-year students from these secondary schools received an information letter for themselves and their parents, in which they were asked to participate. A school year later (2012-2013), all new first year students were also approached for participation in the study.

If students or their parents wished to refrain from participation, they were requested to send a reply card or email within ten days. This consent procedure is in accordance with the Dutch law and has been used in previous studies (Osgood et al., 2013; Shin & Ryan, 2014). Moreover, during the assessments (in October, December, and April of each school year), it was emphasized that participation was confidential and could be terminated at any moment.
The study was approved by the Institutional Review Board (IRB) of one of the participating universities. Of the approached 1826 students for the SNARE study, 1786 students were willing to participate (Mage Time 1 = 12.91 years, SD = 0.70, 50.1% boys, 83.9% Dutch).

Every assessment took place during regular lessons within approximately 45 minutes and started with a brief introduction by research assistants. Subsequently, students filled in the questionnaire on individual computers, including both self-reports and peer nominations. Using ‘Cloud Solutions Socio Software’ (www.sociometric-study.com), particularly developed for the SNARE study, students were able to answer peer nomination questions easily by looking up and selecting their class- or grademates’ names from a database. If possible, absent students filled in the questionnaire within a month after the assessment.

The present study included all seventh graders (first year students in secondary education), eighth graders (second year students), and ninth graders (third year students) in the four northern locations in 2012-2013, with three waves per school year. In the seventh grade, there were 19 classrooms (Time 1; N=390, M age = 12.64, 48.2% boys, 97.7% of the participants was born in the Netherlands, 95.9% of their fathers, and 96.2% of their mothers). In the eighth grade, there were as well 19 classrooms (Time 1; N=418, M age = 13.64, 50.0% boys, 98.7% of the participants was born in the Netherlands, 96.8% of their fathers, and 96.5% of their mothers). In the ninth grade, there were 21 classrooms (Time 1; N=411, M age = 14.75, 49.6% boys; 98.6% of the participants was born in the Netherlands, 96.1% of their fathers, and 97.2% of their mothers). Grade level networks were created per wave per school year. See Appendix for more specific information on the number of students per wave and the missing data due to attrition and dropout. Based on the available information, students had on average less than two classmates in secondary school who attended the same elementary school. Hence, the vast majority of students enter a new peer context when they make the transition to secondary education. Note that students in their first years of secondary school in the Netherlands follow the same courses with the same classmates every school day.

As Dutch secondary schools are organized by a tracked system (see Gremmen et al., 2017 for a detailed description), we differentiated three types of tracks in our analyses. The lowest track included the pre-vocational track with a practical orientation (30.0%) and the middle track included the pre-vocational track with a theoretical orientation (24.5%). The highest track included both the pre-university and general education tracks (45.4%), as these
are both high tracks and often combined within a classroom. In the models, we control for being in the same track (track ego * track alter).

MEASURES

**Friendships** within grades were assessed using a peer nomination procedure. Participants were presented the names of their classmates on a computer screen in alphabetical order, starting at a random name. They were asked to nominate their friends (‘Who are your best friends?’), followed by the same question concerning friends from the same grade across all locations. Participants were allowed to nominate an unlimited number of same- and cross-gender peers. Based on both the within-class and within-grade nominations, we constructed an overall adjacency matrix for the entire grade at all waves within the school year containing all friendship nominations, with 0 and 1 representing absence and presence of a nomination between actors $i$ and $j$.

**Academic achievement (GPA; Grade Point Average)** was derived from administrative data; adolescents’ school report cards. On these school report cards, which are issued four times per school year, adolescents’ average grades on all school subjects are displayed, according to the Dutch grading system (i.e., ranging between 1 and 10, with grades of 5.5 or higher corresponding to a pass). Grades from the first three school report cards match with the data collection waves (i.e., October, December, and April), so we could match the grades obtained for the period preceding data collection with the data collected in the questionnaire.

We calculated the average grades over six school subjects per adolescent if data was at least available for three out of the six subjects: Dutch, English, mathematics, biology, history, and geography. Because RSiena requires dependent variables to be measured on a discrete, ordinal scale, adolescents’ grades were categorized into eight subcategories that optimally differentiate the students (see Table 6.1; Gremmen et al., 2017).
Table 6.1  
Categories for school grades: per school year per wave the number of adolescents that have average grades falling into a specific category.

<table>
<thead>
<tr>
<th>Category</th>
<th>Seventh grade</th>
<th>Eighth grade</th>
<th>Ninth grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>1</td>
<td>&lt; 5.0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>5.0 – 5.49</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>5.5 – 5.99</td>
<td>9</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>6.0 – 6.49</td>
<td>40</td>
<td>51</td>
</tr>
<tr>
<td>5</td>
<td>6.5 – 6.99</td>
<td>71</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>7.0 – 7.49</td>
<td>114</td>
<td>87</td>
</tr>
<tr>
<td>7</td>
<td>7.5 – 7.99</td>
<td>91</td>
<td>68</td>
</tr>
<tr>
<td>8</td>
<td>≥ 8.0</td>
<td>47</td>
<td>37</td>
</tr>
</tbody>
</table>

Note. School grades below 5.5 (categories 1 and 2) are considered unsatisfactory. Adolescents get grades for about 13 subjects. For transition to the next year/grade, an overall maximum of three unsatisfactory grade points on these 13 subjects is allowed.

Alcohol use was measured by asking participants to report on how many occasions they consumed alcohol during the last three months (T1) or since the previous questionnaire (T2 and T3), using a 13-point scale ranging from 0 to over 40 times (Wallace et al., 2002). As the prevalence of alcohol use is relatively low in the examined age period, we decided to recode this variable as binary, indicating no use at all (0) or any use (1). This recoding allowed for an examination of whether students drank alcohol in the last three months, instead of the amount of alcohol use.

Delinquency was measured by asking participants how often (using a five-point scale, ranging between 0 and 12 or more times) they had been involved in 18 types of antisocial behavior during the last three months (T1) or since the previous questionnaire (T2 and T3); including stealing, vandalism, burglary, violence, weapon carrying, threatening to use a weapon, truancy, contact with the police, and fare evasion in public transport. The scale was based on the 12 questions frequently used in Dutch research (Nijhof, Scholte, Overbeek, & Engels, 2010), and six additional items which reflect other important delinquent behaviors (e.g., Van Der Laan, Veenstra, Bogaerts, Verhulst, & Ormel, 2010). As the engagement in delinquent behaviors is relatively low in the examined age period, we decided to recode this variable as binary, indicating no engagement at all (0) or any engagement (1).

Gender was coded 0 for girls and 1 for boys.
ANALYTICAL STRATEGY

Social network analysis

Adolescents’ development of academic achievement and risk behaviors were examined using the Simulation Investigation for Empirical Network Analysis (Siena) software package in R (Ripley et al., 2016; Snijders et al., 2010), package version 1.1.304. The co-evolution of adolescents’ friendship networks and behaviors are estimated by stochastic actor-based simulation models. In this way, we are able to assess the contributions of same-behavior and cross-behavior selection and influence processes to friends’ similarity in academic achievement and risk behaviors (Steglich et al., 2010). Similarity needs to be understood here in a correlational sense: two adolescents are similar to the degree that their behavior scores differ in the same direction from the average adolescent’s scores in the grade.

Both adolescents’ friendships and behaviors are assumed to change continuously between observation moments, based on individual preferences. Enough stability as well as change is needed between time points to reach model convergence. Adolescents’ friendships (i.e., creating a new friendship or dropping an existing one) as well as their behaviors (i.e., by going one or more steps up or down in behavior) may change in response to the current friendship structure and the behaviors of other adolescents in the network. Overall, it is thus a dynamic process in which the model controls for changes in both adolescents’ friendships and behaviors as well as structural and individual effects on these changes in friendships and academic and risk behaviors. These changes in adolescents’ friendships and behaviors are modeled as the result of their decisions, revealing an underlying preference measure (‘objective function’) indicating how ‘satisfied’ adolescents are with their local network neighborhood configuration.

In this study, we estimated friendship dynamics (including same-behavior and cross-behavior selection parameters) and behavior dynamics (including same-behavior and cross-behavior influence parameters) for academic achievement, alcohol use, and delinquency. In the model specification, in the following subparagraph, the parameters are explained and tested using t-ratios (parameter estimate divided by its standard error), similar to other generalized linear models.
Chapter 6

Model specification

Analyses in RSiena include parameter estimates related to both network dynamics (structural network and behavior-dependent selection dynamics) and behavior dynamics (behavior tendencies and influence effects). Using the Robbins-Monro stochastic approximation algorithm (see Ripley et al., 2016), parameter estimates are derived from iterative simulations. Table 6.2 provides an overview and textual and visual explanation of the main effects in the model. Most of the included effects function as control measures in order to more accurately assess selection and influence effects with regard to adolescents’ behaviors (academic achievement, alcohol use, and delinquency). Friendship networks were analyzed on a grade level (seventh, eighth, and ninth grade) and separate models were analyzed for the interplay between alcohol use and GPA, and delinquency and GPA. Moreover, time-heterogeneity was tested running models separately per period within each school year. No differences were found in the parameter estimates in these models.

The network dynamics part of the model consists of the following effects. Rate parameters reflect the rate of change in adolescents’ friendships between time points, indicating whether there is enough change in the friendship network. We also included the most common structural network effects in our model (Veenstra et al., 2013). Density (outdegree) refers to adolescents’ tendency to nominate others. Reciprocity reflects adolescents’ tendency to reciprocate received nominations by peers. Transitive triplets and reciprocated transitive triplets concern the transitive closure of adolescents (‘friends of friends become friends’) and its interaction with reciprocity, respectively (Block, 2015). Three cycles represent nonhierarchical cycles of generalized reciprocity (i.e., adolescent A nominates adolescent B, adolescent B nominates adolescent C, and adolescent C nominates adolescent A). Moreover, ego effects (sender; given nominations) and alter effects (receiver; received nominations) were included for adolescents’ gender, track, alcohol use, delinquency, and GPA. For example, gender ego and gender alter show to what extent gender affects the number of nominations given and received, respectively.

Furthermore, we estimated the ego * alter effect (selection effect) for track, GPA, alcohol, and delinquency, which measures whether adolescents with high (low) scores selected others who also scored high (low), showing whether similarity between ego and alter increases the probability of a friendship between them. For gender, class, and location, we tested the
effect for having the same gender, being in the same class or at the same location. For example, the same gender effect indicates whether girls nominate more girls and boys nominate more boys as friends. Finally, we included the cross-behavior selection effects between GPA and both risk behaviors in the network dynamics part, for example the alcohol ego * GPA alter effect, which indicates whether adolescents with high (low) scores on alcohol use selected others who had high (low) GPA scores.

The behavior dynamics part of the model consists of the following effects. Rate parameters refer to the rate of change in GPA, delinquency, and alcohol use between time points, indicating whether there is enough change in these behaviors. The average alter effect (same-behavior influence effect) estimates whether adolescents’ academic achievement, alcohol use or delinquency were higher for adolescents whose friends also had higher scores on the same behavior, showing whether adolescents tend to behave similarly to their friends over time. Moreover, we estimated the alter’s (friendship) average alter (cross-behavior influence effect), indicating whether a friends’ GPA, alcohol use, or delinquency influenced adolescents’ behavior in a different domain. Hence, it indicates, for example, whether adolescents changed their risk behaviors in response to their friends’ GPA.

We also included the linear shape effect (overall tendency) and the quadratic shape effect to control for the overall mean and variance of adolescents’ behaviors. This latter effect can only be included for variables with more than two categories, here GPA. A negative parameter indicates pulling towards the mean, whereas a positive parameter indicates pushing away from the mean. Also, the effect of indegree on the behaviors was estimated (e.g., do received friendship nominations make an adolescent drink/being delinquent/having high grades?) as well as the outdegree (e.g., do given friendship nominations make an adolescent drink/being delinquent/having high grades?). Finally, we controlled for adolescents’ gender, track, and GPA, alcohol use, or delinquency (depending on the outcome variable).
# Chapter 6

## Table 6.2

*Explanation of some basic parameters in the RSiena model.*

<table>
<thead>
<tr>
<th>Effect</th>
<th>RSiena effect name</th>
<th>Explanation</th>
<th>Graphical representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outdegree</td>
<td>density</td>
<td>The basis tendency to form relationships</td>
<td><img src="image1.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Reciprocity</td>
<td>recip</td>
<td>The tendency toward reciprocation</td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>transTrip</td>
<td>Transitive closure ((i \rightarrow h \rightarrow j; i \rightarrow j)): Friends of friends become friends</td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
<tr>
<td>3-cycles</td>
<td>cycle3</td>
<td>Nonhierarchical cycles of generalized reciprocity</td>
<td><img src="image4.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Same X</td>
<td>sameX</td>
<td>Relations occur more often between actors with this same characteristic</td>
<td><img src="image5.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Alter effect</td>
<td>altX</td>
<td>Actors with higher scores on this characteristic/behavior receive more nominations</td>
<td><img src="image6.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Ego effect</td>
<td>egoX</td>
<td>Actors with higher scores on this characteristic/behavior give more nominations</td>
<td><img src="image7.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Ego * Alter (similarity effect)</td>
<td>egoX * altX and egoX * altY</td>
<td>Relations occur more often between adolescents with these similar characteristics/behaviors</td>
<td><img src="image8.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Average alter</td>
<td>avAlt</td>
<td>The tendency of adolescents to become similar to their friends on a specific behavior</td>
<td><img src="image9.png" alt="Diagram" /></td>
</tr>
<tr>
<td>Alter’s (friendship) behavior Y on ego’s behavior X</td>
<td>avXAlt</td>
<td>Cross-behavior influence: the tendency of adolescents to change behavior X in response to friends’ behavior Y</td>
<td><img src="image10.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>
RESULTS

DESCRIPTIVE STATISTICS

Risk behaviors. In Table 6.3, the percentages of adolescents that recently engaged in some levels of alcohol use or engaged in delinquent behaviors are displayed per wave per school year. It can be seen that the prevalence of alcohol use increased in higher grades, whereas a less clear pattern was found for delinquency. Delinquency was more prevalent than alcohol use in seventh grade, whereas alcohol use was more prevalent in ninth grade compared to delinquency. Moreover, the percentage of adolescents is shown that both used alcohol and engaged in delinquent behaviors. This percentage can be used to calculate the net overlap, which varied between 43.7% (referring to the percentage of delinquent adolescents at T2 in eighth grade (9.3 / 21.3) who also drank alcohol) and 81.9% (referring to the percentage of delinquent adolescents at T3 in ninth grade (25.8 / 31.5) who also drank alcohol). It can thus be concluded that there were adolescents that showed both behaviors.

Table 6.3
Per school year per wave the percentage of adolescents that consumed alcohol, engaged in delinquent behaviors, and the percentage of adolescents that showed both risk behaviors.

<table>
<thead>
<tr>
<th></th>
<th>Alcohol use</th>
<th>Delinquency</th>
<th>Both risk behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seventh grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>21.5%</td>
<td>49.6%</td>
<td>15.9%</td>
</tr>
<tr>
<td>T2</td>
<td>20.0%</td>
<td>39.3%</td>
<td>12.7%</td>
</tr>
<tr>
<td>T3</td>
<td>22.6%</td>
<td>42.6%</td>
<td>16.0%</td>
</tr>
<tr>
<td><strong>Eighth grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>33.3%</td>
<td>32.0%</td>
<td>19.5%</td>
</tr>
<tr>
<td>T2</td>
<td>25.4%</td>
<td>21.3%</td>
<td>9.3%</td>
</tr>
<tr>
<td>T3</td>
<td>31.5%</td>
<td>27.7%</td>
<td>14.9%</td>
</tr>
<tr>
<td><strong>Ninth grade</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>55.1%</td>
<td>46.1%</td>
<td>35.8%</td>
</tr>
<tr>
<td>T2</td>
<td>55.1%</td>
<td>35.5%</td>
<td>26.4%</td>
</tr>
<tr>
<td>T3</td>
<td>55.8%</td>
<td>31.5%</td>
<td>25.8%</td>
</tr>
</tbody>
</table>

Correlations. Table 6.4 shows the correlations between GPA and alcohol use and delinquency for all waves in all three school years. At all waves there was a significant negative correlation between adolescents’ academic achievement and both risk behaviors, indicating that high-achieving adolescents were less likely to drink alcohol or engage in delinquent behaviors. Also, a significant positive correlation was found in all three school years between alcohol use and delinquency, indicating that adolescents who drank alcohol were also more inclined to engage in delinquent behaviors (range = .24-.45). Moreover, correlations (not presented in Table 4) were positively significant across all waves within GPA (range = .71-.86), alcohol use (range
Chapter 6

= .44-.54), and delinquency (range = .40-.57). This indicates that adolescents with higher scores on these behaviors were more inclined to have higher scores on the same behavior over time.

Table 6.4
**Correlations between academic achievement (GPA), alcohol use and delinquency across the seventh grade (N = 390), eighth Grade (N = 418), and ninth Grade (N = 411).**

<table>
<thead>
<tr>
<th></th>
<th>Alcohol</th>
<th></th>
<th></th>
<th>Delinquency</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td><strong>Seventh grade GPA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>-1.1**</td>
<td>-1.5**</td>
<td>-1.4**</td>
<td>-1.6**</td>
<td>-1.7**</td>
<td>-2.0**</td>
</tr>
<tr>
<td>T2</td>
<td>-1.3**</td>
<td>-1.9**</td>
<td>-2.0**</td>
<td>-2.3**</td>
<td>-1.7**</td>
<td>-1.9**</td>
</tr>
<tr>
<td>T3</td>
<td>-1.3**</td>
<td>-1.8**</td>
<td>-1.9**</td>
<td>-2.1**</td>
<td>-1.7**</td>
<td>-2.4**</td>
</tr>
<tr>
<td><strong>Eighth grade GPA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>-2.5**</td>
<td>-1.8**</td>
<td>-1.9**</td>
<td>-2.6**</td>
<td>-2.1**</td>
<td>-1.5**</td>
</tr>
<tr>
<td>T2</td>
<td>-1.8**</td>
<td>-2.2**</td>
<td>-2.1**</td>
<td>-2.4**</td>
<td>-2.1**</td>
<td>-1.4**</td>
</tr>
<tr>
<td>T3</td>
<td>-1.9**</td>
<td>-1.5**</td>
<td>-2.1**</td>
<td>-2.2**</td>
<td>-1.7**</td>
<td>-1.2*</td>
</tr>
<tr>
<td><strong>Ninth grade GPA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>-1.9**</td>
<td>-1.7**</td>
<td>-2.0**</td>
<td>-2.1**</td>
<td>-1.4**</td>
<td>-1.4**</td>
</tr>
<tr>
<td>T2</td>
<td>-2.0**</td>
<td>-1.8**</td>
<td>-2.0**</td>
<td>-1.1**</td>
<td>-0.11*</td>
<td>-1.5**</td>
</tr>
<tr>
<td>T3</td>
<td>-2.2**</td>
<td>-2.3**</td>
<td>-2.2**</td>
<td>-1.6**</td>
<td>-1.7**</td>
<td>-1.8**</td>
</tr>
</tbody>
</table>

*(Note: GPA = Grade Point Average. **p < .01; * p < .05.)*

**Network variables**. Descriptions of the networks and changes in behaviors are presented in Table 6.5. The average number of friendship nominations given varied between 5.25 and 8.63 across the school years. The friendship networks were characterized by a moderate reciprocity index in all years, with participants reciprocating about 52% of the friendship nominations. There was also a tendency for friendships to occur in cohesive subgroups, indicated by a transitivity index in the network of on average 45%. Further, most friendship nominations occurred between adolescents of the same gender (about 84%). The amount of changing nominations per student ranges between 4.71 and 6.09 and indicates sufficient power; its sum over all actors (the so-called Hamming Distance) is the main determinant of statistical power of the study and roughly corresponds to the role played by sample size in regression models. The Jaccard index indicates the amount of stability in friendship nominations. In order to be able to detect structural network effects (and hence control for network interdependence), this index should be higher than 30% (see Veenstra et al., 2013), which is the case for every wave.
Table 6.5
Sample and change descriptives for the seventh grade (N=390), eighth grade (N=418), and ninth grade (N=411).

<table>
<thead>
<tr>
<th>Sample</th>
<th>Seventh grade</th>
<th>Eighth grade</th>
<th>Ninth grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
<td>T2</td>
<td>T3</td>
</tr>
<tr>
<td>Average degree</td>
<td>7.49</td>
<td>8.63</td>
<td>7.85</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>56%</td>
<td>54%</td>
<td>57%</td>
</tr>
<tr>
<td>Transitivity</td>
<td>40%</td>
<td>40%</td>
<td>43%</td>
</tr>
<tr>
<td>Same gender</td>
<td>83%</td>
<td>85%</td>
<td>87%</td>
</tr>
<tr>
<td>Friendship indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jaccard index (stability)</td>
<td>45%</td>
<td>46%</td>
<td>49%</td>
</tr>
<tr>
<td>Hamming distance (change per student)</td>
<td>6.09</td>
<td>6.00</td>
<td>4.77</td>
</tr>
<tr>
<td>No. of friendships dissolved</td>
<td>971</td>
<td>1340</td>
<td>1106</td>
</tr>
<tr>
<td>No. of friendships emerged</td>
<td>1413</td>
<td>1036</td>
<td>1016</td>
</tr>
<tr>
<td>No. of friendships maintained</td>
<td>1951</td>
<td>2024</td>
<td>2029</td>
</tr>
<tr>
<td>Changes in achievement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of steps down</td>
<td>242</td>
<td>120</td>
<td>102</td>
</tr>
<tr>
<td>No. of steps up</td>
<td>63</td>
<td>95</td>
<td>185</td>
</tr>
<tr>
<td>Actors that remain stable</td>
<td>35.4%</td>
<td>51.8%</td>
<td>39.7%</td>
</tr>
<tr>
<td>Changes in alcohol use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of steps down</td>
<td>34</td>
<td>32</td>
<td>65</td>
</tr>
<tr>
<td>No. of steps up</td>
<td>28</td>
<td>42</td>
<td>31</td>
</tr>
<tr>
<td>Actors that remain stable</td>
<td>83.8%</td>
<td>80.5%</td>
<td>76.6%</td>
</tr>
<tr>
<td>Changes in delinquency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of steps down</td>
<td>62</td>
<td>50</td>
<td>70</td>
</tr>
<tr>
<td>No. of steps up</td>
<td>28</td>
<td>58</td>
<td>30</td>
</tr>
<tr>
<td>Actors that remain stable</td>
<td>76.7%</td>
<td>71.8%</td>
<td>75.6%</td>
</tr>
</tbody>
</table>

Note. Reciprocity was calculated as $2M/(2M+A)$, where $M$ = mutual friendship and $A$ = asymmetric friendship; Transitivity was calculated as $N$ of transitive triplets divided by $N$ of 2-paths (potentially transitive triplets); See for more information on the calculation of the different network indices Veenstra and Steglich (2012).
Chapter 6

RSiena Analyses

Alcohol Use and GPA. Table 6.6 shows the results of the RSiena analysis with regard to adolescents’ alcohol use and GPA for the seventh, eighth and ninth grade. The table includes the estimate and the standard error for each effect. Estimates can be interpreted as log odds for a relationship to exist (friendship part of the model) or for a behavior to change (alcohol use or GPA; Ripley et al., 2016).

A negative significant effect for outdegree was found, indicating that participants on average selected few peers (less than half of their grade) as friends. Moreover, adolescents tended to reciprocate friendships, were likely to become friends with friends’ friends, but not necessarily reciprocated, and there was a tendency to have a hierarchical ordering as there were relatively few three cycles. Also, adolescents selected same-gender peers as friends and there were more friendships between adolescents in the same classroom and same location. No significant alcohol ego and alter effects were found, indicating that students’ alcohol use did not affect the amount of given or received friendship nominations. GPA did not influence the amount of given nominations as well, but in the eighth grade high-achieving adolescents received more nominations (GPA alter) whereas in the ninth grade they received less nominations.

In line with the same-behavior academic achievement and risk behavior selection hypotheses, we found significant positive selection effects for GPA and alcohol use in all school years. This indicates that adolescents selected peers with similar behaviors as friends. With regard to the cross-behavior selection hypotheses, it turned out that seventh graders who used alcohol avoided selecting high-achieving peers as friends (and, correspondingly, seventh graders who did not use alcohol to avoid selecting low-achieving peers as friends; alcohol ego x grade alter). This is in line with the expectations. We can also see weaker cross-behavior selection effects over school years. Moreover, high-achieving adolescents in the ninth grade were more likely to select peers as friends who used alcohol whereas low-achieving adolescents more likely selected friends who did not use alcohol. No other significant cross-behavior selection effects were found.

Concerning behavior dynamics, no significant effects were found for gender and GPA on students’ alcohol use, and there were also no significant effect from gender on adolescents’ GPA. Adolescents in seventh and eighth grade from lower tracks, however, were more likely to
drink alcohol, and alcohol use was associated with lower grades in seventh and ninth grade. Adolescents’ track also had a small effect on their grades, negatively in seventh grade and positively in the ninth grade. Same-behavior influence effects were found across all school years for both alcohol use and GPA. This is in line with the same-behavior academic and risk influence hypotheses, revealing that adolescents’ behaviors (alcohol use and GPA) were affected by the same behaviors of their friends. With regard to the cross-behavior influence hypotheses, only in the seventh grade a trend (marginally significant) was found for a negative influence effect of friends’ GPA on an individual adolescent’s alcohol use. This result suggests that having high-achieving friends leads to a lower chance of drinking alcohol, whereas having low-achieving friends leads to a higher chance of drinking alcohol. No significant effects of friends’ alcohol use on individuals’ GPA have been found.

In sum, same-behavior selection and influence processes were found for both alcohol use and GPA. There were also some cross-behavior selection processes, with seventh graders who used alcohol avoiding high-achieving peers as friends and high-achieving ninth graders selecting peers as friends who used alcohol. Furthermore, in seventh grade there was a trend towards cross-behavior influence from friends’ GPA on individual adolescents’ alcohol use.

**Delinquency and GPA.** Table 6.7 shows the results of the RSiena analysis with regard to adolescents’ delinquent behaviors and GPA for the seventh, eighth, and ninth grade. The network structure effects were similar to the ones in Table 4. Further, we found in the seventh grade that adolescents who engaged in delinquent behaviors received more nominations (delinquency alter) and that they gave more nominations (delinquency ego), which happens in the ninth grade as well. Also, related to the same-behavior academic selection hypothesis, we found significant positive selection effects for GPA in all school years. This indicates that adolescents selected peers as friends based on similarities in GPA. Selection effects for delinquency were only found in the ninth grade (same-behavior risk selection hypothesis). With regard to the cross-behavior selection hypothesis, it was shown that seventh and eighth graders who were delinquent avoided high-achieving peers (delinquency ego x GPA alter), which is in line with the expectations. In the ninth grade, high-achieving adolescents were more likely to select delinquent peers as friends. No other cross-behavior selection effects were found.
### Table 6.6

**RSiena results on friendships, academic achievement, and alcohol use in the seventh grade (N=390), eighth grade (N=418), and ninth grade (N=411)**

<table>
<thead>
<tr>
<th>Network dynamics: Friendship</th>
<th>Est.</th>
<th>SE</th>
<th>Est.</th>
<th>SE</th>
<th>Est.</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant friendship rate (period 1)</td>
<td>22.13</td>
<td>1.03</td>
<td>14.34</td>
<td>0.59</td>
<td>15.55</td>
<td>0.63</td>
</tr>
<tr>
<td>Constant friendship rate (period 2)</td>
<td>17.29</td>
<td>0.69</td>
<td>15.34</td>
<td>0.62</td>
<td>16.73</td>
<td>0.64</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-3.89</td>
<td>0.05</td>
<td>-4.10</td>
<td>0.05</td>
<td>-4.25</td>
<td>0.06</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.95</td>
<td>0.06</td>
<td>1.88</td>
<td>0.06</td>
<td>1.67</td>
<td>0.07</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.41</td>
<td>0.01</td>
<td>0.37</td>
<td>0.01</td>
<td>0.42</td>
<td>0.02</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.25</td>
<td>0.02</td>
<td>-0.14</td>
<td>0.02</td>
<td>-0.18</td>
<td>0.03</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-0.21</td>
<td>0.02</td>
<td>-0.31</td>
<td>0.02</td>
<td>-0.30</td>
<td>0.02</td>
</tr>
<tr>
<td>Gender (1=boy) alter</td>
<td>-0.03</td>
<td>0.04</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Gender (1=boy) ego</td>
<td>0.08</td>
<td>0.04</td>
<td>-0.17</td>
<td>0.04</td>
<td>0.14</td>
<td>0.04</td>
</tr>
<tr>
<td>Same gender</td>
<td>0.85</td>
<td>0.04</td>
<td>0.77</td>
<td>0.04</td>
<td>0.73</td>
<td>0.04</td>
</tr>
<tr>
<td>Same class</td>
<td>0.98</td>
<td>0.04</td>
<td>0.94</td>
<td>0.04</td>
<td>0.95</td>
<td>0.04</td>
</tr>
<tr>
<td>Same location</td>
<td>0.42</td>
<td>0.05</td>
<td>0.63</td>
<td>0.06</td>
<td>0.85</td>
<td>0.06</td>
</tr>
<tr>
<td>Track alter</td>
<td>-0.02</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.02</td>
<td>-0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Track ego</td>
<td>-0.10</td>
<td>0.02</td>
<td>-0.03</td>
<td>0.03</td>
<td>-0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Track ego * track alter</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.03</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Alcohol alter</td>
<td>0.04</td>
<td>0.06</td>
<td>0.09</td>
<td>0.06</td>
<td>0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>Alcohol ego</td>
<td>0.09</td>
<td>0.07</td>
<td>0.10</td>
<td>0.06</td>
<td>0.00</td>
<td>0.05</td>
</tr>
<tr>
<td>GPA alter</td>
<td>0.01</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
<td>-0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>GPA ego</td>
<td>0.02</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Same-behavior selection effects</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol ego * alcohol alter</td>
<td>0.51</td>
<td>0.19</td>
<td>0.74</td>
<td>0.22</td>
<td>0.71</td>
<td>0.14</td>
</tr>
<tr>
<td>GPA ego * GPA alter</td>
<td>0.03</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
<td>0.03</td>
<td>0.01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cross-behavior selection effects</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol ego * GPA alter</td>
<td>-0.16</td>
<td>0.04</td>
<td>-0.08</td>
<td>0.06</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>GPA ego * alcohol alter</td>
<td>-0.02</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.05</td>
<td>0.08</td>
<td>0.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Behavior dynamics: Alcohol and GPA</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate alcohol (period 1)</td>
<td>0.86</td>
<td>0.15</td>
<td>0.94</td>
<td>0.12</td>
<td>0.72</td>
<td>0.13</td>
</tr>
<tr>
<td>Rate alcohol (period 2)</td>
<td>1.08</td>
<td>0.19</td>
<td>1.05</td>
<td>0.18</td>
<td>0.78</td>
<td>0.12</td>
</tr>
<tr>
<td>Alcohol linear shape</td>
<td>-2.04</td>
<td>0.53</td>
<td>-2.34</td>
<td>0.45</td>
<td>-0.32</td>
<td>0.39</td>
</tr>
<tr>
<td>Alcohol indegree</td>
<td>-0.02</td>
<td>0.07</td>
<td>0.13</td>
<td>0.06</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Alcohol outdegree</td>
<td>0.05</td>
<td>0.05</td>
<td>0.02</td>
<td>0.03</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Alcohol: effect from gender</td>
<td>-0.26</td>
<td>0.40</td>
<td>0.37</td>
<td>0.30</td>
<td>0.04</td>
<td>0.26</td>
</tr>
<tr>
<td>Alcohol: effect from track</td>
<td>-0.42</td>
<td>0.25</td>
<td>-0.33</td>
<td>0.16</td>
<td>-0.14</td>
<td>0.20</td>
</tr>
<tr>
<td>Alcohol: effect from GPA</td>
<td>-0.15</td>
<td>0.15</td>
<td>-0.28</td>
<td>0.17</td>
<td>-0.24</td>
<td>0.15</td>
</tr>
<tr>
<td>Rate GPA (period 1)</td>
<td>2.08</td>
<td>0.18</td>
<td>1.87</td>
<td>0.15</td>
<td>1.86</td>
<td>0.18</td>
</tr>
<tr>
<td>Rate GPA (period 2)</td>
<td>1.19</td>
<td>0.11</td>
<td>1.58</td>
<td>0.15</td>
<td>2.05</td>
<td>0.19</td>
</tr>
<tr>
<td>GPA linear shape</td>
<td>-0.18</td>
<td>0.12</td>
<td>-0.02</td>
<td>0.11</td>
<td>0.03</td>
<td>0.11</td>
</tr>
<tr>
<td>GPA quadratic shape</td>
<td>-0.05</td>
<td>0.02</td>
<td>-0.12</td>
<td>0.02</td>
<td>-0.16</td>
<td>0.02</td>
</tr>
<tr>
<td>GPA indegree</td>
<td>0.01</td>
<td>0.02</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>GPA outdegree</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>GPA: effect from gender</td>
<td>-0.16</td>
<td>0.10</td>
<td>0.07</td>
<td>0.08</td>
<td>-0.13</td>
<td>0.08</td>
</tr>
<tr>
<td>GPA: effect from track</td>
<td>-0.12</td>
<td>0.06</td>
<td>-0.01</td>
<td>0.05</td>
<td>0.17</td>
<td>0.06</td>
</tr>
<tr>
<td>GPA: effect from alcohol</td>
<td>-0.35</td>
<td>0.20</td>
<td>0.10</td>
<td>0.16</td>
<td>-0.29</td>
<td>0.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Same-behavior influence effects</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol average alter</td>
<td>4.51</td>
<td>1.70</td>
<td>3.03</td>
<td>1.16</td>
<td>2.31</td>
<td>1.08</td>
</tr>
<tr>
<td>GPA average alter</td>
<td>0.23</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
<td>0.42</td>
<td>0.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cross-behavior influence effects</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol: effect from friends’ GPA</td>
<td>-0.86</td>
<td>0.50</td>
<td>0.65</td>
<td>0.46</td>
<td>0.03</td>
<td>0.36</td>
</tr>
<tr>
<td>GPA: effects from friends’ alcohol use</td>
<td>0.69</td>
<td>0.62</td>
<td>0.22</td>
<td>0.35</td>
<td>0.33</td>
<td>0.36</td>
</tr>
</tbody>
</table>

*Note:* *p*-value = .05  *p*-value < .05  **p*-value < .01  ***p*-value < .001 (two-tailed tests).
Results for behavior dynamics showed a positive effect for gender on adolescents’ delinquency in seventh grade, indicating that boys engaged more in delinquent behaviors than girls. No gender effects were found in the other grades, and there were no effects from adolescents’ track on delinquency in all school years. GPA negatively influenced students’ delinquency in seventh and ninth grade, indicating that high-achieving adolescents were less likely to engage in delinquent behavior. Adolescents’ GPA was not significantly affected by their gender, and delinquency only affected their GPA negatively in seventh grade. There was also a negative effect of track in seventh grade, indicating that adolescents in lower tracks had higher grades, whereas in ninth grade a positive effect was found.

Same-behavior influence effects of friends were found in eighth and ninth grade, for both GPA and delinquency. This means that these adolescents, in line with the same-behavior academic and risk influence hypotheses, were affected by their friends’ delinquent behaviors and GPA. Moreover, there was a negative marginally significant effect in the seventh grade of friends’ GPA on individual adolescents’ delinquent behaviors (cross-behavior influence hypothesis). This means that there was a trend that having low-achieving friends increased the likelihood of engaging in delinquent behaviors, whereas having high-achieving friends decreased the chance of engaging in delinquent behaviors.

In sum, same-behavior selection effects were found for GPA in all school years and for delinquency in the ninth grade. Same-behavior influence processes were found for both delinquency and GPA in eighth and ninth grade. Cross-behavior selection and influence processes were similar to the model with alcohol use, with delinquent seventh graders avoiding high-achieving peers as friends and high-achieving ninth graders selecting peers as friends who engaged in some delinquent behaviors. Furthermore, in seventh grade there was a tendency for cross-behavior influence, from friends’ GPA on individual adolescents’ delinquency.
### Table 6.7

**RSiena results on friendships, academic achievement, and delinquency in the seventh grade (N=390), eighth grade (N=418), and ninth grade (N=411)**

<table>
<thead>
<tr>
<th></th>
<th>Seventh grade</th>
<th></th>
<th>Eighth grade</th>
<th></th>
<th>Ninth grade</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Est.</td>
<td>SE</td>
<td>Est.</td>
<td>SE</td>
<td>Est.</td>
<td>SE</td>
</tr>
<tr>
<td><strong>Network dynamics: Friendship</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant friendship rate (period 1)</td>
<td>2.19</td>
<td>1.04</td>
<td>14.44</td>
<td>0.68</td>
<td>15.11</td>
<td>0.69</td>
</tr>
<tr>
<td>Constant friendship rate (period 2)</td>
<td>17.31</td>
<td>0.67</td>
<td>15.51</td>
<td>0.75</td>
<td>16.27</td>
<td>0.75</td>
</tr>
<tr>
<td>Outdegree (density)</td>
<td>-3.90*</td>
<td>0.05</td>
<td>-4.06*</td>
<td>0.05</td>
<td>-4.29*</td>
<td>0.06</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>1.96***</td>
<td>0.05</td>
<td>1.89***</td>
<td>0.06</td>
<td>1.70***</td>
<td>0.06</td>
</tr>
<tr>
<td>Transitive triplets</td>
<td>0.41***</td>
<td>0.01</td>
<td>0.38***</td>
<td>0.01</td>
<td>0.42***</td>
<td>0.02</td>
</tr>
<tr>
<td>Transitive reciprocated triplets</td>
<td>-0.25***</td>
<td>0.02</td>
<td>-0.15***</td>
<td>0.02</td>
<td>-0.18***</td>
<td>0.03</td>
</tr>
<tr>
<td>3-cycles</td>
<td>-0.22***</td>
<td>0.02</td>
<td>-0.31***</td>
<td>0.02</td>
<td>-0.31***</td>
<td>0.02</td>
</tr>
<tr>
<td>Gender (1=boy) alter</td>
<td>-0.06</td>
<td>0.04</td>
<td>0.02</td>
<td>0.04</td>
<td>-0.18</td>
<td>0.04</td>
</tr>
<tr>
<td>Gender (1=boy) ego</td>
<td>0.04***</td>
<td>0.04</td>
<td>-0.18***</td>
<td>0.04</td>
<td>0.10*</td>
<td>0.04</td>
</tr>
<tr>
<td>Same gender</td>
<td>0.85***</td>
<td>0.04</td>
<td>0.76***</td>
<td>0.04</td>
<td>0.74***</td>
<td>0.04</td>
</tr>
<tr>
<td>Same class</td>
<td>0.99***</td>
<td>0.04</td>
<td>0.93***</td>
<td>0.04</td>
<td>0.97***</td>
<td>0.04</td>
</tr>
<tr>
<td>Same location</td>
<td>-0.42***</td>
<td>0.05</td>
<td>0.61***</td>
<td>0.06</td>
<td>0.86***</td>
<td>0.06</td>
</tr>
<tr>
<td>Track alter</td>
<td>-0.02</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.03</td>
<td>-0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Track ego</td>
<td>-0.10***</td>
<td>0.02</td>
<td>-0.03</td>
<td>0.03</td>
<td>-0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>Track ego * track alter</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.05</td>
<td>0.03</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Delinquency alter</td>
<td>0.14**</td>
<td>0.05</td>
<td>-0.06</td>
<td>0.06</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Delinquency ego</td>
<td>0.18***</td>
<td>0.05</td>
<td>0.01</td>
<td>0.07</td>
<td>0.40***</td>
<td>0.06</td>
</tr>
<tr>
<td>GPA alter</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.05***</td>
<td>0.02</td>
</tr>
<tr>
<td>GPA ego</td>
<td>0.02</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.02</td>
<td>0.04***</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Same-behavior selection effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency ego * delinquency alter</td>
<td>0.18***</td>
<td>0.12</td>
<td>0.05</td>
<td>0.22</td>
<td>0.56**</td>
<td>0.13</td>
</tr>
<tr>
<td>GPA ego * GPA alter</td>
<td>0.03***</td>
<td>0.01</td>
<td>0.02*</td>
<td>0.01</td>
<td>0.03**</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Cross-behavior selection effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency ego * GPA alter</td>
<td>-0.16***</td>
<td>0.04</td>
<td>-0.15</td>
<td>0.06</td>
<td>-0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>GPA ego * delinquency alter</td>
<td>-0.02</td>
<td>0.03</td>
<td>-0.10</td>
<td>0.06</td>
<td>0.09*</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Behavior dynamics: Delinquency and GPA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate delinquency (period 1)</td>
<td>0.78</td>
<td>0.10</td>
<td>0.97</td>
<td>0.16</td>
<td>1.13</td>
<td>0.18</td>
</tr>
<tr>
<td>Rate delinquency (period 2)</td>
<td>1.13**</td>
<td>0.18</td>
<td>1.27</td>
<td>0.23</td>
<td>0.91</td>
<td>0.12</td>
</tr>
<tr>
<td>Delinquency linear shape</td>
<td>-1.13***</td>
<td>0.38</td>
<td>-0.78***</td>
<td>0.41</td>
<td>-0.88***</td>
<td>0.40</td>
</tr>
<tr>
<td>Delinquency indegree</td>
<td>-0.04</td>
<td>0.06</td>
<td>-0.04</td>
<td>0.06</td>
<td>-0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>Delinquency outdegree</td>
<td>0.11***</td>
<td>0.04</td>
<td>0.00</td>
<td>0.03</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>Delinquency: effect from gender</td>
<td>0.68***</td>
<td>0.32</td>
<td>0.05</td>
<td>0.28</td>
<td>0.16***</td>
<td>0.28</td>
</tr>
<tr>
<td>Delinquency: effect from track</td>
<td>-0.28</td>
<td>0.18</td>
<td>-0.07</td>
<td>0.17</td>
<td>-0.19</td>
<td>0.17</td>
</tr>
<tr>
<td>Delinquency: effect from GPA</td>
<td>-0.20***</td>
<td>0.12</td>
<td>-0.14</td>
<td>0.11</td>
<td>-0.33***</td>
<td>0.17</td>
</tr>
<tr>
<td>Rate GPA (period 1)</td>
<td>2.02</td>
<td>0.19</td>
<td>1.87</td>
<td>0.20</td>
<td>1.86</td>
<td>0.16</td>
</tr>
<tr>
<td>Rate GPA (period 2)</td>
<td>1.21</td>
<td>0.11</td>
<td>1.59</td>
<td>0.15</td>
<td>2.04</td>
<td>0.21</td>
</tr>
<tr>
<td>GPA linear shape</td>
<td>-0.23***</td>
<td>0.12</td>
<td>-0.03</td>
<td>0.12</td>
<td>0.06</td>
<td>0.11</td>
</tr>
<tr>
<td>GPA quadratic shape</td>
<td>-0.06***</td>
<td>0.02</td>
<td>-0.13***</td>
<td>0.02</td>
<td>-0.16***</td>
<td>0.02</td>
</tr>
<tr>
<td>GPA indegree</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
<td>-0.04***</td>
<td>0.02</td>
</tr>
<tr>
<td>GPA outdegree</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.00</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>GPA: effect from gender</td>
<td>0.04</td>
<td>0.11</td>
<td>0.05</td>
<td>0.08</td>
<td>-0.13</td>
<td>0.09</td>
</tr>
<tr>
<td>GPA: effect from track</td>
<td>-0.19**</td>
<td>0.07</td>
<td>-0.01</td>
<td>0.05</td>
<td>0.17***</td>
<td>0.06</td>
</tr>
<tr>
<td>GPA: effect from delinquency</td>
<td>-0.35***</td>
<td>0.16</td>
<td>-0.11</td>
<td>0.17</td>
<td>-0.22**</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Same-behavior influence effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency average alter</td>
<td>1.59</td>
<td>1.05</td>
<td>2.75**</td>
<td>1.08</td>
<td>3.71***</td>
<td>1.05</td>
</tr>
<tr>
<td>GPA average alter</td>
<td>0.13</td>
<td>0.12</td>
<td>0.21***</td>
<td>0.09</td>
<td>0.41***</td>
<td>0.09</td>
</tr>
<tr>
<td><strong>Cross-behavior influence effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency: effect from friends’ GPA</td>
<td>-0.66***</td>
<td>0.37</td>
<td>-0.01</td>
<td>0.38</td>
<td>-0.05</td>
<td>0.44</td>
</tr>
<tr>
<td>GPA: effect from friends’ delinquency</td>
<td>-0.54</td>
<td>0.53</td>
<td>0.48</td>
<td>0.40</td>
<td>0.26</td>
<td>0.37</td>
</tr>
</tbody>
</table>

*Note: p-value < .05 p-value <.05. p-value <.01. p-value <.001 (two-tailed tests).*
DISCUSSION
This study examined the role of friendship selection and influence processes in adolescents’ academic achievement, alcohol use, and delinquent behaviors in the first three years of secondary education. We investigated not only same-behavior but also cross-behavior selection and influence processes, by tapping into the interplay between different behaviors.

Same-Behavior Selection and Influence Processes
We generally found support for same-behavior selection and influence processes, which is in line with our hypotheses and also matches with findings of previous studies with regard to delinquency (e.g., Knecht, Snijders, Baerveldt, Steglich, & Raub, 2010), alcohol use (e.g., Osgood et al., 2013; Osgood, Feinberg, & Ragan, 2015), and academic achievement (e.g., Flashman, 2012; Fortuin, van Geel, & Vedder, 2015). Our results indicate that adolescents select peers as friends who have similar behaviors, as well as that friends’ behaviors become more similar over time. However, these effects were most pronounced and consistent for academic achievement and alcohol use. For delinquency selection effects were only found in the ninth grade and influence effects in the eighth and ninth grade. These inconsistent effects for delinquency are in accordance with findings by Osgood et al. (2015) and may be related to the following arguments.

First, the prevalence rates over school years followed different patterns for alcohol use and delinquency. Whereas alcohol use steadily increases with age and becomes more normative and social (Crosnoe, 2006), delinquency seems to fluctuate more, with lower prevalence rates in the eighth grade compared to the seventh and ninth grade. Reflecting these fluctuations, selection and influence processes might also be less consistent.

Second, especially in the seventh grade adolescents who engaged in delinquent behaviors received and gave more nominations, indicating that they were attractive, socially central and had many friends (Franken et al., 2016). The seventh grade is the first year of secondary education and thus provides a context in which adolescents do not know each other yet, which might lead to a focus on visible (rebellious) peers. When entering a new peer ecology, adolescents may be more competing to be visible within the classroom and grade, whereas over time friendships may be strongly based on shared behaviors and being similar, in the context of a more settled social hierarchy. As a result, delinquency may be more rewarded
at the start of secondary education, whereas selection and influence processes took place in higher grades.

Third, the inconsistency in results for delinquency might be explained by the way of measuring this global construct using the combination of various types of delinquent behaviors. These wide range of behaviors differ in severity (e.g., weapon carrying versus fare evasion in public transport) and consequently some less severe delinquent behaviors might for instance be rewarded more positively by peers than some more severe delinquent acts (Moffitt, 1993). Moreover, these various delinquent behaviors differ regarding their nature, that is, the difference between overt (e.g., violence) and covert (e.g., stealing) behaviors (Loeber & Farrington, 2000). Consequently, the causes of these behaviors differ, including the role of peers and friends.

**Cross-Behavior Selection and Influence Processes**

We took a relational developmental systems perspective and focused on cross-behavior selection and influence processes by investigating the interplay between academic achievement and risk behaviors. We argued that adolescents behave mostly according to adult- or peer-approved norms, expecting that adolescents’ friendships could explain the negative relation between their academic achievement and risk behaviors. Moreover, we used the maturity gap theory, a discrepancy between adolescents’ physical and social status, as an explanation for engaging in risk behaviors as well as low academic achievement in school (Dijkstra et al., 2015; Moffitt, 1993). Overall, we found some support for this idea.

With regard to cross-behavior selection processes for alcohol use, results showed that in seventh grade, adolescents who drank alcohol were more likely to select low-achieving peers as friends, whereas adolescents who did not drink alcohol were more likely to select high-achieving peers as friends. This is in line with the idea that whether or not adolescents experience the maturity gap affects their friendship preferences, by attraction and avoidance of certain peers. However, in the ninth grade high-achievers selected peers as friends who drank alcohol. One explanation is that alcohol use becomes more normative over time. Consequently, alcohol use might be more sanctioned as deviant in seventh grade compared to ninth grade. In seventh grade, adolescents who drank alcohol did not behave according to the adult-approved norms and therefore also did not prefer to befriend peers who performed well in school. Rebellious peers, however, become more salient and socially prominent during
middle adolescence (Allen et al., 2005). Hence, this clear-cut distinction between being a good student and behaving risky (i.e., drinking alcohol and performing delinquent acts) might fade during adolescence (Crosnoe, 2006). Overall increases in the prevalence of alcohol use and the popularity associated with this behavior allowed early drinkers to befriend high-achieving adolescents as well (Rodkin, Farmer, Pearl, & Van Acker, 2006).

For delinquency, similar cross-behavior selection effects were found as for alcohol use, but the processes might differ. In the seventh grade, adolescents who engaged in delinquent behaviors not only received and gave more nominations, but they were also more likely to select low-achieving peers as friends. Also in the eighth grade there was a cross-selection effect, with adolescents who engaged in delinquent behaviors selecting low-achieving peers as friends. However, in the ninth grade delinquent adolescents received more nominations and high-achieving adolescents were more likely to select peers as friends who showed some delinquent behaviors. This could be explained by the idea that in earlier ages perception of peer behaviors is more dichotomous, that is, either being delinquent or not, a good student or not, whereas overtime adolescents might develop a more nuanced view on behavior of peers. Hence, affiliation of ‘good’ adolescents with delinquent peers is more likely.

Regarding cross-behavior influence effects, we only found a marginally negative effect of friends’ GPA on both adolescents’ alcohol use and delinquent behavior in seventh grade. This finding is in line with the idea that adolescents have a need for social approval (Brechwald & Prinstein, 2011) and susceptibility to peer influence across behaviors, reflected by adult- or peer-approved norms. These cross-behavior influence effects can be interpreted in two ways. On the one hand, it can mean that adolescents who had low-achieving friends were more likely to engage in risk behaviors over time. This would indicate that friends’ low GPA is a risk factor for engaging in risk behaviors. On the other hand, it can mean that adolescents who had high-achieving friends were less likely to engage in risk behaviors. This would indicate that friends’ high GPA is a protective factor against involvement in risk behaviors. This effect, however, was not found in higher grades. Unfortunately, current models do not allow to untangle the direction and strength of these cross-behavior effects. Future research might profit from further extensions of longitudinal social network models.

Although friends’ behaviors seem to affect similar behaviors in adolescents and negative correlations have been found between risk behaviors and academic achievement, only
significant cross-behavior effects were found from friends’ GPA affecting risk behaviors but not from friends’ risk behaviors to adolescents’ GPA. No cross-behavior influence effects have been found from friends’ risk behaviors on an individual’s academic achievement, indicating that an individual student’s academic achievement does not change in response to friends’ risk behaviors. This means that potential spill-over effects from friends’ behaviors to different individual behaviors start from friends’ GPA and not from their risk behaviors.

An explanation for only finding cross-behavior influence effects from friends’ GPA to individual’s risk behaviors may be that positive attitudes towards academics and high grades act as protective factors against risk behaviors (Bryant, Schulenberg, Malley, Bachman, & Johnston, 2003). Moreover, academic achievement is highly indicative of cognitive functions and skills and is harder to modify as compared to alcohol use and delinquent behaviors. Actually, academic achievement requests adolescents to put more efforts in their school work, whereas behaviors such as alcohol use or delinquent behavior depend on specific contexts or situations. However, both academic achievement and risk behaviors are influenced by friends and adolescents apparently seem to balance between these behaviors, where one behavior does not exclude the other behavior. With regards to the maturity gap explanation, and especially adolescent-limited antisocial youth, these results indicate that academic achievement and risk behaviors are not two ends of one continuum from adult-approved positive academic behaviors to adult-disapproved risk behaviors (Moffitt, 1993). These behaviors seem to be largely separate behaviors in the peer context, probably with distinct underlying motivations.

**Limitations and future directions**

This study has a number of strengths. We were able to examine different behaviors within longitudinal social network analyses and studied cross-behavior friendship selection and influence processes. However, it is also important to acknowledge that some limitations apply to the study.

A first limitation is that we studied academic achievement (GPA), which does not always reflect adolescents’ academic abilities as other factors such as attitudes, strategies, behaviors, and non-cognitive skills play a role in their performance as well (for a review see Farrington et al., 2012). Nevertheless, an adolescents’ GPA concerns actual grades which are important, as it determines future educational opportunities (Witkow & Fuligni, 2010). Nonetheless, it would
be interesting for future studies to additionally focus on other school-related factors, such as school interest, effort, engagement, truancy, and school bonding.

A second limitation is that we had to recode adolescents’ alcohol use and delinquency into dummy variables, as well as combining different types of delinquent behaviors in our measure. This is due to the relatively low prevalence of alcohol use and delinquency among the participants. The prevalence, however, is normal in this age period and similar to the percentages found in previous studies (Osgood et al., 2013, 2015). For future studies it would be interesting to replicate this study among older students, for example college students, among whom risk behaviors, such as smoking behaviors and drugs use, are more common (Jeynes, 2002). This also allows to differentiate between various types of delinquent behaviors, which may be important, as neurocognitive abilities relate differently to diverse types of the related construct of aggression, suggesting distinct underlying causes for various forms of delinquent behaviors (Barker et al., 2011).

Relatedly, although selection and influence processes are ongoing processes throughout school years, there were differences between the school years in our subsample. Whereas seventh grade adolescents did not know each other yet at the beginning of the school year, the adolescents in the eighth and ninth grade already knew each other. Due to these differences in familiarity between adolescents, differences between school years should also be treated with caution. Future studies can benefit from following the same respondents over different school years.

What must also not be forgotten is the possibility of unobserved confounding. In the present context, this means that the presence of joint determinants of achievement and risk behaviors (as well as joint determinants of friendship and one, or both, of the risk behaviors) are assumed to be controlled for. Future studies should control for likely common causes. Such common causes could be individual maturity indicators like self-command and internalization of societal norms (for achievement and risk behaviors), or social interaction contexts outside school classes, such as doing homework together (for achievement and friendship) and jointly participating in sports and other structured or unstructured, non-academic activities (for risk behaviors and friendship). Moreover, individual factors, regardless of the peer context, can influence the interplay between behaviors as well. For example, a low self-control can result in
a low academic achievement but also lead to engagement in risk behaviors (Tangney, Baumeister, & Luzio Boone, 2004).

**Practical implications**

Our findings have several practical implications. Adolescents need to be understood within their social contexts and specific behaviors seem to depend on each other as well as on different behaviors by friends. The effectiveness of prevention and intervention programs (e.g., in schools) for risk behaviors might be enhanced by emphasizing the role of friends and academic outcomes in these behaviors. Moreover, it is important that teachers and parents are aware of the complex interaction between behaviors. Teachers can try to facilitate contact between low- and high-achieving adolescents and enhance pro-school behaviors (Gest, Madill, Zadzora, Miller, & Rodkin, 2014), keeping in mind that adolescents’ and their friends’ academic achievement might affect their risk behaviors in some situations.

**Conclusion**

Overall, it can be concluded that not only same-behavior but to some extent also cross-behavior selection and influence processes are relevant for (the interplay between) adolescents’ and their friends’ academic achievement and risk behaviors. Same-behavior processes were more prevalent than cross-behavior processes, but subtle cross-behavior processes occurred as well. In general, future studies should expand knowledge about indirect forms of selection and influence processes in different behaviors. By only focusing on selection and influence processes in one domain, the more complex socializing role of friends across different behaviors remains unclear. Future studies can for example focus on other types of risk behaviors or on prosocial behaviors. Additionally, more insights need to be gained concerning the underlying mechanisms, that is, the reasons for adolescents to engage in a behavior that is different from the behavior endorsed by friends.

Thus, despite the absence of many cross-behavior effects between academic achievement and risk behaviors in our study, research should continue to explore cross-behavior selection and influence processes as focusing on only one type of behavior ignores the complexity of adolescents’ behaviors in the peer context.
APPENDIX

Number of adolescents within the seventh grade (first year). Grade level networks were created at T1, T2 and T3 for all 390 adolescents in the seventh grade, with per wave missing codes for the adolescents who left, refused or were absent. Between T1 and T2 as well as between T2 and T3 one adolescent left the school. Also, at T1 one adolescent refused to participate in the study. In addition, nine adolescents did not fill out the questionnaire at T1, fifteen adolescents at T2, and twelve adolescents at T3. This leaves us with 380, 374, and 376 participants at T1, T2, and T3 respectively.

Number of adolescents within the eighth grade (second year). Grade level networks were created at T1, T2 and T3 for all 424 adolescents in the eighth grade, with per wave missing codes for the adolescents who entered, left, refused or were absent. Between T1 and T2 two adolescents entered the school and between T2 and T3 three adolescents left the school. Also, at all three waves four adolescents refused to participate in the study. In addition, seven adolescents did not fill out the questionnaire at T1, ten students at T2, and twelve adolescents at T3. This leaves us with 413, 412, and 407 participants at T1, T2, and T3 respectively.

Number of adolescents within the ninth grade (third year). Grade level networks were created at T1, T2 and T3 for all 424 adolescents in the eighth grade, with missing codes for the adolescents who entered, left, refused or were absent. Between T1 and T2 four adolescents entered the school and between T2 and T3 four students left the school. Also, at all three waves seven adolescents refused to participate in the study. In addition, eleven adolescents did not fill out the questionnaire at T1, twenty-nine adolescents at T2, and eleven adolescents at T3. This leaves us with 406, 386, and 400 participants at T1, T2, and T3 respectively.
Conclusion and discussion
Chapter 7

Peers seem to play an important role in students’ emotional and social functioning, but also in their academic success (e.g., Crosnoe & Brenner, 2015; Ryan, 2001). School well-being, engagement and academic achievement are important to stimulate a positive social and academic development for students, with long-term consequences for their future educational and job opportunities. Students spend much time at school in the classroom context and students’ social positions among peers and their academic functioning seem to be related (e.g., Altermatt & Pomerantz, 2003). But under which circumstances do certain peers matter the most?

The overarching aim of this dissertation was to gain new insights in the role of peers in students’ academic engagement and achievement by using social network information. More specifically, I addressed to what extent, under which conditions, and in which directions peers can enhance or dampen students’ academic functioning. I focused on the roles of primary and secondary school students’ positive (e.g., friendships) and negative (e.g., bullying) relationships with classmates, the role of near-seated peers, and the role of peer norms in their school well-being, academic engagement, and academic achievement. Moreover, I examined the interplay between adolescents’ and their friends’ academic achievement and risk behaviors.

This concluding chapter provides a summary of the main findings, reflects on these findings, and discusses its implications. In the first part, the main findings will be summarized for each reported study in the five empirical chapters. This is followed by a general discussion of the implications of these findings for theory, practice, and future research.

MAIN FINDINGS

Students need to feel embedded in their peer group within the classroom and to have positive interactions and connectedness with peers in order to feel and achieve well (Eisenberg, Neurnark-Sztainer, & Perry, 2003; Ponzo, 2013). However, they can encounter problems within their social network, which can negatively affect their well-being and academic outcomes. In chapter 2, I focused on four negative social positions among peers for elementary school students, that is, victimization, friendlessness, peer rejection, and a lack of peer popularity. Previous studies already showed that each of these four negative social positions are negatively related to students’ school well-being and academic achievement (e.g., Espelage, Sung Hong, Rao, & Low, 2013; LaFontana & Cillessen, 2009; Nakamoto & Schwartz, 2010). This study extended on current knowledge, by examining whether there was a cumulative negative effect...
of these four negative social positions on students’ self-reported academic achievement and school well-being (Study 1), and teacher-reported academic engagement and academic achievement (Study 2). Moreover, I studied whether specific combinations of negative peer relations were more negatively related to students’ academic outcomes than others.

Mixed models in SPSS were used to analyze multilevel models with fourth to sixth grade elementary school students nested in classrooms (KiVa project). Results showed that each negative social position was uniquely negatively associated with students’ academic outcomes. Moreover, the total number of negative social positions was negatively related to students’ academic functioning. Results for academic engagement and school well-being were stronger than for academic achievement. Cumulative effects were found for school well-being, with each additive negative social position having stronger effects, and the strongest additive effect of four negative social positions compared to three. Finally, combinations of negative social positions that included victimization were most negatively related to students’ academic functioning, followed by friendlessness. Thus, safety and affection seem to be the most basic social needs for students.

These results underscore the importance of students’ social connectedness for their academic functioning. This implies that teachers and students should try to stimulate students’ embeddedness among peers as much as possible to enhance their school well-being, academic engagement, and in the end their academic achievement. Teachers should not only focus on academic functioning, but should acknowledge that well-being and social relationships are crucial for academic success.

Do some specific close peers in elementary school have a particularly influential role in students’ academic engagement and achievement? Teachers make a seating arrangement and in this way they determine which students interact with each other during a school day. The goal of the study in chapter 3 was to study the importance of elementary school students’ near-seated peers in their academic engagement and achievement, while taking into account friendship relationships. I focused on students’ relationships, behaviors, and proximity to each other and applied stochastic actor-based network-behavior co-evolution models (RSiena).

Results for both academic achievement and academic engagement showed that students and their friends adjusted their behaviors to each other, regardless of their seating. However, students became less similar to near-seated peers who were not friends. The
increasing dissimilarity may imply that students get discouraged when peers who are not friends score better or encouraged when these peers score worse. Unfortunately, it was impossible to gain detailed insights in the directions of influence.

This study contributes to our understanding on the role of physically close peers in the classroom on students’ academic development and advances previous studies by using a social network approach. Teachers might benefit from these findings when designing seating arrangements and to monitor ongoing processes, through active awareness of the interplay between students’ friendships, their seatings in the classroom, and peer influence processes regarding academic engagement and academic achievement.

When leaving elementary school, students enter a new peer context and have to find their place in this peer group and form new friendships (Witkow & Fuligni, 2010). Chapter 4 concerned friendship selection and influence dynamics in adolescents’ academic achievement in the first years of secondary education (i.e., seventh and eighth grade). I studied students’ average grades and their grades on different clusters of subjects (i.e., language, exact, and social cluster), as well as differences in directions for low- and high-achieving students.

Data included students who were followed in seventh and eighth grade (SNARE study) and I used longitudinal social network analyses (RSiena). Findings showed developmental differences between the first and second year of secondary education. Whereas selection processes were found in the first year on students’ cluster-specific grades, influence processes were found in the second year on both students’ average and cluster-specific grades. Thus, students in the first year initially tend to select friends on the basis of similar cluster-based grades, but one year later influence each other. It can be concluded that developmental differences and specific school subjects are important for understanding peer selection and influence processes in adolescents’ academic achievement.

Besides the direct effect of friends on adolescents’ academic achievement, the aim was to place these peer processes in context, as the broader peer context in the classroom might also be related to friendship dynamics regarding academic achievement (Rodkin & Ryan, 2012). Findings on friendship processes regarding academic achievement vary considerably with regard to the strength and direction, so I focused on the peer context in which these processes
take place. In chapter 5, I examined academic status norms in friendship selection and influence processes regarding adolescents’ academic achievement.

Peer norms for academic achievement can be defined as the extent to which academic achievement is a positively valued characteristic because of its associations with a high social peer status, or instead, a negatively valued characteristic because of its associations with a low social peer status (McCormick & Cappella, 2014). The aim was to examine whether the extent to which academic achievement is positively or negatively salient in a classroom determines the strength and direction of friendship selection and influence processes related to achievement.

Using data from eighth grade students (SNARE project), longitudinal social network analyses (RSiena) indicated that the unpopularity and popularity norm moderate friendship selection processes (but not influence processes) related to academic achievement. The unpopularity norm in the classroom strengthened similarity-based friendship selection among low-achieving adolescents, rather than among high-achieving adolescents. Also, the popularity norm strengthened friendship selection among similar peers, both among low- and high-achievers. Acceptance and rejection norms did not moderate friendship processes. Hence, adolescents generally chose their friends based on similar levels of achievement and were influenced by their friends in academic achievement. Importantly, unpopularity and popularity norms within the classroom explained differences in strength and direction of friendship selection processes (but not of influence processes) for academic achievement, whereas acceptance and rejection norms did not.

Next to the focus on students’ academic outcomes in secondary education, as adolescence is a time period in which academic motivation and achievement tend to decline, adolescence is also a sensitive period for the initiation of risk behaviors (Crosnoe & Brenner, 2005; Steinberg, 2007). Therefore, the main purpose of the study in chapter 6 was to examine the interplay between adolescents’ and their friends’ academic achievement and risk behaviors (i.e., delinquency and alcohol use).

Using longitudinal data from seventh, eighth, and ninth grade students (SNARE study), I examined same- and cross-behavior friendship dynamics regarding academic achievement and risk behaviors. Findings indicated same-behavior selection and influence effects for both academic achievement and risk behaviors. Thus, students selected peers as friends with similar
behaviors and friends’ behaviors became more similar over time. There were only some inconsistent findings for delinquency, with same-behavior effects in the higher grades but not in seventh grade.

Furthermore, cross-behavior selection effects indicated that risk-behaving students were likely to select low-achieving peers as friends and vice versa in seventh and eighth grade. Cross-behavior influence was found in seventh grade from friends’ academic achievement to students’ risk behaviors, indicating that having low-achieving friends increased the likelihood to engage in risk behaviors whereas having high-achieving friends might protect against engagement in risk behaviors. Overall, this study showed the importance of investigating the interplay between different behaviors with longitudinal social network analysis. By only focusing on selection and influence processes in one domain, the more complex socializing role of friends across different behaviors remains unclear.

DISCUSSION
The studies in this dissertation show that students’ social relationships with peers and their embeddedness in peer networks at school are important for their academic engagement and academic achievement. By fostering positive relationships with peers, students’ academic functioning can be enhanced and it is important to take into account developmental differences with regard to peer dynamics.

I take earlier research a step further by using longitudinal social network information to study different types of social networks and various academic and risk behaviors among primary and secondary school students. The focus of the five papers was on three aspects that are central in social network studies, that is, behaviors, relationships, and proximity. I especially examined interactions between these mechanisms to extend on previous studies (Rivera, Soderstrom, & Uzzi, 2010) and in order to study how and when peers matter the most. In this way, I was able to gain new insights into contextual differences in peer dynamics, the timing of peer processes, the interplay between different behaviors, and strengths and directions of selection and influence processes.

I distinguished between different contexts in which peer dynamics take place, by not only focusing on friendship networks, but also on the role of near-seated peers, as students mostly have opportunities to see these specific peers and interact with them in the classroom. A new effect has been developed to simultaneously examine a static network in the classroom,
students’ near-seated peers as assessed by seating arrangements, and a dynamic network, their friendships as assessed by peer nominations. It turned out that especially friends play an important role in primary school students’ academic functioning, but that physical proximity to peers who are not friends can result in stronger motivation or demotivation for school tasks.

Furthermore, I investigated the timing of peer processes in students’ academic development. In primary education, students follow all school lessons in a fixed seating arrangement with the same peers and teacher. Also, parents and teachers have clear expectations to achieve well and students might be still eager to meet adults’ norms. In contrast, in secondary education, adolescents spend more time with peers and attempt to explore their position within the peer group and try to find acceptance and support from them (Witkow & Fuligni, 2010). This might result in different peer processes between primary and secondary education.

Results showed that peers already play an important role in students’ school well-being and engagement in primary school, but I found that they matter less for their academic achievement. The more negative social positions students have within their peer group, by being victimized, having no friends, being rejected or lacking popularity, the less engaged they are for school and the lower their school well-being. Regarding embeddedness, especially victimization can have negative consequences as well as having no friends, which both touch upon students’ affection goals. Friends turned out to become more similar on their academic engagement (regardless of their seating) and to a lesser extent also their academic achievement. Overall, my studies provided insights in both positive and negative relationships with peers and the importance of positive social positions in a peer network. Thus, students’ social positions in their peer network already seem important for their academic development in primary education.

In secondary education, I found timing differences between the first and second year with regard to friendship processes in academic achievement, stressing the importance to take into account developmental differences when studying adolescents. In the first year (i.e., seventh grade) students have to find their social position within a new peer context and they seem to select peers as friends based on similar interests, as they show similarity in cluster-specific grades. Students tended to become more similar to each other in their average grades in the second year of education (i.e., eighth grade). In this school year they already knew their peers better, which might thus be a necessary condition to be susceptible to their behaviors.
Chapter 7

This timing effect may also be explained by an adolescent being influenced by pro-school behaviors of friends in an early stage, but that it takes some time to really improve school grades. Whereas it is relatively easy to become more motivated for certain school tasks and also to work harder, it is much more difficult to actually get higher grades. Overall, timing differences in selection and influence processes have thus been found, with differences across school subjects and school years.

I also studied the interplay between different behaviors, by examining selection and influence dynamics between adolescents’ and their friends’ academic achievement and risk behaviors. Adolescence is namely a time period in which risk behaviors, such as delinquency and alcohol use, become more common and normative. A new effect has been developed to study these cross-behavior effects next to same-behavior effects to provide unique insights in the complex nature of students’ behaviors and relationships. My results showed that adolescents who engage in risk behaviors often have a lower academic achievement than adolescents who do not engage in risk behaviors. Especially in the first year of secondary education, compared to the second and third year, having high-achieving friends can protect against engagement in risk behaviors whereas having low-achieving friends increases chances to engage in risk behaviors. In this school year, risk-behaving students were particularly likely to select low-achieving peers as friends and vice versa, whereas this distinctive cross-behavior selection was less clear-cut in the second and third year. Hence, the interplay between adolescents’ and their friends’ risk behaviors and academic achievement was especially found at a young age, during which alcohol use is less normative.

Another innovative aspect of this dissertation was to examine the strength and direction of selection and influence processes. Similarity in academic achievement seemed to facilitate friendships for both low-achieving and high-achieving students, but especially high-achieving students avoided friendships with low-achieving peers. Influence processes by friends were mainly in an upwards direction, in the sense that students got higher grades when having high-achieving friends. This might be due to information sharing and motivating each other for involvement in school (Crosnoe et al., 2003). These findings regarding the strength and direction of selection and influence processes can have negative consequences for students’ academic achievement. Low-achieving students might underachieve by having similarly low-achieving friends and in this way have limited possibilities to be positively influenced by friends.
Therefore, it seems important to stimulate and facilitate contact between low- and high-achieving students.

Next to the direct relationships with friends, adolescents are also part of a broader peer group within their classroom. Previous studies have found inconsistent results regarding the strength and direction of friendship processes in academic achievement, both within and across studies. I examined whether these strengths and directions depend on peer norms in the classroom, that is, the extent to which academic achievement is related to a high or low social peer status in a classroom (reputational salience hypothesis; Hartup, 1996). Although peer norms did not play a role in the strength and direction of friendship influence processes, selection effects partly depended on peer norms.

Differences in the strength and direction of friendship selection processes regarding academic achievement were found with regard to the unpopularity and popularity norms within the classrooms. More specifically, when popular students in a classroom had a high academic achievement, both high- and low-achieving adolescents were most likely to select each other based on similarity in academic achievement. At the same time, in classrooms where unpopular adolescents had a high academic achievement, adolescents were more likely to select each other based on similarity in low but not in high achievement. This selection of similar friends limits opportunities for low-achieving adolescents to learn from higher achieving peers. When taking into account the influence effects in every classroom, this may result in a process where similarly low-achieving friends influence each other towards even lower levels of achievement, particularly in classrooms with a high unpopularity norm for achievement. This would be a negative vicious cycle for low-achieving students and might lead to a process of polarization with increasing differences between low- and high-achieving students. High-achieving students would get even more motivated and better grades over time whereas low-achieving students show even less motivation and get worse grades.
Chapter 7

FUTURE DIRECTIONS

Based on this dissertation’s new insights into the role of within-school peers in students’ academic functioning, I will specify several directions for future studies. Generally, more research should be conducted to examine in more detail the role of various contextual factors in students’ academic functioning, next to individual cognitive differences. This will lead to more knowledge on how and why students perform at a certain level and which circumstances and conditions influence academic functioning.

Knowledge on interactions between students’ social networks, both within and outside the school context, should be extended. For example, next to classmates, students’ teachers, friends outside school (e.g., from leisure time activities), parents, and other family members can influence students’ engagement and achievement (Farmer, Mcauliffe, & Hamm, 2011). It is crucial to study an individual within its broader social context, as some people in students’ social networks might actively stimulate pro-school behaviors and for example help with school-related issues such as homework assignments and questions, whereas others might devalue school and rather focus on leisure activities and in this way may demotivate students, resulting in underachievement. Hence, a deeper understanding is needed on the interplay between a students’ behaviors and behaviors by others in their social contexts.

Moreover, much research has focused on the role of friends in students’ behaviors, as friends are important for students and students spend much time with them, especially in early adolescence. By asking students to nominate peers as friends, students’ friendship networks are assessed and how these relationships change over time. These networks are linked to changing behaviors during a school year or across school years in order to examine the interplay between students’ and their friends’ changing behaviors. In this way, two main processes that lead to similarity between peers can be distinguished: whether students select similar peers as friends and whether students behaviors become more similar to the average behavior of friends (Veenstra, Dijkstra, & Kreager, 2018).

However, new longitudinal projects might add a more direct and deeper perspective on these processes by asking students more detailed questions. The underlying assumption of current models is that all friendships are equally important, whereas there might be differences in the quality of friendship, the type of friendships, and students’ perceptions on their and their friends’ behaviors.
First, students can be asked to distinguish between the peers they nominate as friends in the quality of these friendships. Students might have closer relationships and more interactions with some friends than with others. The quality of a friendship can be directly asked to a student or it can be observed. Proximity between peers can also be measured differently than by using self-report data. Recent developments make it possible to examine contact between peers more directly. Innovative technologies via Bluetooth beacons can now automatically assess physical proximity between people and thus measure social contact (Waber, Olguin, Kim, & Pentland, 2008). Using this recently developed wearable device, more knowledge can be gained on the importance of social contact characteristics in predicting students’ behaviors, such as contact duration between peers, the frequency, and diversity of contact.

Second, the type of friendships might be different between friends, with particular domains being more salient within one friendship than within another friendship. Whereas students might turn to specific friends for school-related questions or study together with some friends, they might spend their social time or play sports more regularly with other friends. In future studies, students can be asked follow-up questions for each nominated friend with regard to the frequency and type of interactions with that specific friend. Also, it can for instance be asked which peers students turn to when they have a new school grade. In this way, selection and influence effects regarding specific behaviors can be more directly related to the friends with whom students actually share these interests or behaviors. For example, when examining influence effects in academic behaviors, it can particularly be examined for students’ friends with whom they actively engage in school-related tasks.

In some recent studies, a first step has been made to examine students’ helping networks next to their friendship relationships (Van Rijsewijk, Dijkstra, Pattiselanno, Steglich, & Veenstra, 2016). A general question has been posed about which peers help with problems (e.g., homework, with repairing a flat tire, or when you are feeling down). A next step would be to specify more specific questions on helping behaviors by certain peers, for instance by asking per indicated friendships whether they ‘help each other with homework’, ‘engage in sport activities together’, and so on.

Third, students can be explicitly asked about their perceptions on their own behaviors and the behaviors of their friends. How do students for example perceive their own academic motivation and grades? And how do they evaluate these behaviors in comparison to the
motivation and grades of their friends and other peers? The accuracy of these ideas can be assessed by matching it to teacher-reported behaviors and school report cards. Some students might think it is cool to tell their friends that they did not spend any time on homework whereas they actually did. By assessing students’ perceptions more directly, the relation between actual versus perceived behaviors can be examined more specifically.

Fourth, students can be directly asked about their perceptions on friendship selection and influence processes as well. Why did they become friends with specific peers? Is this related to certain characteristics or behaviors by these peers? Additionally, students can be asked about changes in their own and their friends’ behaviors and to what extent they think their friends play a role in their development.

This more specific knowledge on the type of interactions and quality of relationships with friends can lead to another perspective on ongoing processes. As an addition to current simulation models that can provide interesting insights and take the average behavior of all friends, the more specific perceptions by students themselves and differences across friendships can also be taken into account when studying the role of peers in their behaviors.

Future studies are also encouraged to study the role of different types of static and dynamic networks on students’ behaviors more extensively, as newly implemented effects in social network analyses now also provide possibilities to examine different (types of) networks simultaneously. Students’ relationships, behaviors, and proximity can be assessed more directly, for example by examining the overlap in friendship and physical proximity networks and how these relate to students’ (academic) behaviors. Especially with regard to near-seated peers, more research is needed.

For instance, teachers can be explicitly asked about their goals for specific groups of students in the classrooms and social network analyses can show whether goals are met. If a teacher wants to increase a student’s academic motivation for school work by surrounding this student with motivated peers, analyses can show whether these near-seated peers indeed positively influenced that student. Moreover, future research can focus on specific characteristics of the seating arrangement, such as differences between classroom layouts (rows and groups), differences in sizes between subgroups in the classroom and the actual frequency of contact between a student and all his groupmates.

Also, recent advances in social network analyses allow for exploring the interplay between different behaviors by examining cross-behavior effects between students and their
peers. Instead of focusing on one single behavior, it is now possible to take the complexity of several interacting behaviors into account. Next to studying cross-behavior selection and influence effects, it would also be interesting to examine common underlying mechanisms by including mediating effects. For instance, self-control might both influence adolescents’ academic achievement and engagement in risk behaviors (Tangney, Baumeister, & Boone, 2004).

Another avenue for future studies would be to focus more on gender differences in friendship processes. Friendships are mostly same-gender and friendships between boys and girls differ across several aspects. Among girls, there is for instance stronger emotional closeness than among boys, there are more dyadic interactions, there is more focus on fitting into their social context and there is more cooperation and they more often work together on school-related tasks (Rose and Rudolph, 2006). Only a few studies so far have focused on differences in strengths of selection and influence processes between boys and girls. Recently, strong selection effects regarding academic achievement were found for girls but there was no friendship selection among boys and similar influence effects for boys and girls (Kretschmer, Leszczensky, & Pink, 2018). Therefore, it seems important to study gender-specific network behavior in academic functioning and explicitly test mechanisms that can play a role in differences between boys and girls.

Additionally, it would be interesting to follow students from elementary school until they enter the job market and in this way to map students’ individual school trajectories. This would result in knowledge on which circumstances and individual and contextual factors affect whether some students perform as expected, underperform, or perform better than expected. However, it is difficult to use social network information across such a long time period, as the peer group differs across and within schools but also outside school over the years.

A final and probably essential direction for future research is to examine the mechanisms behind peer selection and influence processes in behaviors and how actions by for example teachers and parents or interventions can enhance students’ academic development. I encourage researchers to test underlying theories, for example by observing students’ interactions and behaviors, to get more insight in the possible causes of specific peer processes.
Chapter 7

CONCLUDING WORDS

Overall, this dissertation provides several new and interesting insights in the interaction between students’ social relationships with peers and their academic functioning. It extends knowledge regarding the circumstances under which peers play a role in students’ academic functioning. Peers seem to matter for students’ academic functioning in both elementary and secondary education, with stronger effects on students’ academic engagement and well-being than their academic achievement. It is important that students are well-embedded in their peer network, with positive social positions in order to feel good and achieve well. Moreover, it seems meaningful to distinguish between different social contexts, to take into account timing differences in peer processes, as well as differences in strength and directions of friendship selection and influence processes in academic functioning.

Future studies can increase our understanding on social network processes in students’ academic functioning by gathering more specific data on their social relationships and by using recent developments in social network analyses to analyze their complex social networks and behaviors.
Nederlandstalige samenvatting
(Summary in Dutch)
De belangrijkste taak van scholen is om leerlingen academisch goed op te leiden en ze voor te bereiden op de arbeidsmarkt. Wanneer leerlingen Weinig motivatie hebben voor school of onderpresteren, kan dit namelijk tot grote kosten leiden voor de maatschappij, en bovenal grote korte- en lange termijn gevolgen hebben voor opleidings- en baankansen van de leerlingen.

Schoolmotivatie en schoolprestaties worden voor een groot deel bepaald door individuele capaciteiten, zoals intelligentie en doorzettingsvermogen. Er zijn echter verschillen in de mate waarin leerlingen het beste uit zichzelf halen. Terwijl sommigen gemotiveerd zijn voor school en hard werken, hebben anderen minder interesse voor school en presteren ze onder hun niveau. Het is belangrijk voor scholen om te begrijpen waarom en onder welke omstandigheden deze verschillen ontstaan, zodat ze de academische ontwikkeling van alle leerlingen zoveel mogelijk kunnen stimuleren.

Eerder onderzoek heeft aangetoond dat leerkrachten en ouders een belangrijke rol spelen in het stimuleren van positief gedrag ten opzichte van school en in het benaderen van het belang van school. Door hun kinderen te motiveren om aan huiswerkopdrachten te werken en ze te helpen wanneer ze problemen of vragen hebben, kunnen ouders fungeren als positieve rolmodellen.

Leerlingen brengen echter veel tijd door op school met leeftijdsgenoten. Eerdere studies hebben dan ook laten zien dat de academische ontwikkeling op school samenhangt met de sociale ontwikkeling. In de schoolcontext ligt de focus op het vergaren van nieuwe kennis, maar het is voor scholen ook belangrijk om ervoor te zorgen dat leerlingen zich prettig en veilig voelen. Relaties met leeftijdsgenoten zijn erg belangrijk voor leerlingen en zich fijn voelen op school en in de klas is een voorwaarde om goed te kunnen presteren. Om zich ook te kunnen ontspannen op school, moeten leerlingen zich betrokken voelen bij hun leeftijdsgenoten. In pauzes kunnen ze bijvoorbeeld gezellig kletsen over hun hobby's, maar klasgenoten kunnen ook helpen wanneer leerlingen vragen hebben over schoolwerk. Wanneer leerlingen onderdeel zijn van de groep, zijn ze vaak meer gemotiveerd voor school en halen ze betere cijfers dan wanneer ze afgeweken of gepest worden. Met name vrienden blijken een belangrijke rol te spelen in schoolsucces, omdat ze steun kunnen bieden en prestaties kunnen beïnvloeden door het stimuleren van positieve of negatieve houdingen en gedrag ten opzichte van schooltaken.

Uit voorgaand onderzoek blijkt verder dat vriendschapsrelaties vaak gevormd worden met leeftijdsgenoten die hetzelfde gedrag vertonen als de leerling zelf en ook worden
Nederlandse samenvatting

leerlingen vaak beïnvloed door vrienden in hun gedragingen, zoals schoolmotivatie, concentratie, een actieve houding in de klas en schoolprestaties. Wanneer vrienden hoger presteren, kan dit motiverend werken en kan de leerling hulp krijgen. Wanneer vrienden echter lager presteren of andere activiteiten belangrijker vinden dan school, kan het ook juist afleiden van schooltaken en prestaties verlagen.

Naast hoe geliefd een leerling is in de klas, kan ook de populariteit van een leerling bij leeftijdgenoten schoolmotivatie en schoolprestaties beïnvloeden. Leerlingen die aardig gevonden worden hebben bijvoorbeeld over het algemeen meer motivatie en halen hogere cijfers dan leerlingen die niet aardig gevonden worden. Ook kan populariteit onder leeftijdgenoten een rol spelen in schoolprestaties. Aan de ene kant kan een hoge populariteit de academische ontwikkeling van leerlingen stimuleren, doordat ze meer ondersteuning kunnen ontvangen van medeleerlingen. Aan de andere kant kan, met name in de adolescentie, status ertoe leiden dat leerlingen zich meer bezighouden met sociale activiteiten buiten school en het gevoel hebben dat ze cool gedrag moeten vertonen om populair te blijven, zoals het drinken van alcohol, wat schoolprestaties vaak juist verlaagt.

Leeftijdgenoten, en vooral vrienden, kunnen dus een grote invloed uitoefenen op het gedrag van leerlingen. In de adolescentie wordt de rol van leeftijdgenoten belangrijker dan de rol van leerkrachten en ouders. Adolescenten brengen meer tijd door met leeftijdgenoten dan kinderen op de basisschool en vinden het belangrijk om erbij te horen en gedrag te vertonen dat gewaardeerd wordt door leeftijdgenoten. Dit is echter niet altijd het gedrag dat ouders en leerkrachten graag zouden willen zien. Ook is de adolescentie een periode waarin de identiteitssentwikkeling plaatsvindt en door cognitieve ontwikkelingen zijn adolescenten gevoeliger voor sociale vergelijkingen met leeftijdgenoten.

In dit proefschrift heb ik geprobeerd om meer inzicht te krijgen in de invloed van leeftijdgenoten op de schoolmotivatie en schoolprestaties van leerlingen. Hierbij heb ik gebruik gemaakt van sociale-netwerkinformation. Meer specifiek heb ik onderzocht in welke mate, onder welke omstandigheden en in welke richting leeftijdgenoten schoolmotivatie en schoolprestaties aanmoedigen of ontmoedigen. Ik heb naar de rol van negatieve sociale posities bij leeftijdgenoten gekomen, de rol van directe leeftijdgenoten en de bredere klascontext (vrienden, zitburen en klasennormen) en ik heb de wisselwerking tussen schoolprestaties en risicogedrag bekeken. Om dit te onderzoeken, heb ik data gebruikt waarbij leerlingen verschillende jaren gevolgd werden op zowel basisscholen als middelbare scholen in
Nederland en enkele keren per schooljaar vragenlijsten invullen. Ook heb ik leerkrachten geïnterviewd en gevraagd vragenlijsten in te vullen en heb ik rapportcijfers opgevraagd bij de schooladministratie. Als aanvulling op kennis uit eerder onderzoek, heb ik me gericht op verschillende aspecten die het belang van de interactie tussen de gedrangingen, relaties en nabijheid van leerlingen en hun leeftijdsgenoten benadrukken.

Ten eerste heb ik onderscheid gemaakt tussen *verschillende contexten* waarin leeftijdsgenoten een rol kunnen spelen in het academisch functioneren van leerlingen. Ik heb me gericht op de Nederlandse context, terwijl eerder onderzoek vooral in de Verenigde Staten is verricht. Daarnaast heb ik me gericht op het bredere sociale netwerk dan alleen op de vriendschapsrelaties van leerlingen. Zo heb ik bijvoorbeeld naar de rol van zitburen op de basisschool gekeken, aangezien kinderen deze klasgenoten het meeste zien tijdens de schooldag en de meeste interacties met hen hebben. Verder heb ik bekeken of acceptatie door, afwijzing door of populariteit bij leeftijdsgenoten belangrijk zijn voor het academisch functioneren van leerlingen.

Ten tweede heb ik onderzocht of er verschillen zijn in de rol van leeftijdsgenoten op *verschillende tijdmomenten*. Op de basisschool hebben leerlingen bijvoorbeeld de gehele dag vaste zitplaatsen, terwijl leerlingen op de middelbare school wisselen tussen klaslokalen en vaak bij verschillende klasgenoten zitten door de dag heen en les krijgen van diverse leerkrachten. Ook veranderen de houdingen van leerlingen tegenover school door de jaren heen: terwijl leerlingen op de basschool over het algemeen graag goed willen presteren om aan de verwachtingen van ouders en leerkrachten te voldoen, ontwikkelen adolescenten op de middelbare school hun eigen identiteit, zoeken ze hun sociale positie bij leeftijdsgenoten en willen ze voldoen aan de heersende normen. Bovendien kunnen er verschillen zijn in processen tussen schooljaren. Aan het einde van de basisschool kennen klasgenoten elkaar vaak al verschillende jaren, dus het selecteren van vrienden en beïnvloeding door vrienden heeft wellicht al plaatsgevonden in eerdere jaren. Daarentegen kennen leerlingen in de eerste klas van de middelbare school elkaar vaak nog niet en moeten ze hun sociale positie in de klas nog vinden. Dit zou misschien tot een meer dynamisch vriendschapsnetwerk kunnen leiden, met meer wisselende vriendschappen en meer aanpassing van eigen gedrag aan het gedrag van vrienden.

Ten derde heb ik gekeken naar de *sterkte en richting* van vriendschapsselectie en beïnvloedingsprocessen. Als iemand goed presteert op school, kunnen leeftijdsgenoten juist
wel of geen vriendschappen met diegene willen sluiten. Ook kan beïnvloeding door vrienden in
de positieve of negatieve richting gaan. Hoogpresteerders kunnen schoolprestaties van lager
presterende leeftijdsgenoten bevorderen, maar laagpresteerders kunnen ook juist de
prestaties van hoger presteerden naar beneden halen. Het is daarnaast mogelijk dat dit
verschilt per klas en afhankt van de geldende klassennormen.

Ten vierde en als laatste, heb ik de wisselwerkingen tussen verschillende gedragingen en ervaringen onderzocht. Zo heb ik meer inzicht verkregen in de rol van negatieve sociale
posities bij leeftijdsgenoten, zoals slachtofferschap van pesten, het niet hebben van vrienden
en de sociale status van leerlingen. Bovendien heeft eerder onderzoek zich slechts gericht op
één specifieke gedraging, waarmee de complexiteit van alle verschillende gedragingen van
leerlingen wordt genegeerd. Daarom heb ik me naast het academisch functioneren van
leerlingen ook gericht op risicogedrag in adolescentie, omdat adolescenten vaak minder
gemotiveerd worden voor school en juist meer geneigd zijn om risicogedrag te gaan vertonen.

SAMENVATTING PER STUDIE

In hoofdstuk 2 heb ik me gericht op vier negatieve sociale posities van basisschoolleerlingen bij
hun leeftijdsgenoten, namelijk gepest worden, het niet hebben van vrienden, afgewezen
worden en niet populair zijn. Eerder onderzoek heeft aangetoond dat deze vier aspecten
belangrijk zijn voor het schoolwelbevinden en presteren van leerlingen. In mijn onderzoek heb
ik naar het cumulatieve effect van deze vier negatieve sociale posities gekeken op de zelf-
gerapporteerde schoolbetrokkenheid en het schoolwelzijn van leerlingen (Studie 1) en de door
de leerkracht gerapporteerde schoolbetrokkenheid en schoolprestaties (Studie 2). Ook heb ik
gekeken of bepaalde combinaties van negatieve sociale posities negatiever zijn gerelateerd aan
deze uitkomstmaten dan andere.

Resultaten toonden aan dat iedere negatieve sociale positie negatief samenhang met
het academisch functioneren van leerlingen en ook het totale aantal negatieve sociale posities
bleek gerelateerd: hoe meer negatieve sociale posities, hoe lager het academisch functioneren
van leerlingen. Voor schoolwelzijn en betrokkenheid vond ik sterkere verbanden dan voor
schoolprestaties. Cumulatieve effecten werden gevonden voor schoolwelzijn, waarbij elke
toegevoegde negatieve sociale positie een extra groot negatief toegevoegd effect had. Het
verschil tussen het hebben van vier of drie negatieve sociale posities was bijvoorbeeld groter
dan het verschil tussen het hebben van drie of twee negatieve sociale posities. Ten slotte waren
combinaties van negatieve sociale posities waarin gepest worden of het niet hebben van vrienden voorkwamen sterker negatief gerelateerd aan het academisch functioneren dan andere combinaties. Veiligheid en affectie bleken dus de meest essentiële sociale aspecten voor leerlingen om zich prettig te voelen, gemotiveerd te zijn voor school en goede prestaties te halen.

Deze resultaten bevestigen het belang van sociale relaties voor het academisch functioneren van leerlingen. Dit betekent dat leerkrachten en leerlingen een goede sociale positie van leerlingen in het netwerk van leeftijdsgenoten moeten stimuleren. Het is belangrijk dat leerkrachten zich niet alleen richten op het academisch functioneren van leerlingen, maar zich ook realiseren dat sociale relaties en welzijn cruciaal zijn voor een gezonde ontwikkeling.

Hebben bepaalde leeftijdsgenoten die dichtbij zijn in de klas op de basisschool misschien een extra belangrijke rol in de schoolmotivatie en prestaties van leerlingen? Leerkrachten bepalen de zitplaatsen van de leerlingen in de klas en daarmee ook welke leerlingen elkaar het meeste zien tijdens de lessen. Het doel van het onderzoek in hoofdstuk 3 was om te onderzoeken hoe belangrijk zitburen op de basisschool zijn voor schoolbetrokkenheid en schoolprestaties van leerlingen, rekening houdend met de vriendschappen van leerlingen.

Resultaten gaven aan dat vrienden meer op elkaar gingen lijken door het schooljaar heen wat schoolbetrokkenheid en schoolprestaties betreft, ongeacht waar ze zaten in de klas. Leerlingen gingen echter minder lijken op zitburen die geen vrienden waren. Deze grotere verschillen door de tijd heen zouden veroorzaakt kunnen worden doordat leerlingen ontmoedigd raken wanneer anderen waar ze niet mee bevriend zijn beter scoren of juist aangemoedigd worden wanneer zijzelf beter scoren dan anderen. Dit is echter alleen gevonden voor zitburen die geen vrienden zijn, wat zou kunnen betekenen dat leerlingen zich meer afzetten tegen het gedrag van klasgenoten die geen vrienden zijn en zich meer aanpassen aan het gedrag van vrienden.

Dit onderzoek draagt bij aan kennis over de rol van leeftijdsgenoten die fysiek dichtbij zijn in de klas op het academisch functioneren van leerlingen. Ook is het de eerste studie die hiervoor een sociale-netwerkbenadering heeft gebruikt. Leerkrachten kunnen deze inzichten toepassen bij het bepalen van de zitplaatsen van kinderen in de klas en bij het monitoren van sociale dynamieken in de klas, door zich actief bewust te zijn van de wisselwerking tussen de
vriendschappen van leerlingen, hun zitplaatsen in de klas en beïnvloedingsprocessen met betrekking tot schoolbetrokkenheid en schoolprestaties.

Wanneer leerlingen de basisschool verlaten, komen ze op een nieuwe school met veel nieuwe leeftijdsgenoten. Binnen deze groep moeten ze opnieuw hun plek zoeken en vriendschappen sluiten. **Hoofdstuk 4** richt zich op de selectie van vrienden en beïnvloedingsprocessen met betrekking tot schoolprestaties van leerlingen in het eerste en tweede jaar van de middelbare school. Hiervoor onderzocht ik gemiddelde schoolcijfers en cijfers op verschillende type vakken (cluster-specifiek met betrekking tot talen, exacte vakken en sociale vakken) en ook verschillen in richtingen voor laag- en hoogpresteerders.

Ik vond verschillen tussen de eerste twee jaren van de middelbare school. Terwijl selectieprocessen in het eerste jaar waren gevonden voor cijfers bij dezelfde type vakken, werden invloedprocessen gevonden in het tweede jaar op zowel cluster-specifieke als gemiddelde schoolcijfers. Leerlingen selecteerden dus in het eerste jaar vrienden op basis van gelijke cijfers bij dezelfde type vakken en een jaar later werden schoolcijfers meer gelijk aan cijfers van vrienden. Een conclusie van dit onderzoek is dat er ontwikkelingsverschillen zijn en dat specifieke schoolvakken belangrijk zijn om vriendschapsselectie en -invloedprocessen te begrijpen in de schoolcijfers van adolescenten.

Naast het directe effect van vrienden op schoolcijfers van adolescenten, kan ook de klasencontext van belang zijn. Bevindingen met betrekking tot vriendschapsprocessen verschillen in sterkte en richting tussen studies, dus richtte ik me op de klasencontext om deze verschillen te verklaren. In **hoofdstuk 5** heb ik statusnormen in vriendschapsselectie en beïnvloedingsprocessen in schoolprestaties onderzocht.

Klassennormen voor schoolprestaties kunnen gedefinieerd worden als de mate waarin schoolprestaties positief of negatief gewaardeerd worden door klasgenoten door het verkrijgen van een hoge of juist lage sociale status. Het doel was om te bekijken of de sterkte en richting van selectie en beïnvloedingsprocessen afhangen van de heersende klassennorm.

Met name de populariteitsnorm bleek selectieprocessen met betrekking tot schoolprestaties te beïnvloeden. Wanneer schoolprestaties leidden tot een lage populariteit werden laagpresteerders meer bevriend met elkaar. Wanneer schoolprestaties leidden tot een hoge populariteit, waren leerlingen met dezelfde schoolprestaties meer geneigd om vrienden
met elkaar te worden, zowel laag- als hoogpresteerders. Normen met betrekking tot acceptatie en afwijzing bleken geen effect te hebben op de sterkte en richting van vriendschapsprocessen. Kortom, leerlingen kozen vaak vrienden op basis van dezelfde schoolprestaties en hun cijfers werden beïnvloed door vrienden. Het bleek voor de sterkte en richting van selectieprocessen van belang of schoolprestaties in een klas tot populariteit leidden.

Naast het onderzoeken van academisch functioneren van leerlingen op de middelbare school, aangezien schoolmotivatie vaak afneemt in de adolescentie, is het ook belangrijk om risicogedrag te onderzoeken, omdat adolescenten gevoelig zijn om risicogedrag te gaan vertonen. Daarom was het doel van het onderzoek in hoofdstuk 6 om de wisselwerking tussen schoolprestaties en risicogedrag (alcoholgebruik en delinquentie) van adolescenten en hun vrienden te onderzoeken.

Ik richtte me op vriendschapsprocessen binnen beide gedragingen (schoolprestaties en risicogedrag) en tussen beide gedragingen in de eerste drie jaren van de middelbare school. Binnen gedrag vond ik dat leerlingen elkaar selecteerden op basis van hetzelfde gedrag en dat vrienden over de tijd heen meer op elkaar gingen lijken. Voor delinquentie vond ik inconsistentie resultaten, met alleen effecten in het tweede en derde schooljaar. Selectie-effecten tussen gedrag toonden in de eerste twee klassen aan dat leerlingen die risicogedrag vertoonden meer geneigd waren om bevriend te raken met laagpresteerders, terwijl leerlingen die geen risicogedrag vertoonden juist eerder vrienden werden met hoogpresteerders. Invoed tussen risicogedrag en schoolprestaties van leerlingen en hun vrienden werd alleen gevonden in de eerste klas: laag presterende vrienden vergrooten de kans om later risicogedrag te gaan vertonen terwijl hoog presterende vrienden die kans juist verkleinden.

Samengevat laat dit onderzoek zien dat het belangrijk is om de wisselwerking tussen verschillende gedragingen te onderzoeken door middel van sociale netwerkanalyse. Door zich alleen te richten op vriendschapsselectie en beïnvloeding door vrienden op één gebied, gaat er informatie verloren over de complexe socialiserende rol van leerlingen en hun vrienden op verschillende gedragingen.
DISCUSSIE EN TOEKOMSTIG ONDERZOEK

De studies in dit proefschrift laten zien dat sociale relaties van leerlingen met leeftijdsgenoten en hun inbedding in het sociale netwerk erg belangrijk zijn voor hun schoolbetrokkenheid en prestaties. Positieve relaties met leeftijdsgenoten kunnen de academische ontwikkeling stimuleren en het is van belang om verschillen tussen leeftijden en schooljaren mee te nemen bij het onderzoeken van sociale netwerken van leerlingen.

Door sociale netwerkinformatie te gebruiken, verschillende typen sociale netwerken te bestuderen en verscheidene academische gedragingen en risicogedrag bij basisschool- en middelbare school leerlingen te bekijken, heb ik nieuwe stappen gezet ten opzichte van eerder onderzoek. De focus van de vijf studies was op de interactie tussen drie aspecten die centraal staan in sociale netwerkstudies, namelijk gedrag, relaties en nabijheid, om te onderzoeken hoe en wanneer leeftijdsgenoten van belang zijn in het academische functioneren van leerlingen. Ik heb meer inzicht verkregen in contextuele verschillen, verschillen tussen tijdsmomenten, de wisselwerking tussen gedragingen en de sterkte en richting van selectie- en invloedprocessen.

Met betrekking tot de verschillende contexten, blijkt dat nieuwe implementaties in sociale netwerkanalyse het mogelijk maken om een statisch netwerk (zitplaatsen) te onderzoeken naast meer dynamische netwerken, zoals vriendschappen. Vooral vrienden zijn belangrijk voor schoolmotivatie en prestaties, maar ook fysieke nabijheid is van belang, aangezien sommige zitburen schoolmotivatie stimuleren of juist verlagen.

Wat de verschillende tijdsmomenten betreft, blijkt dat leeftijdsgenoten al een belangrijke rol spelen in het academisch functioneren van basisschoolleerlingen, met name in hun schoolwelzijn en betrokkenheid en minder in hun schoolprestaties. Ook toont mijn onderzoek dat leerlingen die meer negatieve sociale posities hebben bij leeftijdsgenoten, zoals slachtofferschap van pesten of het ontbreken van vriendschappen, minder schoolmotivatie en een lager schoolwelzijn hebben. Op de middelbare school vond ik verschillen tussen het eerste en tweede schooljaar, waarmee het belang van het onderzoeken van leerlingen in verschillende schooljaren wordt onderstreept. Het eerste schooljaar is namelijk een nieuwe schoolcontext voor leerlingen met voornamelijk onbekende klasgenoten, terwijl ze elkaar in het tweede jaar al beter kennen. Verschillen in selectie en invloed tussen die schooljaren zouden verklaard kunnen worden doordat leerlingen in het eerste jaar gelijkgestemden als vrienden zoeken en in het tweede jaar pas daadwerkelijk meer op elkaar gaan lijken. Misschien worden leerlingen eerder al wel beïnvloed door positief of negatief schoolgedrag van vrienden, maar kost het wat
tijd om daadwerkelijk hun schoolcijfers te veranderen. Het is namelijk vrij gemakkelijk om meer
gemotiveerd te raken voor bepaalde schooltaken, maar ondanks harder werken is het lastiger
om direct gemiddeld veel hogere cijfers te halen.

Een ander innovatief aspect van dit proefschrift is om de *sterkte en richting* van selectie
en invloed processen te onderzoeken. Gelijkheid in schoolprestaties faciliteert vriendschappen
voor zowel hoog- als laagpresteerders, maar vooral hoogpresteerders blijken laagpresteerders
tevormigen als vriend. Invloedprocessen tussen vrienden gingen vooral in de opwaartse
richting, waarbij leerlingen hogere schoolprestaties haalden wanneer ze hoger presterende
vrienden hadden. Dit zou verklaard kunnen worden doorga het delen van informatie en door het
motiveren van elkaar voor school. Deze resultaten kunnen echter negatieve gevolgen hebben
voor laagpresteerders, doordat laagpresteerders elkaar opzoeken als vriend en dus weinig
mogelijkheden hebben om positief beïnvloed te worden door vrienden. Hierdoor gaan ze nog
verder onderpresteren, omdat ze niet kunnen leren van hoger presterende leeftijdsgenoten.
Dit kan leiden tot een negatieve vicieuze cirkel, waarbij laagpresteerders nog lager gaan
presteren en hoogpresteerders nog hoger en hierdoor de verschillen tussen deze leerlingen
nog groter worden (polarisatie). Daarom lijkt het belangrijk om contact tussen laag- en
hoogpresteerders te stimuleren.

Ik heb ook wisselwerkingen tussen *verschillende gedragingen* onderzocht, door
dynamieken in selectie en invloed tussen adolescenten en hun vrienden te bestuderen met
betrekking tot schoolprestaties en risicogedrag. Delinquentie en alcoholgebruik komen
namelijk meer voor in de adolescentie en worden meer normatief. Nieuwe mogelijkheden
binnen sociale netwerkanalyse maakten het mogelijk om effecten *binnen* en *tussen*
gedragingen te onderzoeken. Resultaten tonen aan dat adolescenten die risicogedrag vertonen
vaak lagere schoolcijfers hebben dan anderen die geen risicogedrag vertonen. Vooral in het
eerste jaar van de middelbare school blijkt dat het hebben van hoog presterende vrienden kan
beschermen tegen betrokkenheid in risicogedrag terwijl laag presterende vrienden juist de
kans vergroten om risicogedrag te gaan vertonen. Deze wisselwerking tussen adolescenten en
hun vrienden in de twee gedragingen (schoolprestaties en risicogedrag) werd met name
gevonden op een relatief jonge leeftijd, wanneer alcoholgebruik nog niet veel voorkomt en niet
normatief is.

Gebaseerd op de bevindingen en inzichten die ik verkregen heb in dit proefschrift over
de rol van leeftijdsgenoten in het academisch functioneren van leerlingen, zijn er verschillende
aanbevelingen voor vervolgonderzoek. In het algemeen zou er meer onderzoek verricht moeten worden om de gehele sociale context van leerlingen mee te nemen, evenals individuele cognitieve verschillen. Dit kan leiden tot meer kennis over waarom en wanneer bepaalde leerlingen op, boven of onder hun niveau presteren en welke omstandigheden en condities academisch functioneren beinvloeden.

Interacties tussen verschillende sociale netwerken van leerlingen kunnen bijvoorbeeld worden onderzocht, zoals vriendschappen binnen en buiten de school, de rol van ouders en de rol van leerkrachten. Sommigen zullen namelijk juist positief gedrag ten opzichte van school stimuleren en helpen met schoolzaken en huiswerkvrages en –opdrachten, terwijl anderen leerlingen zouden kunnen afleiden van schoolwerk, bijvoorbeeld omdat ze school minder belangrijk vinden of juist meer gericht zijn op ontspanning en hobby’s. Eerder onderzoek richt zich echter met name op vrienden van leerlingen, door leerlingen in vragenlijsten hun vrienden te laten aantrekken in een lijst met mogelijke vrienden (klasgenoten of jaargenoten op school).

Nieuwe longitudinale projecten kunnen een directer en dieper perspectief krijgen op vriendschapsprocessen door meer gedetailleerde vragen te stellen. Zo kan leerlingen gevraagd worden om op basis van de kwaliteit van de vriendschap onderscheid te maken tussen de leeftijdsgenoten die ze selecteren als vriend. Leerlingen hebben namelijk een hechtere band en meer interacties met sommige vrienden dan met andere vrienden. Leerlingen kunnen zelf aangeven wat de kwaliteit van de vriendschap is, maar de hoeveelheid interacties tussen leerlingen kunnen ook geobserveerd worden. Daarnaast kan nabijheid ook anders gemeten worden door recente technologische ontwikkelingen. Innovatieve technieken via Bluetooth apparaten kunnen nu automatisch fysieke nabijheid tussen mensen meten. Leerlingen kunnen deze apparaten dragen en op deze manier kan er meer kennis vergaard worden over het belang van sociaal contact in het voorspellen en verklaren van het gedrag van leerlingen, zoals hoe lang contact tussen leerlingen duurt, de hoeveelheid contacten van leerlingen en de diversiteit aan contacten.

De onderliggende assumptie binnen de huidige analyses is dat alle vriendschappen even belangrijk zijn. Sommige aspecten kunnen echter belangrijker zijn binnen de ene vriendschap dan binnen de andere. Terwijl leerlingen naar specifieke vrienden zullen gaan voor school gerelateerde vragen of samen leren met hen, spenderen ze hun vrije tijd of gaan ze sporten met andere vrienden. Vervolgonderzoek kan hier meer gedetailleerd naar vragen bij leerlingen, zodat selectie- en invloedprocessen met betrekking tot bepaalde gedragingen ook gelinkt
kunnen worden aan de vrienden met wie leerlingen daadwerkelijk deze interesses of gedragingen delen.

Dit sluit aan bij eerder onderzoek, waarbij hulpnetwerken zijn onderzocht naast vriendschapsnetwerken. In deze studies is aan leerlingen een algemene vraag gesteld over welke leeftijdsgenoten helpen wanneer ze problemen hebben (bijvoorbeeld met huiswerk, het repareren van een lekke band of wanneer iemand zich niet goed voelt). Een volgende stap zou zijn om hier meer specifieke vragen over te stellen, dus met welke leeftijdsgenoten ze bijvoorbeeld ‘huiswerk maken’ of ‘samen sporten buiten schooltijd’.


Verdere ontwikkelingen van statistische technieken maken het bovendien mogelijk om naast de rol van vriendschappen ook andere netwerken tegelijkertijd te onderzoeken. Het is interessant voor vervolgonderzoek om meer statische netwerken te bekijken, bijvoorbeeld om meer inzicht te krijgen in de rol van nabijheid van bepaalde leeftijdsgenoten (zoals zitplaatsen) op het gedrag van leerlingen. Binnen dit onderzoek kunnen bijvoorbeeld strategieën van leerkrachten omtrent de zitplaatsindeling gelinkt worden aan wat daadwerkelijk gebeurt in de klas en kunnen verschillende typen indelingen met elkaar vergeleken worden. Ook kunnen door nieuwe ontwikkelingen interacties tussen verschillende gedragingen van leerlingen en hun vrienden onderzocht worden. Dit biedt mogelijkheden om complexe interacties tussen gedragingen in kaart te brengen, maar het is ook interessant om overeenkomstige onderliggende mechanismen te onderzoeken. Zo kan de mate van zelfcontrole wellicht zowel schoolprestaties als risicogedrag van jongeren verklaren.
Verschillen tussen jongens en meisjes zouden ook nog meer onderzocht kunnen worden, aangezien vriendschappen vaak gesloten worden tussen leerlingen met dezelfde sekse en vriendschappen tussen jongens en meisjes verschillen. Zo is er vaak meer emotionele betrokkenheid bij meisjes dan jongens, hebben zij meer interacties in tweetallen, is er een sterkere focus op het erbij horen in de sociale groep en werken ze vaak meer samen aan schooltaken. Er zijn slechts enkele studies die zich hebben gericht op verschillen in sterktes van vriendschapsselectie en -invloedprocessen tussen jongen en meisjes. In een studie zijn sterke selectie effecten in schoolprestaties voor meisjes gevonden, maar geen selectie bij jongens en gelijke beïnvloeding voor jongens en meisjes. Daarom lijkt het belangrijk om geslacht specifieke verschillen te onderzoeken en de mechanismen die hierin een rol kunnen spelen.

Bovendien zou het interessant zijn om leerlingen te volgen vanaf de basisschool tot ze naar de arbeidsmarkt gaan om op deze manier meer inzicht te verkrijgen in individuele schoolloopbanen van leerlingen. Dit kan kennis vergroten over welke omstandigheden en welke individuele en contextuele aspecten invloed kunnen hebben op waarom sommige leerlingen presteren zoals verwacht, terwijl anderen lager of hoger presteren dan verwacht. Het is echter moeilijk om sociale netwerkinformatie over een dergelijk lange tijdsperiode te verkrijgen, aangezien leerlingen wisselen van scholen en de leeftijdsgenoten telkens veranderen.

Ten slotte zou er meer inzicht verkregen moeten worden in mechanismen achter vriendschapsselectie en -invloed in gedrag en hoe bepaalde interventies en de aanpak van leerkrachten en ouders academisch functioneren kunnen bevorderen. Ik moedig onderzoekers aan om in nieuwe studies onderliggende theorieën explicieter te testen, bijvoorbeeld door gedrag van en interacties tussen leerlingen te observeren en door interventies op te zetten waarin het netwerk van leerlingen wordt bepaald (bijvoorbeeld de zitplaatsen) om de effecten te onderzoeken op vriendschapsrelaties en gedrag van leerlingen.

Kortom, dit proefschrift biedt verschillende vernieuwende en interessante inzichten in de interactie tussen sociale relaties van leerlingen met hun leeftijdgenoten en hun academisch functioneren. Toekomstig onderzoek zou meer kennis kunnen vergaren door meer gedetailleerde informatie te verzamelen over de sociale relaties van leerlingen en gebruik te maken van nieuwe ontwikkelingen binnen sociale netwerkanalyse om complexe netwerken en gedragingen te analyseren.
References


References


References


Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., &
References


References


Jeynes, W. H. (2002). The relationship between the consumption of various drugs by


References


Snijders, T. A. B., Steglich, C. E. G., & Schweinberger, M. (2007). Modeling the co-


References


Dankwoord (Acknowledgements)
Ongeveer vier jaar geleden kwam er een mail binnen met een vacature voor een PhD project. Vanwege het interessante onderwerp, heb ik vrij impulsief een mail gestuurd om meer informatie te verkrijgen over de sollicitatieprocedure. Twee dagen later waren mijn motivatiebrief, CV en cijferlijsten al bekeken door een commissie en had ik een gesprek. Oh, het project is in Groningen... Nou, dan pak ik na een avondje met de studievereniging Maïzena wel gewoon de trein daarheen en ik zie wel hoe het gaat lopen. Na een korte wandeling in de binnenstad, was het een erg goed gesprek op de universiteit. Er was een prettige klik met de begeleiders en de sfeer op de afdeling voelde fijn. Een dag later heb ik dan ook besloten dat ik na de zomer zou gaan starten als PhD student. Een onverwachtse en plotselinge stap, voor iedereen om me heen en voor mezelf, maar een geweldige kans met veel uitdagingen. Vanaf de eerste dag heb ik me enorm thuis gevoeld op het werk, maar ook in de stad Groningen.

Allereerst wil ik mijn (co-)promotoren René Veenstra, Jan Kornelis Dijkstra en Christian Steglich enorm bedanken. Het vertrouwen dat werd uitgestraald tijdens mijn sollicitatie bleef ook de afgelopen vier jaar aanwezig en heeft ervoor gezorgd dat ik mezelf flink heb kunnen ontwikkelen.

René, ondanks dat we geen structurele afspraken hadden over mijn project, wist je toch altijd precies waar ik mee bezig was en toonde je betrokkenheid voor mijn activiteiten naast het werk, zoals het sporten en het verkennen van leuke plekken in het noorden op de fiets. Je hebt me meerdere keren verrast door me beter te kennen dan ik had verwacht, bijvoorbeeld toen je mijn eigenschappen heel goed wist te benoemen voor de loopbaantraining. Ik heb ontzettend veel van je geleerd door jouw gedrevenheid, successen, connecties tijdens congressen en ook door de inhoud van het proefschrift altijd concreet te relateren aan praktijksituaties van bijvoorbeeld jouw kinderen op school.

Jan Kornelis, ik had me geen betere dagelijkse begeleider kunnen wensen. Bij elk artikel heb je heel actief meegedacht en jouw positivisme tijdens de bijeenkomsten maakte dat ik altijd met een relaxed en fijn gevoel door kon gaan. Je hebt inhoudelijk erg veel bijgedragen aan alle artikelen, heel erg bedankt daarvoor! Daarnaast was het ook altijd erg gezellig om bij te kletsen over van alles en toonde je veel interesse in mijn leven buiten het werk om. Regelmátig gingen
Dankwoord

we ook ‘een bakje doen’, met voor jou standaard een verse gevulde koek erbij. Ook bij het lesgeven waren we echt een team en ging het altijd soepel.

Christian, zonder jouw hulp had ik nooit zulke complexe statistische analyses kunnen uitvoeren. Wat een geluk dat ik jou als expert in mijn team had. Je hebt me heel veel uitleg en hulp gegeven en dit heeft geresulteerd in uitdagende en gevarieerde analyses. Je liet me actief meedenken bij het schrijven van de R scripts en ik heb vaak vol bewondering gekeken hoe gemakkelijk die programmeertaal voor jou is. Bedankt dat je altijd klaarstond op de momenten dat het echt even nodig was om vlot door te kunnen.

Mijn dank gaat uiteraard ook uit naar mijn co-auteurs. Yvonne, jouw enthousiasme is ongekend en ik ben blij dat we de samenwerking hebben voort kunnen zetten na de Research Master. Gerine, je was een geweldige collega in alle opzichten. Leuk dat we hebben kunnen samenwerken aan een interessant paper. Lydia, toen we allebei hetzelfde wilden gaan onderzoeken met de SNARE dataset, hebben we besloten om samen te werken. Ik heb erg veel geleerd van jouw aanpak en het is een mooi artikel geworden.

Of course, I also want to express many thanks to my supervisors and co-authors during my internships, Allison Ryan and Christian Berger. You were both very great hosts and I felt more than welcome in Michigan and Santiago. Besides the success of the research paper that we have written together, you both gave me many opportunities to be involved in your research groups, but you also gave me the freedom and chance to explore the countries. It was a great experience, I learned a lot from you and I am very happy that we are still in touch and regularly meet for beers at conferences.

Furthermore, I would like to thank the members of the reading committee, Robert Crosnoe, Tom Snijders, and Toon Cillessen, for their feedback on my dissertation.

Verder ben ik ook mijn jaargroep (Renske, Chaïm, Thomas, Dieko en Natalia) onzettend dankbaar. Vanaf de eerste dag zijn we echt een groep en naast dat dat een van de redenen was om met plezier naar het werk en kantoor toe te gaan, hebben we buiten het werk om ook veel jaargroep etentjes en uitjes gehad. De reizen naar Barcelona en Bergamo/Milaan zijn onvergetelijk. Natalia, great that we visited you in Barcelona, that you were able to join us to
Italy and that you had several opportunities to do internships in Groningen. I really hope to have many more year group dinners in the future, wherever we will all work and live...

Ook wil ik collega’s binnen het ICS en mijn onderzoeksgroep bedanken, de WALM, voor de betrokkenheid en verfrissende en kritische blikken op mijn werk. De wekelijkse bijeenkomsten waarin we elkaars werk bespraken en de schrijfweken waren erg nuttig en het was lekker om publicaties te vieren met taart! Maaike, ondanks dat je in België werkt, is het altijd direct heel gezellig wanneer we elkaar weer zien. Ook hebben we echt een toffe reis naar New York gemaakt en was je altijd bij onze schrijfweken, waar werk en lol perfect afgewisseld werden. Marianne, jou wil ik natuurlijk ook nog specifiek benoemen. De laatste jaren zijn we goede vriendinnen geworden en naast afleiding van werk met lekkere cappuccino’s en gezellige gesprekken, hebben we ook regelmatig samen geluncht en taartjes gegeten. Ook ben ik je op gaan zoeken in LA tijdens je stage en hebben we geweldige reizen gemaakt door heel de VS en veel mooie avonturen beleefd! Ik ga je missen op en buiten het werk.

Gelukkig blijven goede vriendschappen bestaan, ondanks dat ik ‘helemaal naar Groningen’ ben verhuisd. Onder andere Natascha, Dorian, Jeanine, Sasja, Vera, Petrie, Nick, Sander, ik ben echt heel blij dat we elkaar zo regelmatig zien en iedereen bereid is om te reizen! Sander wil ik ook nog apart bedanken, want hij heeft de mooie kaft van mijn proefschrift ontworpen. Ik vind het erg fijn dat ik in Groningen ook veel vriendschappen heb opgebouwd naast het werk, bijvoorbeeld via Veracket (tennis) en met (oud) huisgenoten. Mirjam, onze wekelijkse ententies, altijd met toetje, waren erg gezellig en lekker!

Tot slot wil ik me nog richten tot mijn familie. Oma, je vindt het altijd erg gezellig als ik op bezoek kom en ik word flink door je verwend. Als ik een paar weken op rij niet langs kan komen, dan begrijp je dat en kletsen we gewoon bij door te bellen. Je weet dan ook erg goed wat ik allemaal aan het doen ben en daar heb ik echt bewondering voor. Roel, Martijn en Eline, gelukkig zien we elkaar heel regelmatig en houden we elkaar op de hoogte van onze meest belangrijke bezigheden. Het was dan ook altijd fijn om jullie interesse te merken wanneer ik liet weten dat er bijvoorbeeld een artikel gepubliceerd was. Roel, gaaf om te zien dat je helemaal op je plek zit in Den Haag en ik zal regelmatig langskomen! Martijn, Siobhan, Eline en Bas, jullie zal ik zeker
Dankwoord

ook vaker gaan zien in Nijmegen nu ik dichtbij kom te wonen, voor de gezelligheid en natuurlijk om te helpen als oppas.

Mama en papa, ondanks dat ik nog veel op en neer ben gereisd om jullie te zien, ben ik blij dat we daarbuiten ook altijd ontzettend veel contact hebben. Zelfs toen ik drie maanden naar het buitenland ging, hadden we nog dagelijks contact. Jullie hebben je flexibel opgesteld toen ik naar Groningen ben verhuisd en zijn regelmatig langsgekomen. Ook benadrukten jullie constant dat jullie me zagen ontwikkelen en dat ik veel geweldige kansen kreeg, zoals alle mooie reizen die ik heb kunnen maken. Jullie ondersteunen me altijd volledig in wat ik doe en daar ben ik jullie heel erg dankbaar voor. Papa, het was altijd super gezellig en lekker ontspannen als je langskwam: wij hebben samen heel Grunn en omgeving ontdekt tijdens jouw mini-vakanties bij mij!

Nu op naar een nieuwe stap, als onderzoeker bij CINOP in Den Bosch. Een geweldige uitdaging, waar ik erg naar uit kijk. Maar eerst nog mijn proefschrift verdedigen. Marianne en Martijn, paranimfen, ik ben blij dat jullie me bij willen staan tijdens deze bijzondere dag.
ICS Dissertation Series
The ICS series presents dissertations of the Interuniversity Center for Social Science Theory and Methodology. Each of these studies aims at integrating explicit theory formation with state of the art empirical research or at the development of advanced methods for empirical research. The ICS was founded in 1986 as a cooperative effort of the universities of Groningen and Utrecht. Since 1992, the ICS expanded to the University of Nijmegen and since 2017 to the University of Amsterdam (UvA). Most of the projects are financed by the participating universities or by the Netherlands Organization for Scientific Research (NWO). The international composition of the ICS graduate students is mirrored in the increasing international orientation of the projects and thus of the ICS series itself.


92. Marcel van Egmond (2003). Rain falls on all of us (but some manage to get more wet than others): Political context and electoral participation. ICS-dissertation, Nijmegen.


Mariola Gremmen was born on May 8, 1992 in Oss, the Netherlands. She started her undergraduate studies in Pedagogics and Educational Science in 2009 and then enrolled in the Research Master’s program in Behavioural Science (2012) at the Radboud University Nijmegen, with graduation in 2014. Afterwards, she was appointed as PhD candidate at the ICS graduate school in Groningen. As part of her PhD project, she spent in total three months at the University of Michigan and the Pontifical Catholic University of Chile in Santiago, to collaborate with Allison Ryan and Christian Berger. As of September 2018, she is employed as researcher at CINOP, Den Bosch.