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Social network processes and academic functioning

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Introduction

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.

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

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,

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

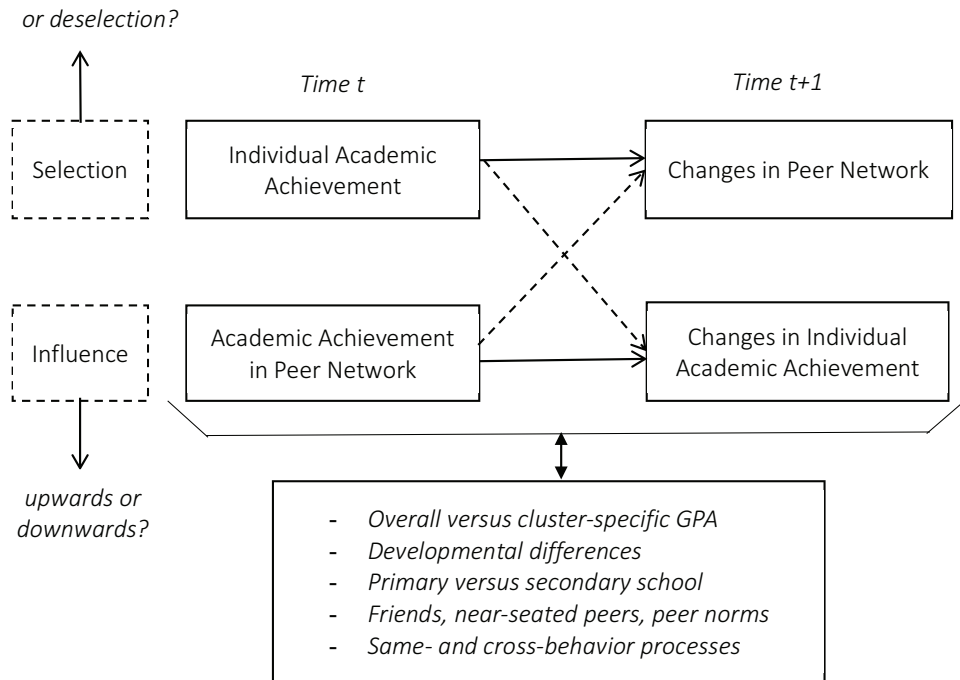
between near-seated peers, between friends, the role of group norms, and the interplay between risk behaviors and academic achievement, expecting that underachievement of students can be explained by peer processes in the classroom and school.

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 eight 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.

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 1.1: Overview of Chapters 2-6

Chapter	Title	Main research aims	Data and sample	Analytical Strategy
2	Students' negative social positions among peers and their academic functioning <i>Cumulative and combined effects of victimization, friendlessness, peer rejection, and a lack of peer popularity</i>	<ul style="list-style-type: none"> - 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 4 th -6 th grade students	Mixed model approach (multilevel)
3	The importance of near-seated peers for elementary students' academic engagement and achievement	<ul style="list-style-type: none"> - 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 4 th -6 th 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	<ul style="list-style-type: none"> - 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 7 th -8 th grade students	RSiena
5	The role of status norms in friendship selection and influence related to academic achievement	<ul style="list-style-type: none"> - Examining the role of academic status norms in friendship selection and influence processes - Exploring the strength and direction of these processes 	SNARE 8 th grade students	RSiena
6	Adolescents' friendships, academic achievement, and risk behaviors: Same-behavior and cross-behavior selection and influence processes	<ul style="list-style-type: none"> - Examining the interplay between adolescents' academic achievement and risk behaviors - Exploring differences between the first three years of secondary education 	SNARE 7 th -9 th grade students	RSiena Both same- and cross-behavior selection and influence effects