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The importance of near-seated peers for elementary students' academic engagement and achievement

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ABSTRACT

Although students are part of a group of classmates, they spend the majority of 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; *M*age = 10.65 years, range = 8–12).

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

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 et al., 2013; Gremmen et al., 2017; Rambaran et al., 2017; Shin & Ryan, 2014a; Shin & Ryan, 2014b)). Particularly friends play a role in students' academic outcomes, such as their academic achievement, motivation, and involvement in school (e.g., (Flashman, 2012; Kindermann & Skinner, 2009; Molloy et al., 2010)). In response to being in contact with friends, students' behaviors and attitudes often change, due to social influence processes (Snijders et al., 2007; Steglich et al., 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 et al., 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 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 et al.,

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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 et al., 2016; McKeown et al., 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 et al., 2004; Hastings & Schweiso, 1995; Marx et al., 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-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 et al., 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 et al., 2005). Teachers play an important role in the implementation of cooperative learning in the classroom with groupings (Gillies et al., 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 et al., 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 (Dijkstra & Veenstra, 2011), especially their near-seated peers (Van den Berg et al., 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 et al., 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 et al., 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 et al., 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 processes in academic achievement and engagement can also be explained by social capital (Crosnoe et al., 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

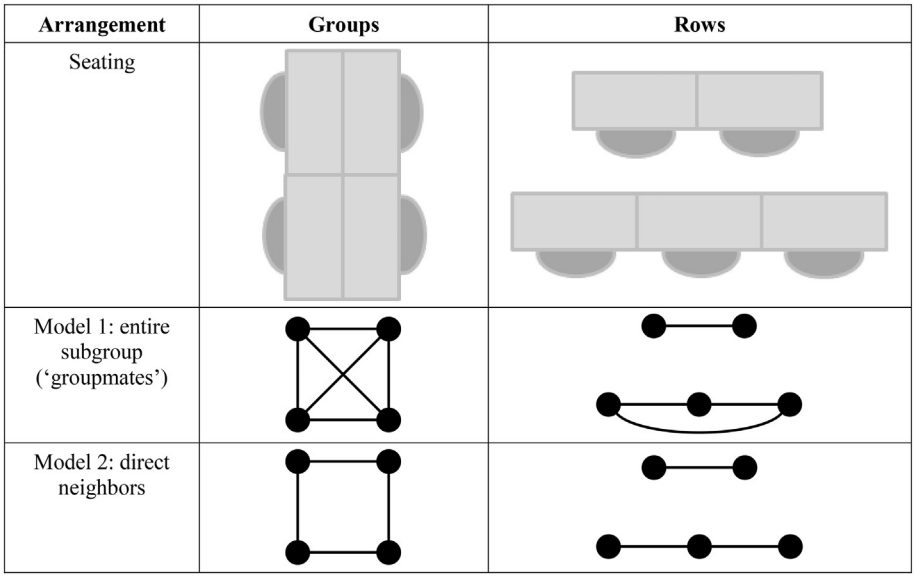

Fig. 1. Examples of seatings networks ("near-seated peers"), derived from teacher-drawn seating arrangements. Model 1 with the entire subgroup as near-seated peers. Model 2 with visually close peers (direct neighbors) as near-seated peers.

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 Fig. 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.*

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; Shin & Ryan, 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.*

The 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 et al., 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; *M* age = 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.

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 0.83–0.95, except for arts (0.52) and gymnastics (0.42). These items loaded high on a second component (0.63 and 0.76), 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 ($\alpha = 0.94$), 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 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 0.66 and 0.90), so a mean score was made of all items. A reliability analysis indicated high internal consistency ($\alpha = 0.94$).

In Table 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.

Table 1
Category specification for academic achievement and engagement and the number of students that fall within specific categories.

Category	Scores (x)	Achievement		Engagement	
		T1	T2	T1	T2
1 (very low)	$-3 \leq x \leq -1.5$	20	12	10	7
2	$-1.5 < x \leq -.5$	56	70	72	58
3	$-.5 < x \leq .1$	119	112	103	114
4	$.1 < x \leq 1.5$	179	166	219	238
5	$1.5 < x \leq 2.5$	121	107	113	101
6 (very high)	$2.5 < x \leq 3$	60	57	38	37

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 et al., 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 et al., 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.

Results

Descriptive statistics of network variables

Descriptions of network and individual variables are presented in Table 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 0.93 for friendships and 0.92 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)).

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

Table 2
Sample and sample change descriptives per class (N = 21).

Sample	T1	T2	Sample change	T1–T2
Network density indicators			Friendship indicators	
Average degree	6.32 (1.29)	7.43 (1.54)	Jaccard index; stability	61% (7%)
Response	97.7%	97.1%	Hamming distance; change	85.33 (36.52)
Other network indicators			No. of ties dissolved	628
Reciprocity	65% (9%)	67% (8%)	No. of ties emerges	1177
Transitivity	58% (7%)	60% (7%)	No. of ties maintained	2747
Same sex	88% (6%)	85% (7%)	Changes in achievement	
Friendship network autocorrelation			No. of steps up	122
Geary's *C* achievement	.97 (.18)	.92 (.19)	No. of steps down	152
Geary's *C* engagement	.96 (.13)	.90 (.13)	Actors that remain stable	51.3% (20.3%)
Seating arrangement autocorrelation			Changes in engagement	
Geary's *C* achievement	.89 (.25)	.92 (.23)	No. of steps up	137
Geary's *C* engagement	.90 (.24)	.98 (.23)	No. of steps down	124
Groupmates but not friends			Actors that remain stable	57.8% (16%)
Geary's *C* achievement	.94 (.30)	1.15 (.74)		
Geary's *C* engagement	.91 (.27)	1.24 (1.01)		
Groupmates and friends				
Geary's *C* achievement	.75 (.39)	.80 (.33)		
Geary's *C* engagement	.86 (.48)	.88 (.45)		

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 (Veenstra & Steglich, 2012).

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

Tables 3 and 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 Tables 5 and 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 η and the random parameters μ. 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.,

Table 3
Bayesian RSiena results on friendships, near-seated peers (entire subgroup), and academic achievement (N = 19 classrooms).

	Random		p	Fixed		p	τ^2	sd(τ^2)
	μ	sd(μ)		η	sd(η)			
Network dynamics: Friendship								
Rate of change	5.66***	0.68					2.24	0.92
Outdegree (density)	−2.22***	0.31	< .01				2.07	0.68
Reciprocity	1.57***	0.35	> .99				2.27	0.82
Transitive triplets	0.34*	0.21	0.95				0.88	0.29
Transitive reciprocated triplets	−0.11	0.23	0.31				0.94	0.31
3-cycles	−0.20	0.21	0.18				0.89	0.30
Seating				0.17**	0.08	0.99		
Achievement alter				0.00	0.02	0.57		
Achievement ego				−0.03	0.02	0.13		
Achievement similarity				0.10	0.13	0.77		
Sex alter	0.14	0.23	0.75				1.05	0.33
Sex ego	0.17	0.26	0.74				1.13	0.37
Same sex	0.83***	0.33	0.99				2.01	0.70
Behavior dynamics: Academic achievement								
Rate of change	1.11***	0.26					0.19	0.07
Linear shape	−0.24	0.35	0.24				1.47	0.69
Quadratic shape	−0.59***	0.22	< .01				0.75	0.29
Average achievement of friends				0.39	0.38	0.86		
Average achievement of groupmates				−0.11†	0.07	0.07		
Average achievement of friends who are groupmates				0.02[A]	0.20	0.56		
Engagement	0.80***	0.28	> .99				1.08	0.44
Sex	−0.26	0.35	0.22				1.03	0.50
Age	−0.62*	0.34	0.02				1.39	0.80

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 τ^2. †p-value ≈ 0.05 *p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). [A]: 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 = √((sum of three squared standard deviations) + (2× sum of three posterior covariances)) = +0.35.

Table 4
Bayesian RSiena results on friendships. Near-seated peers (entire subgroup). and academic engagement (N = 21 classrooms).

	Random		p	Fixed		p	τ^2	sd(τ^2)
	μ	sd(μ)		η	sd(η)			
Network dynamics: Friendship								
Rate of change	5.54***	0.67					2.34	0.90
Outdegree (density)	−2.24***	0.32	< .01				1.95	0.60
Reciprocity	1.56***	0.31	> .99				2.05	0.69
Transitive triplets	0.33*	0.19	0.96				0.81	0.27
Transitive reciprocated triplets	−0.11	0.21	0.33				0.85	0.28
3-cycles	−0.17	0.20	0.18				0.82	0.27
Seating				0.13*	0.07	0.97		
Engagement alter				0.08***	0.03	> .99		
Engagement ego				−0.05*	0.03	0.04		
Engagement similarity				0.09	0.13	0.76		
Sex alter	0.06	0.22	0.58				0.98	0.29
Sex ego	0.21	0.23	0.82				1.02	0.38
Same sex	0.88***	0.29	> .99				1.84	0.64
Behavior dynamics: Academic Engagement								
Rate of change	1.09***	0.30					0.17	0.08
Linear shape	0.15	0.34	0.70				1.37	0.58
Quadratic shape	−0.91***	0.26	< .01				0.99	0.38
Average engagement of friends				0.48†	0.35	0.92		
Average engagement of groupmates				−0.17*	0.09	0.02		
Average achievement of friends who are groupmates				0.24 [A]	0.23	0.83		
Achievement	0.58***	0.34	0.95				1.08	0.48
Sex	0.30	0.29	0.85				0.89	0.34
Age	−0.51*	0.28	0.03				0.95	0.37

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 τ^2. † p-value ≈ .05 * p-value < .05. ** p-value < .01. ***p-value < .001 (one-tailed tests). [A]: 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 = √((sum of three squared standard deviations) + (2× sum of three posterior covariances)) = +0.34.

2016)). Significance is indicated by so-called *Bayesian p*-values, which give the percentile of the value zero in the posterior (for *η* 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

Table 5
Bayesian RSiena results on friendships. Near-seated peers (direct neighbors). and academic achievement (N = 19 classrooms).

	Random		p	Fixed		p	τ^2	sd(τ^2)
	μ	sd(μ)		η	sd(η)			
Network dynamics: Friendship								
Rate of change	5.70***	0.66					2.25	0.94
Outdegree (density)	−2.21***	0.33	< .01				2.09	0.73
Reciprocity	1.57***	0.35	> .99				2.29	0.75
Transitive triplets	0.33*	0.20	0.95				0.89	0.33
Transitive reciprocated triplets	−0.12	0.22	0.29				0.92	0.30
3-cycles	−0.21	0.22	0.17				0.90	0.35
Seating				0.17*	0.09	0.97		
Achievement alter				0.00	0.02	0.49		
Achievement ego				−0.03	0.03	013		
Achievement similarity				0.10	0.13	0.79		
Sex alter	0.12	0.25	0.70				1.05	0.33
Sex ego	0.17	0.23	0.77				1.07	0.36
Same sex	0.85***	0.30	> .99				1.96	0.66
Behavior dynamics: Academic Achievement								
Rate of change	1.13***	0.27					0.18	0.07
Linear shape	−0.14	0.30	0.33				1.36	0.53
Quadratic shape	−0.56***	0.21	< .01				0.69	0.27
Average achievement of friends				0.35	0.33	0.86		
Average achievement of neighbors				−0.05	0.10	0.28		
Average achievement of friends who are neighbors				0.02 [A]	0.20	0.55		
Engagement	0.76***	0.28	> .99				1.08	0.55
Sex	−0.28	0.30	0.17				1.02	0.44
Age	−0.62*	0.33	0.03				1.19	0.51

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 τ^2. † p-value ≈ .05 * p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). [A]: 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) + (2× sum of three posterior covariances)) = +0.34.

Table 6
Bayesian RSiena results on friendships. Near-seated peers (direct neighbors). and academic engagement (N = 21 classrooms).

	Random		p	Fixed		p	τ^2	sd(τ^2)
	μ	sd(μ)		η	sd(η)			
Network dynamics: Friendship								
Rate of change	5.51***	0.64					2.04	0.76
Outdegree (density)	−2.27***	0.29	< .01				1.95	0.59
Reciprocity	1.61***	0.34	> .99				2.09	0.69
Transitive triplets	0.33**	0.19	0.95				0.81	0.25
Transitive reciprocated triplets	−0.11	0.20	0.28				0.84	0.26
3-cycles	−0.19	0.19	0.15				0.83	0.28
Seating				0.15*	0.08	0, .96		
Engagement alter				0.08***	0.03	> .99		
Engagement ego				−0.05*	0.03	0.03		
Engagement similarity				0.08	0.13	0.72		
Sex alter	0.09	0.22	0.65				1.01	0.32
Sex ego	0.20	0.22	0.80				1.01	0.28
Same sex	0.88***	0.28	> .99				1.80	0.54
Behavior dynamics: Academic Engagement								
Rate of change	1.08***	0.29					0.16	0.07
Linear shape	0.11	0.31	0.63				1.37	0.56
Quadratic shape	−0.92***	0.24	< .01				0.98	0.36
Average engagement of friends				0.56†	0.38	0.94		
Average engagement of neighbors				−0.18†	0.12	0.06		
Average engagement of friends who are neighbors				0.17 [A]	0.23	0.76		
Achievement	0.57***	0.33	0.95				0.97	0.40
Sex	0.30	0.30	0.84				0.87	0.36
Age	−0.49*	0.29	0.04				1.00	0.40

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 τ^2. † p-value ≈ .05 * p-value < .05. ** p-value < .01. *** p-value < .001 (one-tailed tests). [A]: 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 = √((sum of three squared standard deviations) + (2× sum of three posterior covariances)) = +0.36.

classrooms for the random parameters, indicated by τ^2 and $sd(\tau^2)$.

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 all groupmates. Therefore, we only discuss the results from Table 3 and Table 4, in which near-seated peers were defined as all groupmates.

Academic achievement

Table 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 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). 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 4 for calculation). Thus, this net effect was more positive, but still not significant and with a high standard deviation.

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 et al., 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; Shin & Ryan, 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 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 et al., 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 et al., 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.

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