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Academic Achievement and Social Interactions: A Longitudinal Analysis of Peer Selection Processes in Inclusive Elementary Classrooms

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This study analyzes the extent to which students in inclusive elementary classrooms select classmates for collaboration and play activities on the basis of academic achievement. To investigate this association, second and third graders ($n = 506$, mean age = 7.6 years) were asked to nominate classmates with whom they collaborate and play at the beginning and middle of the school year. The academic achievement level of students was assessed with a standardized mathematical test at the first measurement point. Two longitudinal social network models were specified to analyze whether academic achievement level functions as a selection criterion for collaboration (academic context) and play activities (play context). Structural network effects, selection effects, and sex-related effects were included in the models. The selection effects on academic achievement revealed that high achieving students were more likely selected by peers for collaboration but not for play activities. Thus, academic achievement was only relevant for peer selection processes in the academic context. Further, a negative homophily effect on academic achievement was found, which indicates that students selected dissimilar peers in terms of academic achievement level for interactions in the academic and play context. Thus, on one hand there was no similarity in academic achievement among peers who liked to collaborate and play together, which is a positive result from an educational and inclusive perspective; on the other hand, there was a tendency to select high achieving rather than low achieving peers for collaborative activities. Teaching practices that can help prevent the formation of such a hierarchy in the classroom and implications for future studies on the link between academic achievement and peer selection processes are discussed.

Keywords: academic achievement, longitudinal social network analysis, RSiena, peer selection, elementary school

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INTRODUCTION

The main purpose of inclusive education is to ensure effective learning processes of students within the same classroom with different levels of academic achievement (Norwich, 2002). This academically heterogeneous setting is expected to enable the social participation of all students regardless of their achievement level. Social participation, which involves experiencing positive social interactions, engaging in social relationships, feeling socially accepted, and being accepted by

peers (Koster et al., 2009), is seen as a crucial condition for children's socio-emotional development and well-being (Eriksson and Granlund, 2004; Piškur et al., 2014). While social interactions and relationships with peers offer children the opportunity to develop social skills (Hay et al., 2004), friendlessness and social rejection—as opposed to social acceptance—can have a negative impact on children's social and academic adjustment (Hanish and Guerra, 2002; Ladd and Troop-Gordon, 2003; Wentzel et al., 2004). In early school years, interactions between peers largely occur in the context of organized groups, such as classrooms (Hay et al., 2004), and teachers structure much of the setting (Gest and Rodkin, 2011). In this rigid group structure wherein students select classmates for social interactions, some students experience greater difficulties in social participation than others. Numerous cross-sectional studies reveal that students with low academic achievement levels, such as students with special educational needs (SEN), enrolled in mainstream elementary classrooms are at higher risk of experiencing peer rejection and being excluded from play interactions and interactions during class than their peers (Huber and Wilbert, 2012; Krull et al., 2014; Nepi et al., 2015; Garrote, 2017). There is evidence that the academic achievement level of students plays a role in their social involvement with peers (Nakamoto and Schwartz, 2010; Huber and Wilbert, 2012; Shin and Ryan, 2014; Nepi et al., 2015; Laninga-Wijnen et al., 2018). Two main research findings have been reported in studies investigating this association: homophily based on academic achievement level and the positive association between peer selection and academic achievement level.

Homophily is a core principle of peer selection processes and is the tendency to affiliate with other individuals who have similar characteristics. This tendency is driven by the need to be understood, trust, predict, and communicate more easily, which is more likely with similar peers (McPherson et al., 2001). Thus, in the school context, students are more likely to interact with classmates, who are similar in terms of academic achievement level. In two longitudinal studies, students from grades five and six were more inclined to select a friend who matched their own academic achievement level than to select someone with a different academic achievement level (Shin and Ryan, 2014; Laninga-Wijnen et al., 2018). This finding is in line with results found in a cross-sectional study by Schwab (2018) in inclusive classrooms, in which fourth graders with SEN—in comparison to their peers without SEN—were more likely to nominate peers with SEN as friends. There are different approaches to explain homophily based on academic achievement level. From a practical perspective, students might select similar peers because similar individuals have much in common and therefore find it easier to get along (McPherson et al., 2001; Laursen, 2017). Having a similar academic achievement level might therefore facilitate interactions among peers, especially during collaborative activities in class. The selection of peers with similar academic achievement level can also be explained with the social comparison theory by Festinger (1954). To gain a more accurate academic self-concept, students tend to compare themselves with similar peers. This comparison influences, in turn, whom students select for social interactions, leading to more relationships between students with similar academic achievement level.

Second, the positive association between academic achievement level and peer selection has been reported in several cross-sectional and longitudinal studies—in regular as well as inclusive elementary classrooms. Compared to peers, high achieving students in elementary school are more likely selected as friends, seat neighbors, and for play and work activities (Huber and Wilbert, 2012; Shin and Ryan, 2014; Nepi et al., 2015; Laninga-Wijnen et al., 2018). In addition, these students are popular among peers and are perceived by peers as displaying prosocial behaviors (Nowicki, 2003; Walker and Nabuzoka, 2007; Galván et al., 2011; Huber and Wilbert, 2012). At the same time, a negative association between academic achievement levels and difficulties in social participation has been confirmed in several studies (Nowicki, 2003; Hughes and Zhang, 2007; Nakamoto and Schwartz, 2010). Students with low academic achievement levels are at higher risk of making negative peer experiences, being less accepted in the peer group, having a lower social status, and being frequently less selected for social interactions than peers (Nowicki, 2003; Huber and Wilbert, 2012; Wang et al., 2014; Nepi et al., 2015). Students' social participation in the peer group reflects their achievements (Eccles, 1999), whereby a higher academic achievement level is associated with a higher probability of being selected for social interactions.

This finding leads to the assumption that students might select peers for interactions to benefit academically from them. However, this explanation is more plausible in the academic context than in the context of recess. While peers probably select classmates for class activities based on their academic achievement, other factors, such as social skills—might be more important for the selection of classmates as friends or for play activities. In general, students with low academic achievement and students with SEN are selected less frequently than high achieving peers in the academic context and in the context of recess (Cambra and Silvestre, 2003; Monchy et al., 2004; Nepi et al., 2015). However, when contexts are compared, students with low achievement levels are more rejected by peers in the academic than in the play context, whereas for high achieving students no contextual differences are found: they are highly accepted as both work and play partners (Nepi et al., 2015). While the general findings support the assumption that academic achievement might be more relevant for peer selection processes in the academic context than in the play context, the latter result reported by Nepi et al. (2015) might as well be explained by correlates of high academic functioning. As high achieving students are often perceived as socially skilled (Nowicki, 2003; Walker and Nabuzoka, 2007), they might be also more selected as friends or play partners than their peers, because of their social skills rather than their academic achievement level. However, these assumptions need to be further evaluated. Given the fact that social interactions vary not only on the basis of the peer's characteristics but also on different contexts (Rubin et al., 2006), there is still a lack of (longitudinal) studies on peer selection when simultaneously comparing contexts (i.e., academic and play).

Further, differences between boys and girls have been found in studies on the association between academic achievement

and peer relationships (e.g., Walker and Nabuzoka, 2007), but the pattern of findings is inconsistent. In the meta-analytic review by Nakamoto and Schwartz (2010), only a few studies included the comparison between boys and girls. The findings with regard to sex have been inconsistent across studies, with a stronger association in boys for some, and in girls for others. The estimated effect sizes of all studies combined were nearly identical for boys and girls. In a recent study using the social network approach in which several sex-related effects were included in the specified model (e.g., sex homophily, interaction between sex and academic achievement similarity), girls in secondary school were more inclined to select friends based on similar academic achievement levels than were boys (Kretschmer et al., 2018). As the authors suggest, this result underlines the importance of taking sex-specific effects in social network research into account. Considering in addition that sex-related differences might depend on the age of the study participants—strengthening with age (Rose and Rudolph, 2006)—such sex-specific effects should also be investigated on a sample of younger students.

From a methodological perspective, when examining social interactions among peers, it is important to consider that they are not only formed as a consequence of individual characteristics (i.e., social skills), but also emerge as a result of social processes occurring in networks, on a dyadic level (e.g., *homophily*, *reciprocity*) and on a classroom level (e.g., *density*). The social network approach facilitates the examination of how peer selection processes are related to individual characteristics, such as students' academic achievement level, while including social network effects (Snijders et al., 2010). Longitudinal social network studies on the role of academic achievement level in peer selection processes have largely included samples of adolescents and young adults (e.g., Lomi et al., 2011; Flashman, 2012; Laninga-Wijnen et al., 2017; Kretschmer et al., 2018). Studies in elementary schools included students from grades five and six (Shin and Ryan, 2014; Laninga-Wijnen et al., 2018). As the role of academic achievement changes with age, resulting in a negative link between academic engagement and social status in adolescence (Galván et al., 2011), it is also important to investigate the impact of academic achievement level on peer selection processes at a younger age.

To fill these research gaps, the following research questions are addressed in the present study:

1. To what extent is academic achievement level a deciding factor in students' selection of classmates in inclusive elementary classrooms, while taking into account sex-related effects and social network dynamics?
2. Do peer selection processes differ depending on the context (collaboration vs. play activities)?

MATERIALS AND METHODS

Participants and Procedure

The present study is part of a longitudinal study on cohesion in Germany ("Soziale Partizipation durch Köhasion," SoPaKo). The goal of the SoPaKo study was to evaluate the effect of an intervention program fostering cohesion in inclusive elementary classrooms. The study was conducted in accordance with recommendations of the German Research Foundation. In compliance with guidelines established by the institutional ethic committee, participation was voluntary and parents gave their written informed consent before participation. For the recruitment of the sample, schools of the eastern Ruhr area were contacted. In all, 46 teachers in 11 schools agreed to participate with their second and third grade classes. Parental consent was obtained for 96% of second and third graders ($N = 1{,}042$).

The participating classes were divided into an intervention and a waiting-control group. Questionnaires asking information about schools were administered to school principals of both groups prior to the study. The schools were matched regarding size, number of classes participating, and socio-demographic characteristics of the area (e.g., proportion of people with migration background, average income in the region). The matched pairs of schools were randomly distributed to the experimental and the waiting-control group. In the intervention group, the program was implemented immediately following t1, and in the waiting-control group, after t2. Prior to implementation, participants of the waiting-control group were not in contact with the intervention. For the present study, data collected at t1 and t2 in the waiting-control group were analyzed.

Out of 21 classes of the waiting-control group, one class had to be excluded from the analyses because of a missing rate of 50% at t2. The method of social network analysis (see Analyses section) can only deal with some randomly missing data. With more than 20% randomly missing data the model simulation can become unstable (Ripley et al., 2017). In the 20 remaining classes, the participation rate was on average of 98%. In all, the study sample included $n = 506$ participants (269 girls) in 20 classes of grade 2 ($n = 219$) and grade 3 ($n = 287$). On an average, 25 students participated per class. The mean age of participants was 7.6 years ($SD = 0.72$). At the beginning of the school year, a total of 5% of participants were identified by teachers as having SEN. According to the teachers, 2.1% had learning disabilities, 1.7% had socio-emotional developmental problems, 0.5% had physical disabilities, and 7% had unspecified SEN. In this particular area of Germany, where participating schools were located, SEN are officially diagnosed after third grade. Consequently, in this study, instead of the category SEN, the continuous variable of mathematical achievement was used in the analyses to represent pupils' academic achievement level.

Data were collected during regular class hours by trained research assistants at the beginning of the school year 2017 (t1) and ∼6 months later (t2). Participating students answered two peer nomination items at both measurement points and took a standardized mathematics test at t1. The peer nomination items were read aloud to ensure that all students understood them. Students whose parents declined participation were given alternative activities by their teacher. Because of absence at t1, academic achievement of 5.7% of students and social networks of 2% of students were not assessed. At t2, data of 2.6% of students were not assessed because of absence. Six participants left after t1, and 12 participants joined the study at t2. These participants were included in the analyses (see Analyses section).

MEASURES

Academic Achievement Level

The academic achievement level of participants was assessed at the beginning of the school year (t1) by means of a mathematic achievement test. Second graders completed the standardized mathematics test DEMAT 1+ (Krajewski et al., 2002) and third graders completed the mathematics test DEMAT 2+ (Krajewski et al., 2004). Cronbach's alpha of the DEMAT 1+ was 0.83 and 0.86 for the DEMAT 2+. All math scores were group-mean-centered.

Social Networks

The data of two networks were assessed by means of two peer nomination items at t1 and t2. Students were asked to nominate classmates they prefer to collaborate with during class activities (collaboration network) and with whom they play the most (play network). The networks were represented as matrices with equal senders (students nominating classmates) and receivers (students being nominated by classmates). The nominations or ties were coded as 1 and a lack of ties as 0. The collaboration network and play network were used as dependent variables in the analyses.

Analyses

The social network analytical package Simulation Investigation for Empirical Network Analysis RSiena 1.2-12 was used to analyze selection effects with stochastic actor-oriented models (Ripley et al., 2017). Within a stochastic actor-oriented model, the evolution of a network is viewed as a stochastic process driven by the actors. This process involves two sub-processes: the choice of the actor who has the opportunity to change the personal network of ties, and the actor choosing the most attractive tie changes. The attractiveness of tie changes may be influenced by the characteristics of individual actors, pairs of actors, and the whole network structure (Snijders et al., 2010).

To answer the research questions, two multi-group Siena selection models were estimated: one with the collaboration network as a dependent network and another with the play network as a dependent network. The network data were represented by directed adjacency matrices, which consist of dichotomous cells in which a tie from one individual to another is present or absent. The individuals' sex (1 = girl; 0 = boy) and academic achievement level (z-standardized math scores) at t1 were added to both models as covariates.

Network effects were included in both models to control for characteristics of the network: *outdegree* (density), reciprocity, and transitivity (*transitive triplets* and *transitive reciprocated triplets*) (Ripley et al., 2017). *Outdegree* (density) represents the effect of network members connected to each other, measured by the number of nominations made taking into account the number of possible nominations in the network. Reciprocity represents the effect of reciprocation of nominations in networks. *Transitive triplets* express the tendency of actors to nominate interaction partners of their interaction partners. *Transitive reciprocated triplets* represent the tendency to reciprocate nominations within the connected triplets in the network. In addition, network effects were added to control for the Mathew-Effect (Merton, 2006) and increase the goodness of fit (GOF) of the model (Ripley et al., 2017): *Indegree popularity* (the extent to which being nominated by many peers leads to being nominated by more peers), *outdegree popularity* (the extent to which nominating many peers leads to being nominated by more peers), and *outdegree activity* (the extent to which nominating many partners leads to nominating more partners).

Further, selection effects were included in both models. Three basic effects are considered: *alter*, *ego,* and *homophily*. The *alter* effect reflects the tendency of individuals with specific individual characteristics (i.e., sex) or with a higher score in a given characteristic (i.e., academic achievement level) to receive more nominations. The *ego* effect represents the tendency of individuals with higher scores in a given characteristic to nominate others. To capture the homophily effect, same-sex, and similar academic achievement level effects were added to the models. Finally, two interaction effects were added. An interaction of sex *ego* and academic achievement level *alter* effect was included to test whether there are differences between boys and girls in the selection of classmates for collaboration and play activities based on academic achievement. To test whether there are sex differences in the selection of classmates with similar academic achievement levels, an interaction of sex *ego* and similar academic achievement level was included in both models. To permit selection modeling in RSiena, the stability of networks has to be sufficient, which is indicated by the Jaccard index. A value above 30% is good, values lower than 20% indicate that there might be difficulties in estimation, and the stability of networks with an index value of 10% is too low (Ripley et al., 2017). In a majority of networks the stability was sufficient. However, three collaboration networks and three play networks had an average Jaccard index between 14.7 and 18.8% and between 11 and 19.6%, respectively. Because the estimation with all 20 classes did not converge for the play networks (overall maximum convergence ratio above 0.35 and convergence t ratios above 0.15), three classes with a Jaccard index lower than 20% in one or both networks were excluded from the network analysis. Thus, the final analyses were conducted with data on 17 classes, two networks each.

In stochastic actor-oriented models, two types of missing data are distinguished and handled separately (Ripley et al., 2017). Missing values were treated as randomly missing. Missing values of participants who joined or left the study between t1 and t2 were specified in the model (composition change). This was accomplished with an additional data file that identified when individuals joined or left the network. In the estimation procedure, missing values of students before they joined the class network ($n = 12$) were regarded as 0 entries, and missing entries of students after they left the class network ($n = 6$) were fixed at the last observed values.

RESULTS

Descriptive Statistics

The mathematical achievement (z-standardized math scores) of students in 17 classes of the sample did not differ significantly

TABLE 1 | Sample descriptives for the collaboration and play networks of the 17 classes included in the social network analyses.

	Collaboration networks		Play networks	
	T1	T2	T1	T2
n	423	424	423	423
Participation rate (%)	98.4	97.2	98.4	97.2
Missing	7	12	7	12
Girls (%)	54	53.21	54	53.21
Number of ties	2,242	2,815	2,042	2,531
Average degree *M* (*SD*)	5.11 (1.45)	6.53 (1.12)	4.69 (1.16)	5.9 (1.13)
Density (%)	20.4	26.1	18.8	37.2
Jaccard (%)	32.07		36.35	

in the function of grade. Boys scored significantly higher in the mathematics test ($M = 0.25$, $SD = 0.92$, $n = 195$) than girls ($M = -0.21$, $SD = 0.99$, $n = 228$), $t(421) = -4.89$, $p = 0.000$, with a medium effect size $d = 0.48$.

The descriptive statistics are presented in **Table 1**. Students nominated on average 5.82 classmates for collaboration and 5.29 classmates for play activities. The average degree per measurement point and per classroom was 5.11 (SD = 1.45) at t1 and 6.53 (SD = 1.12) at t2 for the collaboration networks and 4.69 (SD = 1.16) at t1 and 5.9 (1.13) at t2 for the play networks. Students selected on average 23% of classmates for collaboration and 28% for play activities (density).

Longitudinal Social Network Analysis

Network Effects

The network effects are similar (see **Table 2**) for the collaboration and the play context. They are characterized by a negative *out-degree* effect, which indicates that the networks were sparse rather than dense in nature and is a commonly found result in social network studies (Snijders et al., 2010). Further, there is a significant positive reciprocity effect, which describes to what extent unreciprocated nominations become reciprocated over time. The significant positive *transitive triplets* parameter represents the tendency to nominate friends of friends over time. In other words, when student A, in a triad with students A–C, nominates student B for collaboration or play activities and student B nominates student C at t1, student A is likely to nominate student C at t2 as well. The *transitive reciprocated triplets* parameter was not significant in either of the two networks. Further, *in-degree popularity* was positive and significant in the collaboration networks and play networks: when a student was nominated for collaboration or play activities by many classmates at t1, this student was likely to be nominated by even more classmates at t2. *Out-degree popularity* was negative and significant, which shows that students who nominated many classmates at t1 were less likely to be nominated themselves by many classmates at t2. As a consequence, the association between in-degrees and out-degrees will decrease. Finally, the significant *out-degree activity* effect in both networks shows that students who nominated many others tended to select even more classmates for play activities but fewer classmates for collaboration over time.

Selection Effects

The selection effects were partly similar in the collaboration networks and play networks. In both networks, the negative *sex alter* effect indicates that girls were less likely to be selected by classmates, but the effect is significant only in play networks. The *sex ego* effect was not significant in either network. The homophily tendency of students to nominate same-sex peers for collaboration as well as for play activities is confirmed by the significant same-sex effect in both networks.

The significant positive *alter* effect of academic achievement in the collaboration networks indicates that students with higher achievement levels were more likely selected by peers for collaboration. This effect was not stronger for girls as indicated by the statistically not significant interaction *sex* × *academic achievement*. The academic achievement *ego* effect was negative and significant only in the play networks. This indicates that students with higher academic achievement levels were less likely to select classmates for play activities. The similar academic achievement effect was negative and significant in both networks. Thus, the tendency to select students with a similar academic achievement level was not confirmed. On the contrary, students were less likely to select students with the same academic achievement level. For the girls, the effect appeared to be stronger, but only in the collaboration network, as indicated by the interaction effect *sex* × *similar academic achievement* reveals.

DISCUSSION

The current study investigated the extent to which academic achievement is associated with the selection of classmates for collaboration and play activities in inclusive elementary classrooms, while taking into account sex-related effects and social network dynamics. Echoing previous studies, peer selection was linked to academic achievement (Huber and Wilbert, 2012; Nepi et al., 2015; Kretschmer et al., 2018; Laninga-Wijnen et al., 2018). High achieving students were more likely selected by peers for collaboration. However, this positive relationship between academic achievement level and peer selection was not found with regard to play activities. Further, a negative homophily effect on academic achievement was found, which indicates that students selected dissimilar peers in terms of academic achievement level for interactions in the academic and play context. This dissimilarity effect on academic achievement was stronger for girls than for boys, but only in the collaboration networks. In sum, the extent to which academic achievement predicted peer selection processes depended on sex and on the context—whether classmates were selected for collaboration or for play activities.

Results of this study confirm the positive relationship between academic achievement and peer selection processes. Being selected by peers for collaboration was more likely for second and third graders with high academic achievement levels than for low achievers. On one hand, the positive effect suggests that high achieving students might have been more likely to

TABLE 2 | Selection model for academic achievement and sex in the collaboration and play networks.

	Collaboration networks		Play networks	
	Est.	**SE**	**Est.**	**SE**
NETWORK EFFECTS				
Outdegree (density)	−1.24***	0.1	−1.38***	0.09
Reciprocity	0.85***	0.08	1.38***	0.08
Transitive triplets	0.11***	0.02	0.23***	0.03
Transitive reciprocated triplets	0.03	0.04	−0.05	0.04
Indegree popularity	0.04***	0.01	0.03**	0.01
Outdegree popularity	−0.13***	0.01	−0.17***	0.01
Outdegree activity	−0.02***	0.01	0.01*	0.01
SELECTION EFFECTS				
Effect of sex (1 = girl) on received nominations	−0.04	0.04	−0.09*	0.04
Effect of sex on given nominations	0.01	0.05	0.1	0.06
Same sex	0.51***	0.04	0.52***	0.04
Effect of academic achievement on received nominations	0.06**	0.02	0.04	0.02
Effect of academic achievement on given nominations	−0.02	0.02	−0.06**	0.02
Similar academic achievement	−0.33*	0.15	−0.39**	0.15
Sex × academic achievement	−0.03	0.05	−0.05	0.05
Sex × similar academic achievement	−0.75*	0.32	−0.32	0.3

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

be selected for collaborative activities because they were more salient in the academic context (e.g., more engaged in school, thus more salient), which agrees with research on academic reputation in the peer group (Hughes et al., 2009). On the other hand, students may have selected higher achieving peers for collaborative activities to benefit from these relationships. Working with high achieving peers who are successful in school can help increasing one's own academic achievement gain. This interpretation is supported by studies documenting the functional role of peers in providing support in the academic context (Eccles, 1999; Perdue et al., 2009). On a negative note, this result also means that students with low academic achievement levels were less prominent, at higher risk of being "overlooked," or even excluded from interactions in the academic context because of their academic achievement level. Thus, in line with studies on inclusive elementary classrooms (Huber and Wilbert, 2012; Krull et al., 2014; Nepi et al., 2015) the need for more than average academic support is related to exclusion from social interactions.

In comparison with the academic context, the positive association between academic achievement and peer selection was not significant in the play context. Specifically, higher levels of academic achievement predicted peer nomination in the context of collaboration, but not in the play context. In line with previous studies (Nepi et al., 2015), this result supports the assumption that the context of social interactions is crucial for the peer selection processes (Rubin et al., 2006). Whereas, students might have selected higher achieving peers for collaborative activities because of the academic benefits of the relationship, in the play context, academic achievement is not relevant and therefore has no significant effect on the selection of peers. This is an important finding for the field of social participation in inclusive classrooms. It indicates that low achieving students might not be excluded from all peer interactions to the same extent. Thus, being selected or excluded by peers might not always depend on their academic achievement level. In general, these results also suggest that students' selection of peers for interactions is driven solely by sympathy but is also influenced by the benefits that the selected peer may contribute to the specific relationship (i.e., collaboration, play). Further, the importance of differentiating between contexts is highlighted. For future research in this field, study results need to be interpreted in light of the context assessed with the instruments (e.g., nomination of peers for work or for play activities or as friends); future studies should consider assessing and analyzing interactions among peers in different contexts.

Contrary to expectations, a negative homophily effect was found on academic achievement. The tendency of students to select peers for collaboration and play activities with a similar academic achievement level was not confirmed. This finding is unexpectedly considerate of the fact that individuals tend to relate to others with similar characteristics, and considering that this homophily tendency has been confirmed for academic achievement in previous studies (Shin and Ryan, 2014; Laninga-Wijnen et al., 2018). A possible explanation for this diverging result is that the academic achievement level at the beginning of the school year was less salient than other individual characteristics (i.e., sex) or was not salient enough for students to be aware of it, to find similar others, and affiliate to them (McPherson et al., 2001). At the same time, the found academic achievement *alter* effect suggests that this characteristic somehow affects selection processes. This means that while students might be aware of those who are successful and those who have

difficulties in school (Hughes et al., 2009), they may not know the achievement level of all classmates in detail to the extent to which it would lead to the selection of interaction partners with a similar academic achievement level. This might particularly be the case for younger students in early school years, who compared to older and more experienced students, are beginning to know their peers' competencies at school. The negative homophily effect is also an encouraging result. On one hand, there are advantages for the social and academic development of students who interact and collaborate in academically heterogeneous groups (Robinson et al., 2005). On the other hand, it might be the result of positive learning and interactions that students have with dissimilar peers in the heterogeneous setting of inclusive classrooms. This applies especially if students were aware of the academic achievement levels of their peers, and thus deliberately selected peers who had a different achievement level than themselves. Here, teachers may have played an important role by creating possibilities for interaction in academically heterogeneous groups within the classroom: for example, by making seating arrangements to support academic performance (Gremmen et al., 2016). As arranged interactions during class activities can also help promote peer relations (Farmer et al., 2011; Gest and Rodkin, 2011), students may not only learn to appreciate the collaboration with peers, who differ from them in terms of academic achievement level in class, but may also choose to form friendships with them. However, since neither teacher practices nor students' reasons for their selection were assessed in this study, these remain assumptions worth investigating. In addition, the significant *alter* effect in the academic context suggests a selection hierarchy in which high achievers are on top and low achievers at the bottom. Thus, although there was heterogeneity in terms of academic achievement within affiliated peers in class and recess, there was a clear preference to select academically successful peers for interactions in the academic context.

Differences in peer selection influenced by sex were only partially found. While there were no sex differences for received nominations, girls were less selected for play activities than boys. The latter result—together with the homophily effect on sex—supports the finding that girls' groups are smaller than boys' groups (Rose and Smith, 2009). However, this only seemed to apply to the selection of peers for play activities and not for collaborative activities. At the same, the dissimilarity effect on academic achievement was stronger for girls than for boys, but only in the collaboration networks. Thus, it seems that in the academic context, girls in second and third grade were more likely to select classmates with a different academic achievement level at the beginning of the school year. In contrast, Kretschmer et al. (2018) found that secondary school girls were more likely to select friends with a similar academic achievement level. Leaving the difference in the result aside, whether the tendency was toward or away from homophily, it seems to be stronger for girls than for boys. At this point, sample differences must be addressed. Whereas, Kretschmer et al. (2018) reported significantly higher academic achievement levels for girls, in this study the contrary was the case. This as well as the age of the participants—elementary school vs. secondary school—might have had an impact on the results. It is therefore difficult to make valid conclusions concerning the sex-related effects. In addition, the overall findings on sex differences are rather inconsistent and emerge rather as a consequence of the context than of the actual sex (Rose and Smith, 2009). To gain more knowledge on sex-specific effects, further social network studies modeling selection processes with sex-specific effects are clearly needed.

Limitations

This longitudinal social network study with a sample of second and third grade students enrolled in inclusive classrooms confirms existing results and also offers new insights into the association between peer selection effects and academic achievement. Nevertheless, some limitations have to be considered when interpreting the findings. There are a series of methodological issues. The general nature of the peer nomination items used in this study does not provide information on the content or quality of the interactions among peers. Depending on the activity involved in the collaboration or the play activity, other selection patterns would have been possible. In addition, the nomination question for collaboration had more potential to trigger wishful thinking than the question for play nominations. This probably led to more nominations of classmates for collaboration than for play activities. It is also important to mention that no information was available on the students' relationships outside of the classroom and on contextual factors influencing the relationships among students, such as the location of the school (e.g., in urban or rural areas). There are qualitative and functional differences between relationships limited to the classroom and those that extend beyond the school. In rural areas students have probably more opportunities to interact with classmates outside of the school than students in urban areas, leading to different relationships in terms of their quality and function. Controlling for this relevant information would have better depicted the social reality of students and would have made the classrooms in the sample more comparable. Further, the found negative homophily effect on academic achievement, which is not in line with earlier findings, could be a product of the methodological approach for the assessment of social relationships. While the homophily effect on academic achievement level was found for friendship nominations (Shin and Ryan, 2014; Laninga-Wijnen et al., 2018), in the present study, the effect was not confirmed with regard to task-specific relationships (collaborating and playing). Moreover, the findings could be different because of participants' ages. In early school years, teachers structure much of the interactions in class (Gest and Rodkin, 2011). Thus, the findings might rather reflect teachers' teaching practices than students' selection preferences. In addition, young students are only just starting to get to know their classmates' academic competencies. This means that they might be less able to perceive and select classmates with a similar academic achievement level, compared to older students. Evidently, these are only assumptions, and therefore future studies should investigate possible underlying mechanisms more thoroughly. Further, the academic achievement level of students was operationalized with the score in a standardized mathematical test. Although studies have confirmed the validity

of mathematical achievement to predict student outcomes (e.g., Friedrich et al., 2015), by choosing only one subject, differences between school subjects are not considered (Gremmen et al., 2017). Finally, a multi-group Siena modeling approach was used to analyze the data. This approach implies that the parameters are similar in all classrooms, which is unlikely. Thus, although the model on average fitted the class networks, the results have to be interpreted carefully.

CONCLUSION

In this study, the academic achievement level of individuals in part predicted the peer selection processes. Whether students selected peers based on academic achievement level depended on the context. Academic achievement was only related to student's selection of peers where it appeared to be relevant, which supports the functional role of peers in the academic context (Perdue et al., 2009). Students preferred to collaborate with high achieving students more than with low achieving students, but they had no such preference when selecting classmates for play activities. Further, a negative homophily effect on academic achievement was found. Students preferred to collaborate and play with peers with a different academic level than themselves. Assuming that students were aware of the academic achievement level of their peers at the beginning of the school year, this preference for dissimilar peers in terms of academic achievement is positive. It means that students chose to make learning and interaction experiences in academically heterogeneous groups. At the same time, the fact that the direction of the peer selection was from low achieving students toward high achieving students highlights the potential for academic development as well as the risk of rejection and exclusion of students with low academic achievement levels within inclusive classrooms. Finally, sex-related effects were inconsistent and need to be further included in social network studies.

Three main implications can be derived from these results. First, schools are responsible for the academic as well as the socio-emotional development of students and have the power to condition social processes among peers (Crosnoe and Benner, 2015). In academically heterogeneous settings, such as inclusive classrooms, teachers must be aware of the social hierarchy caused by the academic achievement level of students. Hence, consistent with the concept of the "invisible hand"(Farmer et al., 2011), they need to reflect on their teaching practices so they can foster social relationships among peers with different academic achievement levels. Second, this study and previous studies show that the context in which interactions occur is crucial for peer selection processes. Students make different choices when they select peers for collaborative activities, play activities, or to form a friendship. Thus, researchers need to carefully interpret study results by taking contextual factors into account. Future studies should assess interactions in different contexts when investigating peer selection processes in classrooms. Third, while there are many studies investigating social participation in inclusive classrooms, there is a lack of social network studies in this specific educational setting. To better understand why some students are at higher risk of being socially rejected and excluded from social interactions, more longitudinal social network studies are needed.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Deutsche Forschungsgemeinschaft. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

AG analyzed the data and wrote the manuscript based on the data provided by the research team of the project SoPaKo.

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REFERENCES

Cambra, C., and Silvestre, N. (2003). Students with special educational needs in the inclusive classroom: social integration and self-concept. *Eur. J. Spec. Needs Educ.* 18, 197–208. doi: 10.1080/0885625032000078989

Crosnoe, R., and Benner, A. D. (2015). "Children at school," in *Handbook of Child Psychology and Developmental Science,* ed R. M. Lerner. doi: 10.1002/9781118963418.childpsy407

Eccles, J. S. (1999). Children ages 6 to 14. *Fut. Child.* 9, 30–44. doi: 10.2307/1602703

Eriksson, L., and Granlund, M. (2004). Conceptions of participation in students with disabilities and persons in their close environment. *J. Dev. Phys. Disabil.* 16, 229–245. doi: 10.1023/B:JODD.0000032299.31588.fd

Farmer, T. W., McAuliffe Lines, M., and Hamm, J. V. (2011). Revealing the invisible hand: the role of teachers in children's peer experiences. *J. Appl. Dev. Psychol.* 32, 247–256. doi: 10.1016/j.appdev.2011.04.006

Festinger, L. (1954). A theory of social comparison processes. *Hum. Relat.* 7, 117–140. doi: 10.1177/001872675400700202

Flashman, J. (2012). Academic achievement and its impact on friend dynamics. *Sociol. Educ.* 85, 61–80. doi: 10.1177/0038040711417014

Friedrich, A., Flunger, B., Nagengast, B., Jonkmann, K., and Trautwein, U. (2015). Pygmalion effects in the classroom: teacher expectancy effects on students' math achievement. *Contemp. Educ. Psychol.* 41, 1–12. doi: 10.1016/j.cedpsych.2014.10.006

Galván, A., Spatzier, A., and Juvonen, J. (2011). Perceived norms and social values to capture school culture in elementary and middle school. *J. Appl. Dev. Psychol.* 32, 346–353. doi: 10.1016/j.appdev.2011.08.005

Garrote, A. (2017). The relationship between social participation and social skills of pupils with an intellectual disability: a study in inclusive classrooms. *Front. Learn. Res.* 5, 1–15. doi: 10.14786/flr.v5i1.266

Gest, S. D., and Rodkin, P. C. (2011). Teaching practices and elementary classroom peer ecologies. *J. Appl. Dev. Psychol.* 32, 288–296. doi: 10.1016/j.appdev.2011.02.004

Gremmen, M. C., Dijkstra, J. K., Steglich, C. E. G., and Veenstra, R. (2017). First selection, then influence: developmental differences in friendship dynamics regarding academic achievement. *Dev. Psychol.* 53, 1356–1370. doi: 10.1037/dev0000314

Gremmen, M. C., van den Berg, Y. H. M., Segers, E., and Cillessen, A. H. N. (2016). Considerations for classroom seating arrangements and the role of teacher characteristics and beliefs. *Soc. Psychol. Educ.* 19, 749–774. doi: 10.1007/s11218-016-9353-y

Hanish, L. D., and Guerra, N. G. (2002). A longitudinal analysis of patterns of adjustment following peer victimization. *Dev. Psychopathol.* 14, 69–89. doi: 10.1017/S0954579402001049

Hay, D. F., Payne, A., and Chadwick, A. (2004). Peer relations in childhood. *J. Child Psychol. Psychiatr.* 45, 84–108. doi: 10.1046/j.0021-9630.2003.00308.x

Huber, C., and Wilbert, J. (2012). Soziale Ausgrenzung von Schülern mir sonderpädagoischem Förderbedarf und niedrigen Schulleistungen im gemeinsamen Unterricht. *Empirische Sonderpädagogik* 4, 147–165.

Hughes, J. N., Dyer, N., Luo, W., and Kwok, O.-M. (2009). Effects of peer academic reputation on achievement in academically at-risk elementary students. *J. Appl. Dev. Psychol.* 30, 182–194. doi: 10.1016/j.appdev.2008.12.008

Hughes, J. N., and Zhang, D. (2007). Effects of the structure of classmates' perceptions of peers' academic abilities on children's perceived cognitive competence, peer acceptance, and engagement. *Contemp. Educ. Psychol.* 32, 400–419. doi: 10.1016/j.cedpsych.2005.12.003

Koster, M., Nakken, H., Pijl, S. J., and Van Houten, E. J. (2009). Being part of the peer group: a literature study focusing on the social dimension of inclusion in education. *Int. J. Incl. Educ.* 13, 117–140. doi: 10.1080/13603110701284680

Krajewski, K., Küspert, P., and Schneider, W. (2002). *DEMAT 1+. Deutscher Mathematiktest für Erste Klassen*. Göttingen: Beltz.

Krajewski, K., Liehm, S., and Schneider, W. (2004). *DEMAT 2+. Deutscher Mathematiktest für zweite Klassen*. Göttingen: Beltz.

Kretschmer, D., Leszczensky, L., and Pink, S. (2018). Selection and influence processes in academic achievement—more pronounced for girls? *Soc. Netw.* 52, 251–260. doi: 10.1016/j.socnet.2017.09.003

Krull, J., Wilbert, J., and Hennemann, T. (2014). Soziale Ausgrenzung von Erstklässlerinnen und Erstklässlern mit sonderpädagogischem Förderbedarf im Gemeinsamen Unterricht. *Empirische Sonderpädagogik* 6, 59–75. Available online at: https://www.pedocs.de/volltexte/2014/9245/pdf/ESP_2014_1_Krull_ua_Soziale_Ausgrenzung.pdf

Ladd, G. W., and Troop-Gordon, W. (2003). The role of chronic peer difficulties in the development of children's psychological adjustment problems. *Child Dev.* 74, 1344–1367. doi: 10.1111/1467-8624.00611

Laninga-Wijnen, L., Harakeh, Z., Steglich, C. E. G., Dijkstra, J. K., Veenstra, R., and Vollebergh, W. A. M. (2017). The norms of popular peers moderate friendship dynamics of adolescent aggression. *Child Dev.* 88, 1265–1283. doi: 10.1111/cdev.12650

Laninga-Wijnen, L., Ryan, A. M., Harakeh, Z., Shin, H., and Vollebergh, W. A. M. (2018). The moderating role of popular peers' achievement goals in 5th-and 6th-graders' achievement-related friendships: a social network analysis. *J. Edu. Psychol.* 110, 289–307. doi: 10.1037/edu0000210

Laursen, B. (2017). Making and keeping friends: the importance of being similar. *Child Dev. Perspect.* 11, 282–289. doi: 10.1111/cdep.12246

Lomi, A., Snijders, T. A. B., Steglich, C. E. G., and Torló, V. J. (2011). Why are some more peer than others? evidence from a longitudinal study of social networks and individual academic performance. *Soc. Sci. Res.* 40, 1506–1520. doi: 10.1016/j.ssresearch.2011.06.010

McPherson, M., Smith-Lovin, L., and Cook, J. M. (2001). Birds of a feather: homophily in social networks. *Ann. Rev. Sociol.* 27, 415–444. doi: 10.1146/annurev.soc.27.1.415

Merton, R. K. (2006). The matthew effect in science: the reward and communication systems of science are considered. *Science* 159, 56–63. doi: 10.1126/science.159.3810.56

Monchy, M., de Pijl, S. J., and Zandberg, T. (2004). Discrepancies in judging social inclusion and bullying of pupils with behaviour problems. *Eur. J. Spec. Needs Educ.* 19, 317–330. doi: 10.1080/0885625042000262488

Nakamoto, J., and Schwartz, D. (2010). Is peer victimization associated with academic achievement? A meta-analytic review. *Soc. Dev.* 19, 221–242. doi: 10.1111/j.1467-9507.2009.00539.x

Nepi, L. D., Fioravanti, J., Nannini, P., and Peru, A. (2015). Social acceptance and the choosing of favourite classmates: a comparison between students with special educational needs and typically developing students in a context of full inclusion. *Br. J. Spec. Educ.* 42, 319–337. doi: 10.1111/1467-8578.12096

Norwich, B. (2002). Education, inclusion and individual differences: recognising and resolving dilemmas. *Br. J. Educ. Stud.* 50, 482–502. doi: 10.1111/1467-8527.t01-1-00215

Nowicki, E. A. (2003). A meta-analysis of the social competence of children with learning disabilities compared to classmates of low and average to high achievement. *Learn. Disabil. Quart.* 26, 171–188. doi: 10.2307/1593650

Perdue, N. H., Manzeske, D. P., and Estell, D. B. (2009). Early predictors of school engagement: exploring the role of peer relationships. *Psychol. Schools* 46, 1084–1097. doi: 10.1002/pits.20446

Piškur, B., Daniëls, R., Jongmans, M. J., Ketelaar, M., Smeets, Rob, J. E. M., Norton, M., et al. (2014). Participation and social participation: are they distinct concepts? *Clin. Rehabil.* 28, 211–220. doi: 10.1177/0269215513499029

Ripley, R. M., Snijders, T. A. B., Boda, Z., Vörös, A., and Preciado, P. (2017). *Manual for SIENA version 4.0 (version September 9, 2017)*. Oxford: University of Oxford, Department of Statistics; Nuffield College.

Robinson, D. R., Schofield, J. W., and Steers-Wentzell, K. L. (2005). Peer and cross-age tutoring in math: outcomes and their design implications. *Educ. Psychol. Rev.* 17, 327–362. doi: 10.1007/s10648-005-8137-2

Rose, A. J., and Rudolph, K. D. (2006). A review of sex differences in peer relationship processes. *Psychol. Bull.* 132, 98–131. doi: 10.1037/0033-2909.132.1.98

Rose, A. J., and Smith, R. L. (2009). "Sex differences in peer relationships," in *Handbook of Peer Interactions, Relationships, and Groups*, eds K. H. Rubin, W. M. Bukowski, and B. P. Laursen (New York, NY: Guilford Press), 379–393.

Rubin, K. H., Bukowski, W. M., and Parker, J. G. (2006). "Peer interactions, relationships, and groups," in *Handbook of Child Psychology*, ed N. Eisenberg (Hoboken, NJ: John Wiley & Sons), 571–645. doi: 10.1002/9780470147658.chpsy0310

Schwab, S. (2018). Friendship stability among students with and without special educational needs. *Educ. Stud.* 100, 1–12. doi: 10.1080/03055698.2018.1509774

Shin, H., and Ryan, A. M. (2014). Examining peer selection and influence processes on early adolescents' academic adjustment with longitudinal social network analysis. *Dev. Psychol.* 50, 2462–2472. doi: 10.1037/a0037922

Snijders, T. A. B., van de Bunt, G. G., and Steglich, C. E. G. (2010). Introduction to stochastic actor-based models for network dynamics. *Dyn. Soc. Netw.* 32, 44–60. doi: 10.1016/j.socnet.2009.02.004

Walker, A., and Nabuzoka, D. (2007). Academic achievement and social functioning of children with and without learning difficulties. *Educ. Psychol.* 27, 635–654. doi: 10.1080/01443410701309175

Wang, W., Vaillancourt, T., Brittain, H. L., McDougall, P., Krygsman, A., Smith, D., et al. (2014). School climate, peer victimization, and academic achievement: results from a multi-informant study. *School Psychol. Quart.* 29, 360–377. doi: 10.1037/spq0000084

Wentzel, K. R., Barry, C. M., and Caldwell, K. A. (2004). Friendships in middle school: influences on motivation and school adjustment. *J. Educ. Psychol.* 96, 195–203. doi: 10.1037/0022-0663.96.2.195

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