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Friendship networks in inclusive elementary classrooms: Changes and stability related to students' gender and self-perceived social inclusion

Ariana Garrote[1] · **Carmen L. A. Zurbriggen**[2] · **Susanne Schwab**[3,4]

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Abstract
Friendships with classmates play a significant role in student's development. However, only some friendships are maintained for longer than a school year and their formation depend on many factors. One important factor is gender because gender homophily is consistently found in friendship networks. In addition, there is evidence that same-gender friendships are more stable. In the context of inclusive education, friendship can be considered as one of four key dimensions of social inclusion. While three of these dimensions are assessed from others' perspective, self-perception of social inclusion focuses solely on the individual students' view. However, hardly any studies investigated how students' self-perception of social inclusion is related to friendships, and more specifically, whether and how self-perceived social inclusion is related to changes in friendship networks in the classroom. To contribute to this research gap, friendship networks of 280 students aged 9–11 years (49% girls) in 15 classes of Grade 4 were examined at the beginning and at the end of one school year. Network changes were analyzed with longitudinal social network analyses. Students' gender and self-perception of inclusion were added as predictors of changes in the friendship networks. The results confirmed gender homophily for formation and stability. The analyses also showed that students who perceived themselves as socially included nominated more best friends at the end of the school year but were not necessarily perceived as best friends by their peers. This highlights the importance of considering different perspectives to better understand social inclusion in classrooms.

Keywords Social inclusion · Friendship network · Elementary school · Peer selection · Homophily · Perceptions of inclusion questionnaire

Extended author information available on the last page of the article

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1 Introduction

Friendships with classmates play a significant role for every student's personal and academic development (Wentzel et al., 2014). Corresponding to a major socialization context in childhood and adolescence, school provides students a wide range of opportunities for social interactions with their peers with whom they then might build relationships and possibly become friends (Crosnoe, 2011). In the course of the widespread implementation of inclusive education, the student body's diversity has increased within most schools, especially in elementary education. Consequently, students' choices for forming relationships and friendship networks with classmates has become richer (Zurbriggen et al., 2018). This coincides with one of the main aims of inclusive education, namely to support all students' social participation in school contexts, but also in the longer term in society (United Nations, 2006).

However, friendships often change over a school year. According to Poulin and Chan's (2010) literature review, only about half of friendships among school-aged children and adolescents are stable. This finding was confirmed in mainstream classrooms (Meter & Card, 2016) and inclusive classrooms (Garrote & Moser Opitz, 2021). In addition, forming friendships depends on many factors. Students' individual characteristics can explain why some friendships are more likely to form than others are. More specifically, gender homophily is consistently found in the research: girls are more likely to befriend girls and boys are more likely to befriend boys (McPherson et al., 2001). In the context of inclusive education, the topic of friendship has been addressed most frequently in relation to the status special educational needs (SEN) or disability. In corresponding research, friendship is considered as one of four dimensions of social inclusion (cf. review by Bossaert et al., 2013; Koster et al., 2009). Although studies consistently show that students with SEN are less accepted by their peers and less involved in social interactions within the classroom, findings regarding friendships and self-perceived social inclusion are somewhat inconclusive (Garrote, 2016; Schwab, 2018a). The thriving field of research on social inclusion has significantly enhanced the understanding of students' peer relationships in school; however, no studies are available that investigate friendship networks in inclusive classrooms in relation to students' views of being socially included.

Therefore, in the present study, we aimed to address this research gap by investigating friendship networks in inclusive elementary classroom in relation to students' self-perceived social inclusion. More specifically, we examined whether students' self-perception of social inclusion predicted the formation and maintenance of friendships. In doing so, we adopted a broad definition of inclusion, emphasizing that all students and marginalized groups are concerned (Göransson & Nilholm, 2014; Thomas, 2013). Based on previous research on classroom social dynamics consistently showing gender homophily effects (e.g., Dijkstra et al., 2007; Garrote, 2020; Henke et al., 2017; Mamas et al., 2020), we investigated gender as a selection criterion in friendship nominations.

2 Theoretical background

2.1 Measuring social inclusion

In research on inclusive education, the social inclusion concept has often been used synonymously with social integration or social participation. Koster et al.'s (2009) literature review revealed four dimensions central to these concepts (cf. also review by Bossaert et al., 2013): students' friendships and relationships, social contacts and interactions, acceptance by classmates, and students' self-perception of inclusion.

The few studies that have simultaneously investigated the social inclusion of students along all four dimensions, have shown that the dimensions do not necessarily correlate (Avramidis et al., 2018; Garrote, 2016; Koster et al., 2010; Schwab, 2015). Students can be socially included even though they do not have the highest scores in all dimensions. This highlights the importance of assessing social inclusion along multiple dimensions to gain a further differentiated picture of the students' situation. It also indicates that the student and peers' different perspectives might lead to different outcomes (e.g., McMullen et al., 2014). For instance, students can perceive themselves as being included and nominate many friends, while simultaneously, the peers might reject them and not consider them friends (Garrote, 2016; Koster et al., 2010). In addition, the feeling of being socially included in class varies considerably among students. While one student might feel included with one best friend in class, another might feel lonely despite having many friends. Thus, obtaining insights into students' self- and interpersonal perspectives (De Leeuw et al., 2018; Østvik et al., 2018) is important, because they can provide information needed to effectively promote social inclusion in classrooms.

That said, peers significantly contribute to the social inclusion of an individual student. Thus, it makes sense to complement the individuals' perspective with the (external) perspective of peers. One of the most prominent ways to assess social inclusion from both perspectives is using sociometric nomination methods (Coie et al., 1982). The individual perspective, which the number of friends a student nominates represents (*outdegrees*), and the peers' perspective, which the peer nominations a student receives represent (*indegrees*), can be simultaneously analyzed. This technique is easy to use because students are asked to nominate, for example, their best friends in class or their seatmates (Avramidis et al., 2017; Bossaert et al., 2013; Hymel et al., 2004; Koster et al., 2009; Mamas et al., 2019). Moreover, mutual nominations can be analyzed as reciprocity, which is a specific characteristic of friendships (Rubin et al., 2011).

2.2 Friendships in inclusive elementary classrooms

Much research on social inclusion has focused on friendships with peers in school. One particularity of the school as a peer context is that classrooms are involuntary peer groups (Juvonen & Galvan, 2008), mainly due to the compulsory nature of elementary education in most societies. First, this offers every child the opportunity for social interactions with various children of a similar age, with whom they might not

have contact otherwise. However, the choice of peers, and as such, the social interactions, are restricted to the specific classroom as a non-self-selected peer group (Müller & Zurbriggen, 2016). This is particularly relevant in the context of inclusion because inclusive education can support the social inclusion of children generally and of those with disabilities and SEN particularly (United Nations, 2006).

Moreover, the voluntary nature of friendship and the assumption that it is reciprocal by definition challenge the notion of social inclusion for every child. Friendships among children are mainly characterized by symmetrical reciprocity, meaning that two individuals contribute equally to their relationship and that they call for equivalent rights, and obligations (Laursen & Hartup, 2002). Across childhood to preadolescence, the basic understanding of friendship expands beyond companionship to a needs-based exchange emphasizing mutuality. Although usually all children report having friends, not all friendships among students are reciprocal (Rossetti & Keenan, 2018; Vacquera & Kao, 2008). In addition, some students, such as students with SEN, are more likely to experience unreciprocated friendships (Kasari et al., 2011; Petrina et al., 2014). Sociometric studies focusing on inclusive classrooms have shown a lower number of reciprocal friendships for students with SEN compared to their peers without SEN (Avramidis et al., 2018; Henke et al., 2017; Hoffmann et al., 2021; Rotheram-Fuller et al., 2010; Schwab, 2018a).

Several authors have argued that nonreciprocal or unilateral friendships (i.e., a child reports a relationship that the other child does not acknowledge) should be given special attention because they reflect a child's own perceptions of their relationships and the feeling of identification with peers (e.g., Furman, 1996; Kiesner et al., 2002; Poulin & Chan, 2010). Self-perceived friendships or relationships can influence an individual, even if they do not correspond with other-reported friendships or observed social interactions. Although there is compelling evidence on the importance of self-perceived friendship (cf. review by Poulin & Chan, 2010), to the best of our knowledge, there is no study available investigating whether the formation of friendships in (elementary) inclusive classrooms relates to the self-perceived social inclusion of students.

2.3 Selection tendencies

Driven by the need to be understood, to have trust, to predict, and communicate more easily, people tend to associate or bond with others who are similar to them (McPherson et al., 2001). This tendency, called homophily, is one of the most persistent findings in studies on friendship networks (Block & Grund, 2014). According to McPherson et al. (2001), homophily is "the principle that contact between similar people occurs at a higher rate than among dissimilar people" (p. 416). In their seminal work, Lazarsfeld and Merton (1954) differentiate between status and value homophily. Status homophily include sociodemographic characteristics such as age, gender, or ethnicity, while value homophily concerns beliefs, attitudes, or other internal states.

A vast majority of research on homophily among children and adolescents has focused on status homophily, with gender homophily as probably the most frequently

investigated and observed selection effect in general (e.g., Fabes et al., 2003; Martin et al., 2012) but also in school (e.g., De Boer et al., 2013; Lee et al., 2007). Studies consistently show that girls are more likely to interact with or befriend female classmates, while boys are more likely to interact with or befriend male classmates in mainstream as well as in inclusive classrooms (Dijkstra et al., 2007; Garrote & Moser Opitz, 2021; Henke et al., 2017; Mamas et al., 2020). Garrote and Moser Opitz (2021) further found a strong association between gender homophily and stable reciprocal relationships. This means that reciprocal relationships among students that were maintained over 1 school year were almost entirely between same-gender students. Even stable friendships between students with and without SEN are more often found to be same-gender friendships (Freeman & Kasari, 2002).

2.4 Friendship stability

There are not many studies on friendship stability in inclusive classrooms. The few studies mainly focus on friendships of students with SEN. Schwab's (2019) findings suggest that SEN students' friendships are less stable than those of students without SEN are. Wiener and Schneider (2002) found that students with learning disabilities in Grade 4 to 6 had less stable unreciprocated friendships than their typically developing peers did. For reciprocal friendships no significant differences were found between the groups. Garrote and Moser Opitz's (2021) recent study also showed that students with intellectual disabilities compared to their peers without SEN maintained a similar number of stable reciprocal relationships in inclusive elementary classrooms over 1 school year. In both student groups, about half of the reciprocal relationships were maintained, which is in line with findings on friendship stability in mainstream classrooms (Bowker, 2004; Meter & Card, 2016; Poulin & Chan, 2010).

Adopting a developmental perspective, research suggests that friendship stability increases with age. In other words, studies indicate that adolescents are more likely to maintain friendships than children are (Poulin & Chan, 2010). Berndt and Hoyle (1985) reported that children in Grade 4 maintained more of their friendships across 1 school year than those in Grade 1. However, the friendship stability did not increase regularly to Grade 8. In line with this finding, most studies reported in Meter and Card's (2016) meta-analysis did not find evidence for the association between stability and age.

3 The present study

In the present study, we aimed to examine changes and stability in friendship networks in inclusive elementary classrooms. More specifically, we examined the extent to which students' gender and self-perceived social inclusion related to the formation and maintenance of friendships over 1 elementary school year (i.e., from the beginning to the end of 1 school year). Based on previous studies (e.g., Garrote & Moser Opitz, 2021; Henke et al., 2017), we included gender as a predictor for friendship formation (received and

given best friend nominations). In addition, gender homophily was assumed to affect the formation and maintenance of friendships. In other words, we expected the formation of more new friendships among same-gender students by the end of the school year, and we assumed the stability of friendships over 1 school year would be higher among same-gender students. Further, in line with the social inclusion concept being represented along multiple dimensions (Koster et al., 2009), students' self-perceived social inclusion was hypothesized to associate positively with their perception of having friends. This means that students who perceived themselves as being more included would nominate more peers as best friends. Because of the lack of clear and conclusive findings, no hypotheses were formulated for the relationship between students' self-perception of social inclusion and peer nominations, and for the effect of having a similar self-perception of inclusion (value homophily) on friendship nominations.

4 Methods

4.1 Sample and procedure

Data for the current study are part of a wider project called ATIS-STEP ("Attitudes Towards Inclusive Schooling—Students, Teachers, and Parents"; for detailed information see e.g., Schwab, 2018b). The local school authority of the Austrian federal state Styria ("Landesschulrat Steiermark") gave ethical approval for the study. All parents or legal guardians of the involved participants had to provide written consent. Participants were enrolled in schools in urban and rural areas of the Austrian federal state Styria. Almost half of students (43.7%) spoke the language of instruction (i.e., German) at home, 47.4% spoke another language, and 4.9% spoke the language of instruction and another language. The foreign languages that were indicated the most were Serbian (8.2%), Turkish (4.9%), Polish (4.1%) and Arabic (5.2%). The first measurement point (t_1) was at the beginning of Grade 4, and the second one (t_2) was at the end of the same school year. Within the current study, data from both measurement points were included. The paper–pencil survey took approximately one hour for the students.

The sociometric network analysis—our analytical approach to investigate friendship networks within class (cf. Analyses section)—requires a relatively high proportion of participating students per class. With more than 20% randomly missing data, the model simulation can become unstable (Ripley et al., 2022). In the present study, the final study sample consisted of 15 classes with 280 students aged 9 to 11 years (49% girls). On average, 19 students ($SD = 3.64$; $Min = 10$; $Max = 24$) participated per class. The participation rate per class in the study sample was on average 95% at t_1 ($Min = 83\%$) and 94% at t_2 ($Min = 83\%$).

4.2 Measures

4.2.1 Friendships

The data of the friendship networks were assessed using peer nominations with one item at t_1 and t_2. Students were asked to nominate up to five peers of their classroom as their best friends ("Who in your classroom do you consider to be your best friends?"). The students received a list of names of all those peers, whose parents or legal guardians had given informed consent.

On average, participants nominated four best friends (*outdegrees*) of the participants list at t_1 ($M = 3.99$; $SD = 1.17$) and t_2 ($M = 4.18$; $SD = 1.18$) and they received (*indegrees*) up to twelve best friend nominations at t_1 ($M = 3.82$; $SD = 2.01$) and t_2 ($M = 4.00$; $SD = 2.07$) from peers, who participated in the study. For the analyses of the networks, data were transformed into matrices with equal senders (i.e., students nominating classmates) and receivers (i.e., students classmates nominated). The nominations or ties were coded as 1 and a lack of ties as 0. The friendship network was used as the dependent variable in the analyses.

4.2.2 Self-perceived social inclusion

Self-perceived social inclusion was assessed with one scale of the Perceptions of Inclusion Questionnaire (PIQ; Venetz et al., 2015). The PIQ consists of 12 items, which are rated on a 4-point Likert scale (ranging from 1 = "not at all true" to 4 = "certainly true"). Previous studies showed that the PIQ yields good psychometric properties (e.g., Knickenberg et al., 2022; Zurbriggen et al., 2019). The scale *Social Inclusion* includes three positively worded items (e.g., "I get along well with my classmates") and one negatively worded item ("I feel lonely in my class"). For each student an average score of self-perceived social inclusion at t_1 ($M = 3.52$; $SD = 0.52$) was calculated and included in the model as the independent variable. The internal consistency of the scale was moderate 0.61 at t_1. At t_2 however, it was acceptable 0.72, like in previous studies (e.g., Venetz et al., 2019; Zurbriggen et al., 2019).

4.3 Analyses

To answer the research questions, a multigroup selection model was estimated with the friendship network as a dependent network. The network data were represented by directed adjacency matrices, which consisted of dichotomous cells, in which a tie from one individual to another (i.e., from one student to another student) was present or absent. The students' genders were added to the model as a dichotomous covariate (1 = girl; 0 = boy).

We used the social network analytical package Simulation Investigation for Empirical Network Analysis RSiena 1.3.0 to analyze selection effects with stochastic actor-oriented models (SAOMs; Ripley et al., 2022). Within a SAOM, a

network's evolution is viewed as a stochastic process that the actors drive. This process involves two subprocesses: 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 characteristics of individual actors, pairs of actors, and the whole network structure may influence the attractiveness of tie changes (Snijders et al., 2010).

Network effects were included to control for characteristics of the network (Ripley et al., 2022): *outdegree* (i.e., density), *reciprocity*, and *transitivity* (i.e., transitive triplets and transitive reciprocated triplets). *Outdegree* or density represents the effect of network members connected to each other, measured by the number of nominations made considering the number of possible nominations in the network. *Reciprocity* represents the effect of reciprocation of nominations in networks. *Transitive triplets* express actors' tendency to nominate friends of their friends. In other words, when student A, in a triad with students A, B, and C, nominates student B as best friend and student B nominates student C, student A is likely to nominate student C as well. *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 Matthew effect (Merton, 1968) and increase the model's goodness of fit (GOF; Ripley et al., 2022): *indegree popularity* (i.e., the extent to which being nominated by many peers leads to more peer nominations), *outdegree popularity* (i.e., the extent to which nominating many friends leads to more peer nominations), and *outdegree activity* (i.e., the extent to which nominating many friends leads to nominating more friends). Because the nominations were limited to five best friends, the maximum value of five was specified in the model with the *MaxDegree* parameter.

Further, we included selection effects in the model. Three basic effects were considered: *alter*, *ego,* and *homophily*. The *alter* effect reflects the tendency of individuals with specific individual characteristics (i.e., gender) or with a higher score on a given characteristic (i.e., self-perceived social inclusion) 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-gender and similar self-perceived social inclusion effects were added to the model. For the gender homophily effect, the extent to which it predicted the forming (*evaluation*) and the maintaining (*endowment*) friendships over time was analyzed.

To permit selection modelling in RSiena, the networks' stability has to be sufficient, which the Jaccard index indicates. A value above 30% is good, values lower than 20% indicate there might be difficulties in estimation, and the stability of networks with an index value of 10% is too low (Ripley et al., 2022). In all friendship networks the stability was good ($M = 52\%$; $Min = 36\%$; $Max = 67\%$). The estimation with all 15 classes converged (overall maximum convergence ratio 0.19 and convergence t ratios < 0.07).

In SAOM, two types of missing data are distinguished and handled separately (Ripley et al., 2022). Missing values were treated as randomly missing. Missing values of participants who joined or left the study between t_1 and t_2 were specified in the model (*composition change*). This was accomplished with an additional data file that identified when individuals joined ($n = 2$) or left ($n = 0$) the network. In the estimation procedure, missing values of students before they joined the class network

were regarded as 0 entries, and missing entries of students after they left the class network were fixed at the last observed values.

5 Results

5.1 Descriptive statistics

In a first step, received (*indegrees*) and given (*outdegrees*) best friend nominations at t_1 and t_2 were correlated with gender and the average score of self-perceived social inclusion (Table 1). Self-perceived social inclusion positively and significantly correlated with received and given best friend nominations at both measurement occasions. Gender was only significantly and positively correlated with given nominations at t_1, indicating a tendency of girls to nominate more best friends at the beginning of Grade 4.

All nomination variables positively correlated with each other. Correlations between received best friend nominations at t_1 and t_2 and between given nominations at t_1 and t_2 were the highest. This suggests stability over time, especially for the number of received best friend nominations.

5.2 Longitudinal social network analysis

To investigate further the relationship between self-perceived social inclusion and best friend nominations, a social network analysis considering network effects was run. Table 2 presents the descriptive statistics of the friendship networks. The average degree for all classrooms was slightly higher at t_2 than it was at t_1. Students nominated on average 24% of classmates at t_1 as best friends and 25% at t_2 (i.e., density).

5.2.1 Network effects

Table 3 summarizes the results of the SAOM by displaying mean estimates and standard errors obtained. The network effects are characterized in Table 3 by a negative *outdegree* effect, which indicates that the analyzed networks were sparse rather

Table 1 Bivariate correlations among the study variables

	(1)	(2)	(3)	(4)	(5)	(6)	*n*	Missing
1. Gender (1 = girl; 0 = boy)	1						280	0
2. Perceived social inclusion	.08	1					270	10
3. Received nominations t_1	.03	.24**	1				278	2
4. Given nominations t_1	.16*	.23**	.27**	1			266	14
5. Received nominations t_2	-.05	.22**	.65**	.29**	1		280	0
6. Given nominations t_2	.007	.22**	.26**	.36**	.25**	1	268	12

*$p < .05$, **$p < .01$, two-tailed

Table 2 Sample descriptives for the friendship networks of the 15 classes included in the social network analyses

	Friendship networks	
	t_1	t_2
n	423	424
Participation rate (%)	98.4	97.2
Missing	7	12
Girls (%)	54	53.21
Number of ties	1062	1116
Average degree *M* (*SD*)	3.96 (0.3)	4.2 (0.34)
Density (%)	24	25
Jaccard (%)	51.9	

Table 3 Model of gender and perceived social inclusion as predictors in friendship networks

	Friendship networks	
	Estimate	SE
Network effects		
Outdegree (density)	-2.02***	0.36
Reciprocity	1.6***	0.18
Transitive triplets	0.48***	0.06
Transitive reciprocated triplets	-0.21*	0.09
Indegree popularity	0.04	0.02
Outdegree popularity	-0.2***	0.06
Outdegree activity	0.17**	0.05
Selection effects		
Effect of gender (1 = girl) on received nominations (*alter*)	-0.18	0.09
Effect of gender on given nominations (*ego*)	0.15	0.15
Same gender (*homophily*) formation	1.01***	0.21
Same gender (*homophily*) maintenance	1.1*	0.43
Effect of perceived social inclusion on received nominations (*alter*)	0.08	0.08
Effect of perceived social inclusion on given nominations (*ego*)	0.28*	0.14
Similar level of perceived social inclusion (*homophily*)	-0.08	0.22

*$p < .05$, **$p < .01$, *** $p < .001$

than dense in nature. This result is commonly found in social network studies (Snijders et al., 2010). Further, there was a significant positive reciprocity effect, which describes the extent to which unreciprocated best friend nominations became reciprocated over time. The significant positive *transitive triplets* parameter represents the tendency to nominate the best friends of best friends over time. In other words, when student A, in a triad with students A, B, and C, nominated at t_1 student B as best friend and student B nominated student C, student A was likely to nominate student C at t_2 as well. The significant negative *transitive reciprocated triplets* parameter indicates that the reciprocity was weaker within the transitive triplets over

time. Further, *indegree popularity* was not significant. This means that students who many peers nominated at t_1 were not significantly nominated by more peers at t_2. *Outdegree popularity* was negative and significant, which shows that students who nominated many classmates at t_1 were less likely to have many classmates nominate them at t_2. Consequently, the association between indegrees and outdegrees decreased. Finally, the significant positive *outdegree activity* effect shows that students who nominated many others as best friends at t_1 tended to nominate even more classmates as best friends at t_2.

5.2.2 Selection effects

The effect of gender on received best friend nominations (*alter* effect) and the effect of gender on given best friend nominations (*ego* effect) were not significant (Table 3). This means that girls were less likely to receive or give new best friend nominations at the end of the school year than boys were. The significant same-gender effect for formation confirmed the *homophily* tendency of students to nominate same-gender peers as best friends. In other words, girls were more likely to nominate female participants from their class as best friends and boys were more likely to nominate male participants from their class as best friends by the end of the school year. In addition, the significant homophily effect for maintenance indicates that same-gender students more likely maintained friendships.

The effect of self-perceived social inclusion on received nominations (*alter* effect) was not significant, but the effect of self-perceived social inclusion on given nominations (*ego* effect) was positive and significant for forming new ties over time. This indicates that students who reported higher levels of social inclusion did not receive significantly more best friend nominations (*alter* effect) from other participants in their class than students did with lower levels of self-perceived social inclusion over time. At the same time, students with higher levels of self-perceived social inclusion were more likely to nominate more classmates as best friends (*ego* effect) over time. Moreover, we found no (value) homophily tendency of students to nominate other participants of the class with similar levels of self-perceived social inclusion as best friends. This suggests heterogenous perceptions of social inclusion among befriended participants.

6 Discussion

In this study, we examined longitudinally formation and stability in friendship networks in inclusive elementary classrooms, considering students' gender and their self-perceived social inclusion as predictors. Both predicted the changes in friendship networks of Grade 4 students over one school year. However, the effects of these predictors differed.

6.1 Friendships and self-perceived social inclusion

The weak correlations between students' self-perceived social inclusion and best friendship nominations indicate that the number of friendships students had is not the only factor that explains their feeling of being socially included. This is in line with the often reported finding that having a few, close high-quality friendships may be more beneficial for children's well-being than having many casual friendships (Hodges et al., 1999; Hoza et al., 2000). Thus, students who felt socially included might have had less but high-quality friends.

The longitudinal social network analyses also showed that students with similar perceptions of inclusion were not more likely to befriend each other (i.e., value homophily; Lazarsfeld & Merton, 1954). Hence, befriended students felt often different about their social inclusion. This suggests that having friends does not automatically create the feeling of being included and that two individuals may have a different perception of their relationship and its contribution to their own well-being.

The results further revealed that the more the students perceived themselves as included in the classroom at the beginning of the school year, the more best friends they nominated at the end of the school year. This indicates a coherence between the students' self-perception of inclusion and the perception of their friendship network: the more included students felt, the more classmates they perceived as best friends over time. Feeling included in the classroom could possibly lead students to feel more confident in the peer group and willing to consider more classmates as best friends. At the same time, students' self-perceived social inclusion was not related to an increase of received friendship nominations over time. In other words, feeling included did not seem to lead to more classmates perceiving them as best friends by the end of the school year. When self-perceived social inclusion leads to more perceived best friends but not objectively to more best friends, it suggests that students may have an inflated sense of their friendship network or the quality of their relationships with peers. The students' perception of their friendships may be influenced by their desire to be included and accepted by others, leading them to overestimate the extent of their friendship network. This assumption is also supported by the weak correlations between the students' self-perceived social inclusion and the best friend nominations. This suggests that those students, who subjectively felt socially included might not have been included from an objective point of view (i.e., received best friend nominations by peers).

Overall, these findings underline the importance of the students' own view of social relationships (e.g., Poulin & Chan, 2010). In line with previous studies, our findings suggest that assessing social inclusion from different perspectives could lead to a different understanding of the students' situation (e.g., McMullen et al., 2014). Combining sociometric nomination methods with measures of self-perception of social inclusion can provide a further differentiated picture of the social inclusion and the social dynamics in inclusive classrooms.

6.2 Friendships and gender

Based on previous research, students' gender was examined as a predictor of changes and stability in the friendship networks. No gender differences were found regarding given or received best friend nominations. That is, both girls and boys were similarly likely to nominate best friends and peers perceive them as best friends. As expected, a significant gender homophily effect was found, similar to many other studies in educational science (e.g., Dijkstra et al., 2007; Garrote, 2020; Henke et al., 2017; Mamas et al., 2020). Girls were more likely to nominate each other as best friends, and boys were more likely to nominate each other as best friends. In addition to the gender homophily effect on forming new friendships, a gender homophily effect was found on maintaining friendships. In other words, friendships between same-gender students were more likely to remain stable over one school year than friendships between students of different genders. This result is in line with previous findings on social relationships in inclusive classrooms and between students with and without SEN (Freeman & Kasari, 2002; Garrote & Moser Opitz, 2021). This also supports the assumption that similar others are easier to understand, trust, predict, and communicate with (McPherson et al., 2001) because these features substantially contribute to the stability of friendships (Newcomb & Bagwell, 1995).

6.3 Limitations

This study provides further insights into the relationship between friendship networks in inclusive elementary classrooms and students' gender as well as self-perceived social inclusion. Still, some methodological and conceptual limitations should be considered when interpreting the findings. First, the sociometric nominations were limited to five best friends. Limited nominations entail the risk of being less psychometrically sound (Hymel et al., 2004) and thus are less suited for social network analyses. However, the limited number was specified in the model. Second, participants could only nominate classmates who also participated in the study. Some participants might not have been able to nominate their best friends because they did not participate. However, the probability for such cases occurring was relatively low because the participation rate per class in the study sample was high. Third, selection effects were only accounted for gender and self-perceived social inclusion because the study aimed at exploring more general social processes, such as gender homophily, that might affect all students in inclusive classrooms. However, multiple other predictors, such as SEN, social background, and social behavior, could also explain the formation and stability of friendships in inclusive classrooms. Fourth, the PIQ scale used to measure students' self-perception of inclusion involved items related to the classroom level. For example, students were asked to rate how lonely they felt in the classroom. In contrast, best friend nominations were assessed at a dyadic level. Thus, not finding significant relationships between students self-perceived social inclusion and peer nominations could be due to the different levels of assessment. Furthermore, it should be noted that the PIQ was developed as

a screening instrument. Thus, the scale *Social Inclusion* captures aspects of self-perceived social inclusion in class on a general level. Future studies might consider using instruments measuring specific aspects of social inclusion, such as social contact or sense of belonging. Finally, the internal consistency of the scale was moderate at the first measurement point. The analyses were nevertheless carried out with the original scale to be able to draw comparisons with previous studies (e.g., Knickenberg et al., 2022). In addition, the internal consistency of the scale at the second measurement point in the study sample and in previous studies (e.g., Venetz et al., 2019; Zurbriggen et al., 2019) was acceptable.

6.4 Conclusion

As important as it is to promote positive relationships and interactions in inclusive classrooms for the social inclusion of all students, it remains a challenge. Whether relationships are formed and whether they last depend on many factors. This study provided further evidence for gender selection-effects on students' friendship networks in elementary classrooms. Friendships among same-gender students were more likely and more stable than cross-gender friendships. This is a social process that needs consideration when implementing strategies to promote friendships among students in classrooms. Furthermore, self-perceived social inclusion enhances students' social activity. Creating a positive and inclusive classroom environment might lead to a more positive perception of students and consequently increase students' willingness to form new friendships with classmates. In the long term, such social dynamics can have a positive effect on the entire classroom. Finally, this study shows how important it is to distinguish and consider the self-perception and the peer perspective to better understand social inclusion in classrooms. More importantly, it highlights that different perspectives have their justification.

7 Data availability and materials

Full data cannot be provided for ethical motives. Requests to access the material should be directed to SS, susanne.schwab@univie.ac.at.

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Author contributions AG, CZ and SS designed and agreed on the aim of this study. AG conducted the data analyses, wrote the Methods and Results sections as well as the Discussion and contributed to parts of the Theoretical background. CZ wrote the Introduction and the Theoretical background and contributed to parts of the Methods and the Results sections. SS was responsible for the data collection and data preparation and contributed to parts of the Theoretical background. All authors read and agreed to the final version of the submission.

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Declarations

Conflict of interest We have no known conflict of interest to disclose.

Ethical approval The study was approved by the local school authority of the Austrian federal state (Landesschulrat Steiermark).

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Ariana Garrote is a Postdoc at the FHNW School of Education, Center of Learning and Socialization. Her work focuses on social dynamics in classes in which students from diverse social backgrounds (e.g., migration backgrounds, socio-economic status) and with a broad range of educational needs are enrolled. She studies how students' relationships with peers and teachers, and teacher beliefs influence their socio-emotional development and academic functioning.

Carmen L. A. Zurbriggen is a Full Professor in Special Education at the University of Fribourg Switzerland. Her areas of research encompass adolescents' subjective well-being and social participation in inclusive classrooms and beyond, social-emotional development in heterogeneous learning contexts, as well as professionalism in special and inclusive education..

Susanne Schwab is a Full Professor for School Pedagogy at the University of Vienna, Austria (Center for Teacher Education and Educational Science) and Extraordinary Professor at the North-West University in Vanderbijlpark, South-Africa. Her current research focuses on teacher training and teacher professionalization in the field of inclusive education, as well as on the students' achievement and social and emotional development of students from minority groups (e.g., students with SEN, students with migration background).

Authors and Affiliations

Ariana Garrote[1] · Carmen L. A. Zurbriggen[2] · Susanne Schwab[3,4]

✉ Ariana Garrote
ariana.garrote@fhnw.ch

[1] School of Education, University of Applied Sciences and Arts Northwestern Switzerland, Bahnhofstrasse 6, 5210 Windisch, Switzerland

[2] University of Fribourg, Fribourg, Switzerland

[3] University of Vienna, Vienna, Austria

[4] North-West University, Vanderbijlpark, South Africa