Received: 9 June 2023 | Accepted: 3 February 2024

DOI: 10.1002/berj.3989

ORIGINAL ARTICLE

BERJ BERA

Classroom social networks, students' peer-related social experiences and sense of belonging: The specific case of students with SEN

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Funding information
Fundação para a Ciência e a Tecnologia

Abstract

One main argument for inclusion refers to the social benefits that students with SEN might have from being in contact with typically developing classmates. Students' sense of belonging to the classroom is also a relevant dimension of inclusion, given its importance for positive emotional and social development and academic motivation. Yet, studies specifically focused on students with SEN show mixed results regarding their sense of belonging. While some studies have highlighted the effect of classroom social networks on peer-related social experiences, to our knowledge no study has examined its effect on the sense of belonging. Thus, the goal of the current study is to examine the associations between the structure of classroom social networks, peer-related social experiences in the classroom and the sense of belonging of students with and without SEN. The participants were 914 students (56% boys, 10% SEN, average age 12.68) attending Portuguese schools. Contrary to what was expected, although students with SEN were, on average, more rejected and less accepted by the peer group than students without SEN, they did not differ in their levels of sense of belonging. In addition, the structure of classroom social networks was associated with students' belonging in

unexpected ways. Results point to the importance of creating social conditions in the classroom to facilitate positive peer interactions and relationships, and the need for teachers to pay attention to the social structure of the classroom in order to create a positive atmosphere where all students feel accepted, respected, valued and a part of the classroom.

KEYWORDS
classroom social networks, peer-related social experiences, sense of belonging, students with SEN

Key insights

What is the main issue that the paper addresses?

Considering that a sense of belonging in the classroom is a relevant dimension of inclusion, the mixed results regarding students with SEN and that classroom social networks play a key role in peer-related social experiences, this paper examines the association between classroom social networks and students' sense of belonging.

What are the main insights that the paper provides?

Despite being more rejected and less accepted, students with SEN did not differ from their classmates in their sense of belonging. Classroom social networks showed an association with sense of belonging in unexpected directions. This paper offers tentative explanations based on the presence of cohesive subgroups and students' perceptions of classroom peer context and classroom climate.

INTRODUCTION

The classroom is a social system where different social actors, having mutual expectations and sharing implicit or explicit social norms, play multiple roles and functions (Babad, 2009; Farmer et al., 2018). This system is not only influenced by the teacher (Farmer et al., 2011, 2018, 2019), but also by the students themselves (Babad, 2009). In particular, students' social networks affect peer-related social experiences (Almquist, 2011; Farmer et al., 2018; Hendrickx et al., 2016) as they function as pathways that facilitate (or constrain) sharing information, emotional support, as well as processes of social influence (Almquist, 2011). Social networks also affect students' opportunities for interacting with each other, developing friendships and obtaining access to the peer group (Almquist, 2011; Hallinan & Smith, 1989). Thus, investigating the effect of the structure of classroom social networks on peer-related social experiences is particularly relevant. Notably, studies tend to focus on typically developing children, neglecting the effect of specific structures of classroom social networks on the social experience of students with special education needs (SEN) (Farmer et al., 2018, 2019). However, one main argument for inclusion refers to the social benefits that students with SEN might have from being in contact with typically developing classmates, including

developing friendships and engaging with the peer group (Koster et al., 2009; Mamas, Schaelli et al., 2020; Schwab, 2015). Also important, the few studies available suggest that peer-related social experiences of students with SEN vary as a function of the structure of classroom social networks (Mamas et al., 2019; Mamas, Schaelli et al., 2020).

Thus, understanding how classroom social networks affect peer-related social experiences is fundamental to improving the experiences of students with SEN. Importantly, some authors have highlighted the need to also examine students' subjective experiences within the peer group (e.g., Prince & Hadwin, 2013) to understand the process of inclusion. Students' sense of belonging to the classroom seems to be a particularly relevant subjective experience, given its importance for positive emotional and social development and for academic motivation and achievement (e.g., Allen et al., 2018, 2021; Korpershoek et al., 2020; McNeely et al., 2009; Osterman, 2000). Therefore, the current study aims to examine the association between the structure of classroom social networks, peer-related social experiences in the classroom and the sense of belonging of students with and without SEN.

Students' sense of belonging

Belonging is a basic human need that moves individuals to develop a set of actions for initiating and maintaining a minimum of positive, meaningful and lasting social relationships (Baumeister & Leary, 1995). As a basic need, the difficulty in establishing and maintaining regular positive and meaningful relationships with others may translate into feelings of isolation, depression and anxiety, as well as negative behaviours towards others (Baumeister & Leary, 1995). Belonging arises when individuals feel connected to a community, that is, when people feel that the group is important to them and feel important to the group, when they feel that the group meets their needs and when they share an emotional connection with the members of the group (Osterman, 2000). Considering educational settings, Goodenow (1993) defines a sense of belonging as 'the extent to which students feel personally accepted, respected, included, and supported by others in the school social environment' (p. 80).

Numerous studies have aimed to identify what characteristics of the school environment and of the students facilitate the experience of belonging. According to Goodenow (1993), school belonging depends on students' individual predispositions (e.g., perceiving others as being accepting or rejecting), particular circumstances (e.g., being a new student in the school) and characteristics of the school. At the school level, perceived safety, teacher support and student–teacher relationships, as well as support from peers, are important dimensions associated with belonging (Slaten et al., 2016). According to Stiefel et al. (2016), relationships with classmates and teachers, as well as teachers' instructional practices, are fundamental for developing feelings of belonging, as they help students feel welcome and secure, and facilitate students' involvement in class activities. Allen et al. (2018, 2021) identified teacher support as one of the most important variables associated with school belonging. When students believe that they have a positive relationship with their teachers and perceive them as caring, empathic and fair, they are more likely to feel that they belong. Also important is peer support, in particular having friends and perceiving positive and caring relationships with peers. According to Hamm and Faircloth (2005), friendship is strongly associated with belonging, due to the strong emotional connections and the sense of security which arise from feeling accepted and valued and from being able to trust friends. In addition, the feeling of companionship that stems from friendship makes students feel part of the school/classroom. Further, according to Craggs and Kelly (2018), when students establish positive relationships with peers, they feel that their individual identities are known,

understood and accepted, they feel safe and are more likely to experience belonging to a group and to the school.

Even though previous research highlights the important role that relationships with peers and teachers play in promoting a sense of belonging, studies specifically focused on students with SEN show mixed results. For instance, Schwab (2015) reported that students with SEN, in addition to having fewer friends and being more rejected by the group, feel less socially included in the classroom than their classmates without SEN. Yet, Frederickson et al. (2007) reported that although students with SEN are more rejected by their peers, they do not differ significantly from them in their sense of belonging to the school. Avramidis (2013) found that, despite being less popular and having fewer friends than their peers without SEN, students with SEN felt socially accepted by their classmates. In turn, Nepi et al. (2013) showed that despite their positive levels of social acceptance (as measured by the number of positive choices to play with or work with others on a sociometric task), students with cognitive and sensorial disabilities showed low feelings of belonging to the school. In this case, being accepted did not guarantee that students would feel part of the group. It is important to note that these studies used different definitions and measures of belonging, which could also explain the mixed results. Moreover, in a literature review, Avramidis et al. (2017) found an association between methods of data collection and research findings on the social experiences of students with SEN, with studies relying on peer nominations and peer ratings reporting negative outcomes and studies using social cognitive mapping portraying a more nuanced picture. Thus, these findings call for additional studies to better understand these processes. Importantly, considering that students spend much of their time within the classroom, it is also necessary to consider the associations between classmates' social networks, peer-related social experiences in the classroom and students' sense of belonging.

Classroom social networks and peer-related social experiences

To our knowledge, no studies have explicitly examined the association between the structure of classroom social networks and students' sense of belonging. Yet, the existing studies focusing on classroom social networks and peer-related social experiences provide an important context for hypothesising associations between classroom social structures and students' sense of belonging.

Ahn et al. (2010), focusing on bullying and victimisation, examined the relationship between the distribution pattern of connections among classmates (embeddedness) and the average connections in the classroom (density), and how bullies and victims were appreciated by their classmates. Results showed that students with higher levels of aggression were more likely to be perceived as popular in classrooms, with an unequal distribution of connections between students (i.e., high embeddedness). In contrast, these students were more likely to be perceived as unpopular in classrooms where the distribution of connections was more egalitarian. The authors explained this relationship based on the efficiency of aggressive behaviour for maintaining central positions or for restraining more peripheral members from reaching more central positions. This effect was stronger when considering classroom density, as classrooms where students establish many connections with each other (high density) are highly effective in transmitting norms, which reinforces these same norms, making them valued by all classmates. In less dense classrooms, the paths to transmit norms are less numerous and, therefore, transmission is less effective. Therefore, the norm—aggressive behaviour—is not as shared or reinforced, making this behaviour less valued by classmates. Similarly, according to Schafer et al. (2005), a hierarchical structure favours victimisation by establishing more rigid and stable positions over time. In contrast, more egalitarian structures in the distribution of power and prestige facilitate changes in

position, with victimisation positions becoming less stable. Aligned with this study, Serdiouk et al. (2013) noted that in classrooms in which some victimised students were very visible and central (high centralisation of victimisation), the number of victims tended to increase over time, as well as the likelihood of rejected students becoming victimised. Serdiouk and colleagues explained this mechanism, referring to the study by Ahn et al. (2010). Highly centralised structures increase tension between groups, making it difficult to change positions and for some students to access resources. Within these network structures, peer victimisation might work as a mechanism that allows each student to improve his/her position. Students tend to annoy students with less positive statutes (e.g., rejected) to improve their own position and protect themselves from victimisation. Accordingly, Ahn and Rodkin (2014) found that in classes in which the distribution of friendships was more egalitarian (low centralisation) and in which all children tended to be named by other children as friends or as being liked (high density), social status and aggression were not associated, and aggressive children tended to lose their social status throughout the year.

When examining the moderating effect of group cohesion (i.e., the average number of reciprocal nominations per child in each classroom) on the relationship between classroom hierarchisation and students' rejection (negative choices in a sociometric task) and victimisation, Babarro et al. (2017) reported more victimisation in hierarchised classrooms with high cohesion and also that rejected students tended to be more victimised in such classrooms. Babarro and colleagues suggested that aggressive adolescents have two main goals: to obtain peer affection and to dominate specific students. Therefore, to minimise the risk of losing their classmates' affection while still dominating others, these students tend to focus their aggression on already rejected students. In highly hierarchical structures, more students occupy more peripheral positions and thus are more vulnerable and more easily subjected to greater victimisation. Further, in high cohesion structures, norms are more easily spread, including norms of aggressive behaviour, which may result in aggressive students not becoming disliked by their classmates.

Considering the case of students with SEN, Mamas, Schaelli et al. (2020), using a critical case study design with six classrooms from three different countries (students aged 9–10 years old), found that students identified as having SEN had nearly as many friends and play partners as their classmates without SEN, in classrooms high in reciprocity and in density. In a similar study with two classrooms (2nd grade), Mamas et al. (2019) compared the position of students with SEN on four classroom social networks (e.g., friendship, play with during recess, seek help when teacher is not around, talk with if having a bad day) and examined its relationship with two structural properties of the classroom social networks (centralisation and reciprocity). Findings showed that in the classroom characterised by high reciprocity in talk, recess and help networks, and also low centralisation in talk networks, students with SEN received as many positive choices as their classmates without SEN. The authors suggest that having sources of emotional support readily available when having a bad day may be particularly important for students with SEN.

Current study

The goal of this study was to examine the associations between two properties of the structure of classroom social networks (i.e., centralisation and density), peer-related social experiences in the classroom (e.g., reciprocity, social acceptance and social rejection) and the sense of belonging of students with and without SEN. As data have a hierarchical structure, with students nested within classrooms, and the goal of the study was to examine cross-level interactions, we employed multilevel analysis (Hayes, 2006; Maroco, 2018; Raudenbush & Bryk, 2002).

Although studies with students with SEN show mixed results (e.g., Avramidis et al., 2017; Frederickson et al., 2007; Nepi et al., 2013), previous studies focusing on school belonging point out that peer relationships are important for developing a sense of belonging to school (e.g., Craggs & Kelly, 2018; Hamm & Faircloth, 2005). Thus, at an individual level, it is expected that students who have fewer reciprocated peer relationships (H1) or who are less accepted (H2) or more rejected (H3) will experience less belonging. Similarly, it is expected that students with SEN will experience less belonging to the classroom (H4), as they tend to have fewer reciprocal relationships and to be less accepted and more rejected by classmates (e.g., de Boer & Pijl, 2016; Petry, 2018; Schwab, 2015).

At the classroom level, as students' sense of belonging is associated with positive relationships with classmates (e.g., Craggs & Kelly, 2018; Hamm & Faircloth, 2005), it is expected that a higher density structure of positive peer connections will be associated with increased feelings of belonging (H5). In contrast, given that high centralisation is associated with tension in status and power management (Ahn et al., 2010), it is expected that in highly centralised classrooms students will feel less belonging to the classroom (H6). Finally, based on the work of Mamas et al. (2019) and Mamas, Schaelli et al. (2020), it is expected that students with SEN will experience more belonging in classrooms characterised by high density (H7) and characterised by low centralisation (H8).

METHODS

Participants

The participants were 914 students (56% boys, 10% SEN). Students' average age was 12.68 (SD = 1.50). Students belonged to 43 Portuguese classrooms, including 16 classrooms from 5th and 6th grades (representing 35% of the students) and 27 classrooms from 7th and 8th grades (representing 65% of the students) (Table 1). In Portugal, compulsory schooling is organised in three different cycles of basic education and secondary education. The first cycle comprises students from 1st to 4th grade (6–9 years old); the second cycle comprises students from 5th to 6th grade (10–11 years old); and the third cycle comprises students from 7th to 9th grade (12–14 years old). The transition to 5th grade is one of the most important transitions, as students usually move to larger schools and have more school subjects and teachers (who, in turn, have a less prominent role in organising peer-related social experiences). The structure of the second and third cycles of education is similar, despite small differences regarding the number of school subjects and teachers (which are greater in the third cycle of education). Secondary education includes students from 10th to 12th grade (15–17 years old).

TABLE 1 Sample characteristics in terms of sex, age and SEN condition.

	5th/6th grade	7th/8th grade	Total sample
	(*n* = 320)	(*n* = 594)	(*n* = 914)
Sex			
% Girls	42%	46%	44%
Age [M (SD)]	11.46 (1.23)	13.34 (1.19)	12.68 (1.5)
Normative ages	10–12	12–14	
Students with SEN	*n* = 35	*n* = 59	*n* = 94
% Girls	37%	29%	32%
Age [M (SD)]	12.29 (1.15)	14.07(1.38)	13.40 (1.55)

Classrooms ranged between 12 and 30 students ($M_{students} = 22.68$, $SD_{students} = 4.14$). Participating schools were diversified in terms of demographics and urban–rural regions, with seven schools serving students from low socioeconomic neighbourhoods and/or with an immigrant background, and eight schools serving both middle and high socioeconomic neighbourhoods; four schools served suburban areas and eleven served urban areas.

Students with SEN[i] were typically 1 year older than students without SEN ($t(113.196) = -4.774$, $p < 0.001$) and there were more male students within the SEN students sample than in the sample of students without SEN ($\chi^2(1) = 6.413$, $p = 0.011$). The samples did not differ in grade distribution (Table 1).

Measures

Outcome: Sense of belonging to the classroom

Our criterion variable was measured with the Comfort subscale of the Classroom Peer Context Questionnaire (CPCQ) (Boor-Klip et al., 2016; Portuguese version, Pipa et al., 2023). CPCQ requires students to rate how much they agree with 20 statements (items) regarding their perception of classmates' interactions and relationships. Items are measured on a five-point Likert scale ranging from 1: *Definitely No* to 5: *Definitely Yes*. The original study revealed an adequate factor structure of the CPCQ, organised in five dimensions: Cooperation, Conflict, Cohesion, Isolation and Comfort, which was confirmed by the validation study with a Portuguese sample. A confirmatory factor analysis (CFA) was conducted using maximum likelihood estimation. A model with greater fit to the data was achieved by excluding item 4 from the Isolation subscale ($\chi^2(142) = 345.35$, $\chi^2/df = 2.43$, $p < 0.001$, CFI = 0.95, TLI = 0.94, RMSEA = 0.05, 90% CI = 0.04, 0.06, SRMR = 0.05). In addition, age and gender measurement invariance was found for students in both the second and third cycles of education (Pipa et al., 2023).

The Comfort subscale includes four items, measuring how much students feel connected to and at ease with their classmates and how much they like their classroom ('*I like my class*; *In this class, I feel comfortable*; *I feel that I belong to this class*; *In this class, I can be myself*'). Boor-Klip et al. (2016) reported that Cronbach's alpha ranged between 0.84 and 0.87. In the Portuguese sample, the internal consistency coefficient of the Comfort subscale was $\alpha = 0.80$ (Pipa et al., 2023).

Individual-level predictors

SEN condition was measured as a dummy variable, coded 0 (student with SEN) or 1 (student without SEN). Additionally, both sex and age were included as control variables. *Sex* was measured as a dummy variable, coded 0 (female) or 1 (male). *Age* was measured as a quantitative variable.

Measures related to dyadic and group relationships were derived from traditional sociometric nominating tasks (Bukowski et al., 2000; Cillessen & Marks, 2017), according to which students were asked to nominate, on an unlimited basis, the classmates they liked to hang out with the most/least at recess. Self-nominations were not allowed, and students could nominate as many or as few classmates as they wished.

Reciprocity was measured as the proportion of reciprocal positive nominations when considering the total number of positive nominations made by each student, ranging from 0 (no reciprocal positive nominations) to 1 (all positive nominations were reciprocated). *Social acceptance* was measured as the number of positive nominations received by each student.

Social rejection was measured as the number of negative nominations received by each student. Individual-level predictors were rescaled, using *z*-standardisation. This procedure not only allows us to control for classroom dimension effects, but also is recommended for examining cross-level interactions (Aguinis et al., 2013; Enders & Tofighi, 2007).

Classroom-level predictors

Centralisation captures the extent to which a network is organised around particular focal points. This measure was calculated by summing 'the difference between each node's centrality and the centrality of the most central node' (Borgatti et al., 2013, p. 160). In this study, we considered the network of positive nominations. High centralisation scores mean a highly centralised structure of the network.

Density captures the degree to which students establish connections with each other in the class (Ahn et al., 2010). This measure was computed as the total number of ties divided by the total number of possible ties (Borgatti et al., 2013). The higher the number of ties, the higher the network density. This study considers the network of positive choices.

Based on Enders and Tofighi (2007), the two class-level predictors were centred at their grand mean.

Data collection

This study is part of a broader research project approved by the Directorate-General of Education and by the National Commission for Data Protection. Parental consent was required for students' participation in the study and students' assent was also obtained. Data were collected between January and June 2018 by trained researchers. Aligned with Mayeux et al. (2007), ethical precautions were implemented to prevent any potential negative effects on students. During data collection, teachers were present and students were briefed about the procedure for ensuring anonymity and data confidentiality. It was emphasised that they would not participate if they chose not do so, even if their parents had given consent. No negative emotional reactions or behaviours were reported either by the students, the teachers or the schools after testing. Students actively engaged in the sociometric task and questionnaire and provided positive feedback.

Data analyses

The analytical strategy followed was to first compare students with and without SEN regarding sense of belonging, reciprocity, social acceptance and rejection, using independent-sample *t*-tests. We then calculated Pearson correlations among these individual-level variables. Next, four models were tested for the criterion variable, sense of belonging. SEN, sex and age, reciprocity, social acceptance and social rejection were included as individual-level predictors (level 1 variables), and centralisation and density were included as classroom-level predictors (level 2 variables). Multilevel modelling was used to test the hypotheses using Linear Mixed Models in IBM SPSS Statistics for Windows, v.27.

The analyses were based on the principle of parsimony; that is, the goal was to find the simplest model. Thus, a step-up exploratory strategy was used from the simplest model to a more complex model (i.e., the cross-level interactions model) (Field, 2009; Maroco, 2018). This approach starts with the simplest model, without predictor variables, and progresses to more complex models, until a reference model that does not fit significantly better to the

data than the immediately preceding model is identified. The significance of the quality gains of the models was evaluated with a chi-square likelihood ratio test, using the maximum likelihood (ML) estimation method. In addition, the overall fit of the models was evaluated using Akaike's information criterion (AIC) and Schwarz's Bayesian information criterion (BIC). Considering these measures, the preference should be for the model that presents lower values (Kline, 2011). The significance of the fixed parameters of the model was evaluated with Student's *t*-tests, and the significance of the parameters associated with random effects was calculated with the Wald *Z* test. Effects with $p < 0.05$ were considered statistically significant.

Model 0

The baseline model (Model 0) is a non-constrictive model. This model has no predictors, assuming that the fixed effects are the ordered effects at the origin of the model for class *j* (β_{0j}) and the random effects are the variances/covariances associated with the units of the higher hierarchical levels (u_{0j}):

$$Sense\ of\ belonging = (\beta_{0j}) + \varepsilon_{ij}$$

where $i = 1, \ldots, n_j$ represents level 1 (students) and $j = 1, \ldots, k$ represents level 2 (classrooms).

The baseline model assumes that no predictor affects the dependent variable regarding student *i*, and that the residual values of the dependent variable are different across classrooms *j*. This model breaks down the variance of the dependent variable into two components: one associated with level 1 (students) (ε_{ij}) and another at level 2 (classrooms) (u_{0j}). This model allows us to analyse the partition of between-group variance in relation to total variance. The partition of the total variance attributable to level 2 (classrooms) is estimated by the intraclass correlation coefficient (ICC) (Hayes, 2006; Maroco, 2018):

$$ICC = \frac{\sigma^2_{u_{0j}}}{\sigma^2_{u_{0j}} + \sigma^2_{\varepsilon_{ij}}}$$

When the ICC is higher than 0.1 or when $\sigma^2_{u_{0j}}$ is statistically significant, this implies the existence of a considerable level 2 effect, and thus a multilevel analysis is necessary (Hayes, 2006; Maroco, 2018).

Model 1

Model 1 consists of the addition of first-level predictors. By adding these variables to the model described in the previous step, we have

$$Sense\ of\ belonging = \Upsilon_{00} + \beta_1\ SEN_{ij} + \beta_2\ Sex_{ij} + \beta_3\ Age_{ij} + \beta_4\ Reciprocity_{ij} + \beta_5\ Acceptance_{ij} + \beta_6\ Rejection_{ij} + \varepsilon_{ij}$$

In this model, predictor variables may vary between students *i* and between classrooms *j*. The effects of the individual predictors on dependent variables are fixed, that is, they are the same for all classrooms. The effect u_{0j} of level 2 predictors (classrooms) on the dependent variable is variable.

Model 2

Model 2 consists of the addition of level 2 predictors. These variables aim to explain Var(u_{0j}) in the model with the level 1 predictors. In this step, it is assumed that the intercepts vary significantly in each of the groups defined by the variables of higher hierarchical level 2:

$$\begin{aligned} \textit{Sense of belonging} = {} & \Upsilon_{00} + \beta_1\, \textit{SEN}_{ij} + \beta_2\, \textit{Sex}_{ij} + \beta_3\, \textit{Age}_{ij} + \beta_4\, \textit{Reciprocity}_{ij} + \beta_5\, \textit{Acceptance}_{ij} \\ & + \beta_6\, \textit{Rejection}_{ij} + \beta_7\, \textit{Centralisation}_{j} + \beta_8\, \textit{Density}_{j} + u_{0j} + \varepsilon_{ij} \end{aligned}$$

In this model, the level 2 variables may vary only between classrooms, and the effect of classroom characteristics on dependent variables is fixed, that is, they are the same for the classrooms (level 2) and for the students (level 1). The effect u_{0j} of classrooms (level 2) on the dependent variable varies.

Model 3

In addition, based our hypotheses, we investigated two cross-level interactions between SEN condition and classroom centralisation and between SEN condition and classroom density (Model 3):

$$\begin{aligned} \textit{Sense of belonging} = {} & \Upsilon_{00} + \beta_1\, \textit{SEN}_{ij} + \beta_2\, \textit{Sex}_{ij} + \beta_3\, \textit{Age}_{ij} + \beta_4\, \textit{Reciprocity}_{ij} + \beta_5\, \textit{Acceptance}_{ij} \\ & + \beta_6\, \textit{Rejection}_{ij} + \beta_7\, \textit{Centralisation}_{j} + \beta_8\, \textit{Density}_{j} \\ & + \beta_1\, \textit{SEN}_{ij} * \beta_7\, \textit{Centralisation}_{j} + \beta_1\, \textit{SEN}_{ij} * \beta_8\, \textit{Density}_{j} + u_{0j} + \varepsilon_{ij} \end{aligned}$$

According to indications from Maroco (2018), missing values were treated case wise, that is, case by case, meaning that the information presented in all records of observations of students was considered even if it may have been incomplete.

RESULTS

Associations between SEN condition and students' social experiences in the classroom

Descriptive scores and correlations were calculated (Table 2). Students with SEN were less accepted by the group ($t(119.512) = 4.337$, $p < 0.001$) and more rejected ($t(912) = -3.920$, $p < 0.001$) than their classmates. They did not differ in terms of reciprocity, meaning that

TABLE 2 Descriptive scores and correlations regarding individual characteristics.

	SEN	Non-SEN	Total	Correlations		
	M (SD)	M (SD)	M (SD)	1	2	3
1. Sense of belonging	3.97 (0.99)	4.15 (0.04)	4.14 (0.92)	–	–	–
2. Reciprocity	0.38 (0.32)	0.41 (0.25)	0.41 (0.25)	−0.05	–	–
3. Acceptance	2.91 (2.44)	4.08 (2.65)	3.96 (2.65)	0.25**	0.23**	–
4. Rejection	3.17 (2.76)	2.11 (2.45)	2.22 (2.50)	−0.23**	−0.09*	−0.37**

Abbreviation: SEN, special education needs.

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

students with SEN tended to have as many reciprocal positive nominations as students without SEN, and they did not differ in terms of sense of belonging (Table 2).

Sense of belonging was weakly and positively associated with social acceptance ($r = 0.25$), and weakly and negatively associated with social rejection ($r = -0.23$). Reciprocity was weakly and positively associated with acceptance ($r = 0.23$), and social acceptance and rejection were moderately associated in the expected direction ($r = -0.37$) (Table 2).

Predictors of students' sense of belonging

Baseline model. The estimate for average students' sense of belonging was 4.12 ($t(40.455) = 0.06$, $p < 0.001$). Variance in students' sense of belonging resulted both from between-student and between-classroom variance as the estimated variances of the residues were significant, that is, estimated variances between students ($Z_{wald} = 18.36$, $p < 0.001$) and between classrooms ($Z_{wald} = 2.98$, $p = 0.003$). Importantly, ICC = 0.14, meaning that 14% of the total variance of sense of belonging was explained by differences between classrooms (Table 3).

Model 1 had a better overall fit than the baseline model, as AIC and BIC values were lower than those for the baseline model. In addition, the difference in the adjustment quality of the two models was also significant ($\Delta\chi^2(1) = 33.406 > \chi^2 0.95$; $(1) = 3.84$). The addition of level 1 predictors resulted in a reduction in the variance estimate ($\hat{V}ar(e_{ij})_{baseline} = 0.76$, $\hat{V}ar(e_{ij})_{student\text{-}level\ predictors} = 0.70$), meaning that level 1 predictors explain some of the variance observed in the sense of belonging of students. This variance was significantly different from 0 ($Z_{Wald} = 18.27$, $p < 0.001$). Between-classroom variance remained unchanged ($\hat{V}ar(u_{0j})_{baseline} = 0.09$, $\hat{V}ar(u_{0j})_{classroom\text{-}level\ predictors} = 0.09$), yet the estimate of the variance of the random effect (classroom level) was significant ($Z_{Wald} = 3.09$, $p = 0.002$), indicating the need to add level 2 predictors to the model (Table 3).

Model 2. The quality of the model improved with the inclusion of classroom-level predictors. The difference in the adjustment quality of the two models was significant ($\Delta\chi^2(1) = 37.51 > \chi^2 0.95$; $(1) = 3.84$). The better adjustment of the model was also confirmed by the lower values of AIC and BIC. The addition of level 2 predictors resulted in a reduction in the variance estimate ($\hat{V}ar(e_{ij})_{baseline} = 0.76$, $\hat{V}ar(e_{ij})_{student\text{-}level\ predictors} = 0.70$). This variance was significantly different from 0 ($Z_{Wald} = 18.10$, $p < 0.001$). Between-classroom variance remained the same ($\hat{V}ar(u_{0j})_{baseline} = 0.09$, $\hat{V}ar(u_{0j})_{classroom\text{-}level\ predictors} = 0.09$), yet the estimate of the variance of the random effect (classroom level) was still significant ($Z_{Wald} = 2.93$, $p = 0.003$) (Table 3).

Model 3. The quality of adjustment of Model 3 was an improvement from Model 2. AIC and BIC values decreased, and the difference in the adjustment quality was significant ($\Delta\chi^2(1) = 7.93 < \chi^2 0.95$; $(1) = 3.84$). The addition of cross-level interactions resulted in a reduction in the variance estimate ($\hat{V}ar(e_{ij})_{baseline} = 0.76$, $\hat{V}ar(e_{ij})_{student\text{-}level\ predictors} = 0.71$), meaning that cross-level interactions explained some of the variance observed in the sense of belonging of students. This variance was significantly different from 0 ($Z_{Wald} = 18.07$, $p < 0.001$). Between-classroom variance remained the same ($\hat{V}ar(u_{0j})_{baseline} = 0.09$, $\hat{V}ar(u_{0j})_{classroom\text{-}level\ predictors} = 0.09$), yet the estimate of the variance of the random effect (classroom level) was significant ($Z_{Wald} = 2.94$, $p = 0.003$) (Table 3).

Globally, the results showed that having SEN did not predict students' sense of belonging. In addition, the results showed that social acceptance and social rejection, both level 1 predictors, were significantly associated with students' sense of belonging across different models. Specifically, students' sense of belonging increased by 0.14 units per unit of increase in social acceptance ($\beta_5 = 0.14$, $t(673.273) = 3.34$, $p = 0.001$) and decreased by 0.17 units per unit increase in social rejection ($\beta_6 = -0.17$, $t(658.373) = -4.36$, $p < 0.001$) (Table 3).

TABLE 3 Predictors of students' sense of belonging.

Variable	Baseline model		Model 1: random intercept and fixed slope level 1 predictors		Model 2: random intercept and fixed slope level 2 predictors		Model 3: random intercept and fixed slope cross-level interactions	
	Estimate	*t*	Estimate	t	Estimate	*t*	Estimate	*t*
Fixed effects								
Level 1								
Intercept (Υ_{00})	4.12 (0.06)	72.36**	4.26 (0.40)	10.70**	4.10 (0.42)	9.79**	4.08 (0.42)	9.72**
SEN [SEN = 0]			0.06 (0.11)	0.56	0.09 (0.82)	0.75	0.11 (0.11)	0.99
Sex [Female = 0]			−0.12 (0.07)	−1.80	−0.12 (0.07)	−1.75	−0.12 (0.07)	−1.73
Age			−0.01 (0.03)	−0.41	−0.01 (0.03)	−0.05	−0.02 (0.03)	−0.07
Reciprocity			−0.01 (0.01)	−0.67	−0.01 (0.01)	−0.64	−0.01 (0.01)	−0.64
Acceptance			0.14 (0.04)	3.29**	0.14 (0.04)	3.30**	0.14 (0.04)	3.34**
Rejection			−0.16 (0.04)	−4.30**	−0.17 (0.04)	−4.31**	−0.17 (0.04)	−4.36**
Level 2								
Centralisation					1.19 (0.81)	1.48	3.00 (1.52)	1.98*
Density					0.45 (1.28)	0.35	−0.54 (2.30)	−0.23
Cross-level interaction								
SEN × Centralisation							−2.05 (1.46)	−1.41
SEN × Density							1.19 (2.21)	0.54
Variance of random effects								
Within-student variance (L1) S^2_{eij}	0.76 (0.04)		0.70 (0.04)		0.71 (0.04)		0.71 (0.04)	
Intercept (L2) variance S^2_{u0j}	0.09 (0.03)		0.09 (0.03)		0.09 (0.03)		0.09 (0.03)	
Quality adjustment								
−2 Log likelihood (−2LL)	1887.296		1853.089		1815.659		1807.725	
AIC	1891.296		1857.089		1819.659		1811.725	
BIC	1900.440		1866.214		1828.741		1820.802	

Abbreviations: AIC, Akaike information criterion; BIC, Schwarz's Bayesian information criterion.
*$p < 0.05$; **$p < 0.01$.

Regarding level 2 predictors, the results showed that students' sense of belonging varied as a function of classroom centralisation ($\beta_7 = 3.00$, $t(330.528) = 1.98$, $p = 0.049$), meaning that centralisation positively predicted students' sense of belonging. No significant associations were found for classroom density. Finally, regarding cross-level interactions, the relationship between SEN condition and student level of sense of belonging did not vary as a function of classroom centralisation or density.

DISCUSSION

This study aimed to examine the associations between reciprocity, social acceptance and social rejection, as well as classroom centralisation and density, and students' sense of belonging to the classroom, measured by how much students with and without SEN feel connected to and at ease with their classmates and how much they like their classroom.

Considering individual predictors, reciprocity did not predict students' sense of belonging and, thus, H1 was not supported. Yet, both social rejection and social acceptance predicted the level of students' sense of belonging in the expected direction, supporting H2 and H3. Further, contrary to our predictions, although students with SEN were, on average, more rejected and less accepted by the peer group than students without SEN, they did not differ in their levels of sense of belonging, not supporting H4. Age and sex were not associated with students' sense of belonging in any of the models tested.

Considering that relationships with peers—in particular, feeling secure, accepted and valued by classmates—are positively associated with students' sense of belonging (Craggs & Kelly, 2018; Hamm & Faircloth, 2005) and that students with SEN were less socially accepted and more socially rejected than their classmates without SEN, it should be expected that the former would feel less connected to their classroom. That was not the case, though. Importantly, it should be noted that students with and without SEN did not differ in terms of the number of reciprocal relationships. Thus, it is possible that dyadic relations with classmates might have a protective role in the case of students with SEN. Other authors have already pointed out the importance of friendships for students' sense of belonging, as friends function as a source of companionship and emotional support and might have a protective role in situations of difficulty in group integration and rejection (e.g., Hamm & Faircloth, 2005). Along the same lines, Koster et al. (2010) reported that having at least one friend makes the social experience at school not one of isolation, with positive effects on the subjective experience of students with SEN. Indeed, having a friend confirms that one is accepted by another person, and when one's sense of esteem is affirmed, it is possible to infer that one has value as a person (Ladd & Troop-Gordon, 2003). In addition, according to Craggs and Kelly (2018), feeling assured, accepted and recognised by classmates is an important predictor of belonging. Together, these studies seem to support our explanation for these results and encourage studies focused on friendship. It would, however, be important to characterise pairs of students (with reciprocal relationships) regarding their composition, as there are reports of students with SEN being more likely to develop friendships with other students with SEN (e.g., Mamas, Bjorklund et al., 2020; Pinto et al., 2019). While these reciprocal relationships might play a protective role in students' sense of belonging, they might also signal difficulties in ensuring extended opportunities to interact and build relationships with peers without SEN.

In terms of classroom predictors, results showed no effect of classroom density on students' sense of belonging, not supporting H5. In fact, it was expected that density would positively predict belonging, as in these classrooms students tend to establish connections with each other and, therefore, more easily provide practical and emotional support to each

other (e.g., Ahn et al., 2010). That was not the case in this study. In addition, also contrary to what was expected, centralisation positively predicted a sense of belonging (H6). It was expected that more centralised classrooms would negatively predict belonging, as they might result in tensions around the distribution of power and status and their maintenance (e.g., Ahn et al., 2010). This unexpected result calls for future research. In future studies, it might also be important to examine the presence of cliques (or subgroups) within centralised networks, where the members establish strong, intense and direct relationships (Lazega, 2007), based on positive affect (Hallinan & Smith, 1989). These cliques may affect students' sense of belonging, as clique members tend to work together on assignments, spend free time together and participate together in curricular and extracurricular activities (Hallinan & Smith, 1989), which are important for a sense of belonging (Craggs & Kelly, 2018; Hamm & Faircloth, 2005). In addition, Hallinan and Smith (1989) have shown how the emergence of student cliques is influenced by structural characteristics of the classrooms in which they emerge. It might also be that highly centralised structures call for the emergence of highly cohesive subgroups, where students feel connected to each other and develop positive feelings of acceptance and self-worth. That could explain why centralised structures predicted a sense of belonging.

Finally, considering cross-level interactions, we expected that more centralised or less dense classrooms would be particularly detrimental for students with SEN, who tend to occupy more vulnerable positions (e.g., Broomhead, 2018; Koster et al., 2010) (i.e., be less accepted and more rejected, as is the case in this study). However, this was not the case, and thus H7 and H8 were not supported. This means that both groups of students felt as much as ease within their classrooms and with their classmates, no matter the structure of the classroom social networks.

Although the results regarding the effect of density and centralisation did not line up with our initial expectations and cross-level interactions were not significant, differences in between-classroom sense of belonging should not be disregarded, as suggested by the ICC value. Thus, it might be that other classroom-level variables explain the differences in between-classroom sense of belonging. Some studies have shown that students' perceptions of their classroom's peer context affect their social experiences in such contexts (e.g., Boor-Klip, 2017). For instance, Boor-Klip (2017) found that positive perceptions of the classroom peer context moderated the relationship between peer status and social functioning, academic achievement, social self-concept and academic self-concept. In addition, Pipa et al. (2023) found that students are more likely to feel more connected to their classmates when they perceive a positive context (i.e., high in cooperation and cohesion). Therefore, it may be important in the future, in addition to examining additional properties of the structure of classroom social networks, to examine the effect of students' perceptions of their classroom's social context on their sense of belonging. Furthermore, some authors have highlighted the importance of classroom climate for explaining several student outcomes (e.g., Wang et al., 2020). According to Wang et al. (2020), an optimal classroom climate involves three classroom components: effective instruction, positive interactions and effective classroom organisation and management. An optimal classroom climate creates opportunities for students to engage in different learning and social activities, and to interact and build relationships with each other and with the teacher, which have been shown to have an important effect on belonging (e.g., Allen et al., 2018, 2021; Slaten et al., 2016; Stiefel et al., 2016). Indeed, extant literature has highlighted how a trusting and warm student–teacher relationship affords students important resources for navigating the peer social world (Pianta, 1999). In addition, teachers' actions in relation to particular student behaviours and regarding particular students provide the classroom with important clues for appreciating classmates' value and evaluating their social desirability and likeability (Chang et al., 2007; Hughes & Kwok, 2006; Mikami et al., 2010).

Finally, the specific way of organising the teaching–learning process may either constrain or enable students' interactions and relationships within the classroom (Brown, 2019), as well as the emergence of cliques (Hallinan & Smith, 1989). Relatedly, Mamas et al. (2019) found that the pedagogical climate and teaching practices make classrooms more (or less) socially responsive, with an effect on the social participation of students with SEN in the classroom (considering both friendships and acceptance by the peer group). Therefore, future studies should also consider other classroom variables in addition to the structure of classroom social networks, to better explain students' sense of belonging.

Limitations and conclusions

This study presents four main limitations that should be highlighted. A first limitation was the use of cross-sectional data, which prevents inferences regarding cause-and-effect relationships. Second, despite using two different types of measures for collecting data on the predictors and outcome variable, only a single informant was considered, which may have resulted in artefactual covariance based on common rater effects (Podsakoff et al., 2003). Thus, it might be important in future studies to use other informants and methods, such as observation of classroom interactions and teachers' reports on student relationships. Finally, although a high variability of observations was accomplished and the dimension of level 1 and level 2 units was adequate, the standard deviation of sense of belonging was low, which might decrease the likelihood of detecting a cross-level interaction effect (Mathieu et al., 2012). Therefore, results on the lack of a cross-level interaction should be read with caution. Also, in this study we only considered students with SEN, without further characterising functioning profiles and/or diagnoses. Yet, some studies have shown that different profiles are associated with different experiences of belonging (e.g., Nepi et al., 2013). Therefore, future studies could consider the possibility of examining sense of belonging on specific groups of students with SEN, having in mind their functioning profiles or diagnoses.

Despite these limitations, this study makes an important contribution to understanding the predictors of students' sense of belonging. Importantly, it confirms previous findings (e.g., Frederickson et al., 2007) suggesting that students with SEN feel connected and part of the school. In addition, it calls attention to the importance of creating social conditions in the classroom to facilitate positive peer interactions and relationships, and to the need for teachers to pay attention to the social structure of the classroom in order to create a positive atmosphere where all students feel accepted, respected, valued and a part of the classroom. Particularly, studies validating specific teacher actions and strategies for dealing with, for example, highly centralised classrooms are still needed, as the existing studies generally focus on broader strategies to manage classroom social dynamics (e.g., Endedijk et al., 2022; Farmer et al., 2019; Hendrickx et al., 2016). In addition, it may also be important to promote teachers' professional development in such areas, by making them aware of the importance of managing classroom social dynamics to promote positive learning environments where all students feel connected and accepted, and thus safe to participate.

ACKNOWLEDGEMENTS

The authors are grateful to the students, parents, teachers and school administrators who made this research possible.

FUNDING INFORMATION

This study was supported by the Portuguese National Funding Agency: FCT – Fundação para a Ciência e a Tecnologia, I.P. Grant No. PTDC/MHC-CED/4150/2014.

CONFLICT OF INTEREST STATEMENT

No potential conflict of interest was reported by the authors.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon request.

ETHICAL GUIDELINES

This study was authorised by the Portuguese Data Protection Commission and by the Ministry of Education and followed the guidelines expressed in the Code of Conduct and Ethics of the Instituto de Educação da Universidade de Lisboa (Deliberação n° 453/2016). Data were collected after obtaining permission from the schools, and active parental informed consent and confidentiality was assured to all informants and schools. Data was kept secure.

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ENDNOTE

[i] According to previous Portuguese legislation (Decree-Law No. 3/2008, 1st July), students with SEN are those displaying 'significant restrictions concerning activity and participation in one of the several life domains' OR 'permanent, functional or structural changes' OR 'difficulties in terms of communication, learning, mobility, autonomy, interpersonal relationships'.

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How to cite this article: Freire, S., Roçadas, C., Pipa, J. & Aguiar, C. (2024). Classroom social networks, students' peer-related social experiences and sense of belonging: The specific case of students with SEN. *British Educational Research Journal*, *50*, 1617–1635. https://doi.org/10.1002/berj.3989