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Loneliness Among Autistic and Non-Autistic Children in Special Education Settings: Investigating School Environment Factors

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Master Thesis Child & Adolescent Psychology

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Abstract

Loneliness affects both autistic and non-autistic children. Nevertheless, differences exist in the prevalence and characteristics of loneliness experienced by these two groups, especially in school settings. This study investigated how four school environment factors, i.e., physical connection, perceived emotional connections, received emotional connections, and recess enjoyment impact loneliness in school-aged children, focusing on the differences between autistic and non-autistic children. Conducted in 2 Dutch special education primary schools, this cross-sectional, between-group study included 104 students (M age = 10.4, age range: 6.8 – 14 years): 47 autistic (M age = 10.2) and 52 non-autistic (M age = 11.4). Loneliness levels were measured with the self-report questionnaire Children's Loneliness Scale (CLS). For physical connection, the total time children spent in social contact during school recess was measured with proximity sensors (Radio Frequency Identification Device, RFID). Perceived emotional connections was measured with friendship nomination and received emotional connections with the "Like to play" (LITOP) questionnaire. Recess enjoyment was measured with Lunchtime Enjoyment of Activity and Play Questionnaire (LEAP). A regression analysis measured the relationship between feelings of loneliness and the four school environment factors, and the moderating role of autism. An independent sample t-test compared differences between groups for all variables. The results showed a significant relationship between physical connection and loneliness ($\beta = -.409$, $t = -3.040$, $p = .003$) and recess enjoyment and loneliness ($\beta = .333$, $t = 2.690$, $p = .009$). Autism moderated the impact of physical connection on loneliness: increased physical connection is associated with reduced loneliness in non-autistic children but heightened loneliness in autistic children ($\beta = .596$, $t = 2.236$, $p = .028$). Lastly, levels of physical connection ($t(97) = 3.393$, $p = .001$) were significantly lower in autistic ($M = .539$, $SD = .221$) than in non-autistic children ($M = .695$, SD). Our findings highlight the importance of understanding the distinct social needs and experiences of social interactions of autistic children. Policymakers and educators should prioritize gaining a deeper understanding of these differences between autistic and non-autistic children in order to develop more effective programs. With this knowledge, tailoring interventions specifically for autistic children can more effectively address loneliness.

Keywords: Loneliness, autism, school environment, special education

Layman's Abstract

Loneliness refers to the mismatch between desired and actual social connections. Feelings of loneliness are common in childhood, impacting the well-being and academic performance of all students. However, autistic students often experience heightened loneliness due to social challenges such as peer rejection, isolation, and fewer friendships compared to their non-autistic peers. Although autistic children show interest in social connections, they are not always successful in making these connections with peers.

This study investigated the relationship between feelings of loneliness and four other factors typically encountered in schools: time of physical contact (physical connection), perceived numbers of friends (perceived emotional connections), peer acceptance (received emotional connections) and the self-perception of recess enjoyment. Additionally, we explored the differences between autistic and non-autistic students. Understanding these effects and potential differences between the two groups is important for developing inclusive school environments that support the social well-being of all children.

In this study 104 Dutch students from 2 special education primary schools participated, specifically 47 autistic (M age = 10.2) and 52 non-autistic students (M age = 11.4). To assess loneliness, children filled out the Children's Loneliness Scale (CLS). Physical contact duration was tracked using Proximity sensors (RFID). Perceived number of friends were measured through friendship nominations, and peer acceptance with the "Like to play" (LITOP) questionnaire. For recess enjoyment, children filled out the Lunchtime Enjoyment of Activity and Play Questionnaire (LEAP).

We found that less physical contact and higher enjoyment of recess predict greater loneliness. Also, autism affects how physical contact relates to loneliness: more contact reduces loneliness in non-autistic children but increases it in autistic children. Moreover, autistic children have less physical contact than non-autistic children but both groups show similar levels of loneliness, friends, peer acceptance, and enjoyment of recess.

The study suggests that programs designed to reduce loneliness need different strategies for autistic and for non-autistic children. When creating new programs, policymakers and teachers should focus on understanding the specific needs and differences between autistic and non-autistic children.

Loneliness Among Autistic and Non-Autistic Children in Special Education Settings: Investigating School Environment Factors

Research has shown that loneliness impacts both autistic and non-autistic children alike. However, there are notable differences in the rates and experiences of loneliness between these two groups, particularly within school environments (Birdwhistell, 2015; Chamberlain et al., 2006; Libster et al, 2022). These differences have been observed during recess time where the establishment of social networks, or the lack thereof, can significantly contribute to feelings of loneliness. Understanding how school environments contribute to these feelings of loneliness among autistic children compared to their non-autistic peers is crucial for developing effective interventions and support systems, and thus was explored in this study. This topic is highly relevant as it highlights the social challenges faced by autistic children and the importance of fostering inclusive and supportive educational settings to enhance their well-being.

Loneliness in Autistic and Non-Autistic Children

Loneliness is defined as the negative emotional response to a discrepancy between desired social connections and those actually experienced (Deckers et al., 2017). It is a universal human experience that impacts the majority of people at some point in their lives, including childhood (Harris et al., 2013). Feelings of loneliness are very common among children despite the misconception that it is more prevalent among older people (Mushtaq et al., 2014). For example, studies from Finland, Greece, and Denmark respectively showed approximately 25% of 8-year-old children wishing they had more friends (Lempinen et al., 2018), more than two thirds out of 180 children aged between 7-11 years report feelings of loneliness (Galanaki, 2004), and approximately 7.2% of children between 11-15 years are exposed to lonely experiences (Surkalim et al., 2021). Due to its prevalence, loneliness is a widely studied area of research.

This extensive examination sets the stage for understanding the detrimental effects of loneliness on children's well-being, which have been increasingly recognized in research. Veiga et al. (2017) noted loneliness as a significant factor impacting overall well-being in children. This notion is further supported by Harris et al. (2013) who found that 11-year-old children experiencing high but decreasing levels of loneliness exhibited higher depressive symptoms and sleep disturbances compared to those with low and stable levels of loneliness. Similarly, Maes et al. (2015) found that children who feel lonely are more likely to experience depressive symptoms and have lower social self-esteem than children who do not experience loneliness. Additionally, Galanaki et al. (2022) highlighted the adverse impact of loneliness on children's academic adjustment, showing associations with lower reading ability, academic readiness, grade point average, and overall academic achievement.

Loneliness is also commonly observed in children experiencing behavioral challenges, for example, those facing social difficulties and those exhibiting social withdrawal (Bauminger et al., 2003; Galanaki et al., 2018; Locke et al., 2010). Specifically, students with ASD (Autism Spectrum Disorder) commonly encounter heightened levels of loneliness in comparison to their non-autistic peers, primarily

stemming from their social challenges such as peer rejection and social isolation (Locke et al., 2010). Furthermore, research shows that the experiences of autistic children with loneliness are more intense and more common than with non-autistic children (Bottem-Beutel et al., 2019; Chamberlain et al., 2007; Whitehouse et al., 2009), with lower functioning children being even less socially involved than their high functioning peers (Bauminger et al., 2003).

Thus, it becomes apparent that over the past few years, the perception that autistic children prefer spending time alone has changed. A study by Whitehouse et al. (2009) demonstrated that even though children and adolescents between 12 and 17 years of age display lower levels of self-determined motivation in developing friendships compared to non-autistic children, it is worth mentioning that while their motivation was lower it was not entirely absent. Similar studies showed that despite sometimes experiencing difficulties, many autistic children show interest in connecting with others (Grace et al., 2022; Whitehouse et al., 2009). Nonetheless, according to multiple studies, their motivation and interest in social connections may not always be successful. To illustrate, autistic children typically have fewer friendships compared to their non-autistic peers (Galanaki et al., 2018; Zeedyk et al., 2016). Calder et al. (2013) specifically reported that “children with autism tend to have fewer friends than typical children” (p. 298). Even though some children on the spectrum are integrated in the social networks within their classroom, the number of peer connections is significantly lower than their non-autistic peers (Kasari et al., 2011; Zeedyk et al., 2016). As friendships tend to serve as a protective barrier against loneliness (Calder et al., 2013), it is important to understand these differences in friendship experiences as it may contribute to heightened feelings of loneliness among autistic children. Lastly, similarly to non-autistic children, the social isolation experienced by autistic children may contribute to feelings of depression or anxiety, a phenomenon often observed during adolescence (Zeedyk et al., 2016).

School Environment and Social Relationships

Children spend a significant part of their day in school. School environments provide children with ample opportunities to engage with peers and develop or improve interpersonal relationships and social skills. Social interactions and friendships often require spontaneous socialization and communication skills. Thus, communication challenges that are characteristic of ASD can impact the number of social interactions for autistic children in schools, according to the literature (Bauminger et al., 2003). Additionally, autistic children have less opportunities for socialization with non-autistic children in schools, (Bauminger et al., 2003; Kasari et al., 2011) decreasing the number for available social connections. However, it is important to highlight that some autistic students have a greater number of friendships compared to others. (Birdwhistell, 2015). Therefore, additional investigation must examine potential factors influencing the lack of friendships, and therefore loneliness, among autistic students in general education settings compared to their non-autistic classmates.

Specifically, four factors of interest may affect how children feel connected to their school environment and thus influence loneliness in school. The first factor is *physical connection*, which is

referring to the closeness between individuals in a shared space, emphasizing the importance of the proximity of children during school hours. Second is *perceived emotional connections*, which indicates the subjective sense of closeness and of having meaningful friendships with peers. The third is *received emotional connections* which refers to the acceptance and inclusion in social interactions and group activities a child experiences from their peers. Lastly, *recess enjoyment* pertains to the level of satisfaction and enjoyment children experience during unstructured periods such as recess.

In schools, children have the chance to *physically connect* with a diverse range of classmates for various functions. These connections could take multiple forms such as two children working together to finish an assignment or they can aim to form social relationships, like when two kids play together during breaktime. Research indicates that proximity is one of the most reliable predictors of how social relationships will develop (Birdwhistell, 2015). Previous work has also found that loneliness could be alleviated with social connections (Weiss, 1973). However, for autistic students, research also suggests that physical proximity alone is insufficient to form meaningful connections with non-autistic students (Birdwhistell, 2015). Without additional support, merely being near non-autistic peers does not significantly reduce feelings of loneliness for autistic students (Birdwhistell, 2015).

Regarding the second factor, *perceived emotional connections*, autistic children often navigate emotional connections differently from their non-autistic peers. The friendships they report are occasionally not confirmed by their caregivers, possibly indicating aspirations rather than genuine friendships (Calder et al., 2013). Other studies also suggest that their perception of friendship is different than those of non-autistic children, with less emphasis on emotional closeness and more on companionship (Bauminger et al., 2003). Additionally, the number of peer relationships play a role, as studies consistently show a trend of autistic children having fewer connections than non-autistic children (Chamberlain et al., 2007). The depth of friendships is also a factor, with meaningful and genuine friendships being less common for autistic children compared to their non-autistic peers, despite the fact that children with higher functioning autism frequently seek mutual, meaningful relationships (Locke et al., 2016). When these aspirations are not met, it can result in feelings of loneliness (Locke et al., 2016).

Analyzing the third factor, *received emotional connections*, as observed in the following study by Dean et al. (2023), autistic children are typically found on the outskirts of social circles, reporting fewer friendships and encountering greater peer rejection. For example, loneliness can stem from failed efforts to fit in with peers, showing that efforts do not always result in connections or acceptance into peer groups (Dean et al., 2023). Finally, the number of opportunities to connect with peers in schools contributes to feelings of loneliness, with autistic children usually having fewer opportunities than their non-autistic classmates (Bauminger et al., 2003; Bauminger and Kasari, 2000). Thus, it can be seen how feelings of loneliness may result from different aspects of peer relationships.

Lastly, regarding how autistic children *experience recess*, one study found that despite being socially connected inside the classroom, autistic children are very likely to be unengaged during recess

regardless of whether they have reciprocal friendships (Kasari et al., 2011). One reason why it might be difficult for autistic children to enjoy recess time is due to the chaotic nature of the playground. When it is crowded, autistic children might not be able to participate in the playground culture (Anderson et al., 2004). One of the reasons include that they might exhibit heightened sensitivity to certain stimuli such as sounds, light, and touch, that are usually found in abundance on the playground, while simultaneously respond slowly to other types of stimuli (Anderson et al., 2004). Moreover, studies show that they might be afraid of densely populated spaces, such as playgrounds (Wu et al., 2020). Despite the challenges it often presents to autistic children, the emphasis on recess time arises from its potential to facilitate spontaneous peer interaction, peer communication as well as opportunities for social play (Bauminger et al., 2003). In addition, recess time allows children to learn about cooperation, and creativity (Nasri et al., 2022). Understanding how autistic children feel during recess is important as it provides insight into their overall experiences and well-being. While they may express feelings of loneliness during this time due to the possibility of going through negative experiences such as alienation and exclusion (McNamara et al., 2017), it is also important to know whether they still find recess enjoyable. Recognizing their feelings might help teachers and school officials to create inclusive environments, enjoyable for everyone.

Current Study

The loneliness that children with and without ASD face, as noted in the above studies, underlines the importance of understanding how school environments can play a role in intensifying or decreasing feelings of loneliness. Children spend a large amount of their time at school; thus, it is where their social interactions or the lack of them can have a big impact on their well-being. Research has shown that feelings of loneliness often intensify during school hours, specifically during unstructured periods such as recess (Bauminger et al., 2003; Nasri et al., 2022). These times offer opportunities for social interaction, yet not for every child. Autistic children may face challenges in navigating social interactions, often feeling lonely and left out of things at school (Zeedyk et al., 2016). These challenges underline the importance of investigating the factors contributing to loneliness within the school environment and identify ways to promote an inclusive environment for every student.

Thus, the goal of this study is to understand the relationship between loneliness and various factors of children's school experiences while focusing on how these relationships manifest in autistic and non-autistic children. Even though loneliness is very prevalent and a much-studied phenomenon that impacts children's well-being, the factors contributing to loneliness, especially within the school environment, are relatively understudied. To address this, the present study aims to investigate the role of four school environment factors: physical connection (i.e., the quantity of physical interactions during recess), perceived emotional connections (i.e., the perception of friendships), received emotional connections (i.e., peer acceptance), and recess enjoyment (i.e., self-rated overall enjoyment of recess activities) in feelings of loneliness in school-aged children, and how these relationships differ between autistic and non-autistic children. Furthermore, this study seeks to examine how the levels of loneliness and the

levels of the four school environment factors differ between autistic and non-autistic children. Autistic children face challenges in social interaction and communication (American Psychiatric Association, 1994) which may cause experiencing loneliness differently compared to their peers. By understanding these differences, this study will potentially contribute to the development of strategies and interventions to reduce loneliness.

To test all of the above, the following hypotheses are proposed: According to findings from existing research about loneliness being alleviated with social connections (Weiss, 1973) it is expected that stronger feelings of loneliness in school-aged children would correlate with less physical connection. It is also expected that loneliness would correlate with fewer perceived emotional connections, based on the work of Locke et al. (2016) where it was found that the lack of friendships could result in feelings of loneliness. Furthermore, given that the lack of fitting in with peers could result in loneliness (Dean et al., 2023), loneliness is expected to correlate with fewer received emotional connections. Lastly, taking into consideration that recess can be a turbulent time (Anderson et al., 2004; Wu et al., 2020) which could result in feelings of loneliness (McNamara et al., 2017) it is expected that feelings of loneliness would correlate with lower levels of recess enjoyment (Hypothesis 1).

Furthermore, it is anticipated that the relationship between feelings of loneliness and physical connection, perceived emotional connections, received emotional connections and recess enjoyment would be stronger for autistic children compared to non-autistic children (Hypothesis 2). Finally, it is expected that autistic children would exhibit stronger feelings of loneliness compared to non-autistic children, and also less physical connection, fewer perceived emotional connections, fewer received emotional connections, and lower levels of recess enjoyment (Hypothesis 3). While empirical evidence comparing the relations between autistic and non-autistic children might be limited, hypotheses 2 and 3 are proposed after considering the following: autistic children face unique social challenges that differentiate their experiences of loneliness from the non-autistic children (Bauminger et al., 2003; Locke et al., 2010), while also experiencing higher levels of social rejection (Dean et al., 2023). They are also more likely to have fewer meaningful peer connections (Kasari et al., 2011; Zeedyk et al., 2016). These social difficulties suggest that the presence or absence of physical, perceived and received emotional connections could have a more pronounced effect on feelings of loneliness for autistic compared to non-autistic children. Lastly, the chaotic nature of playground environments (Anderson et al., 2004; Wu et al., 2020) might also exacerbate feelings of loneliness.

Methods

Design

The present study employed a cross-sectional, between-group design and it is a part of a larger investigation. This larger study aimed to assess the impact of environmental changes, specifically, the impact of the adaptation of the school playground, on several factors related to autistic and non-autistic children's social experiences during recess. The study was conducted in two primary special-needs

schools in the Netherlands. Parents provided their written consent after receiving the information regarding the study and the role of the children in it, and the Leiden University ethical committee provided with approval for the study. In the following analysis, the focus is on exploring the dynamics of loneliness in school, considering both autistic and non-autistic children.

Participants

In total, 159 students from 2 different special education primary schools in the Netherlands were enrolled for this study (M age = 9.5, age range: 5–14 years). Due to missing data from the autism spectrum diagnosis variable, the loneliness variable as well as the four school environment variables the final sample comprised of 104 children (M age = 10.4, age range: 6.8 – 14 years). Among the participants, there were 47 autistic children. In terms of additional diagnoses, 16 had Attention Deficit Hyperactivity Disorder (ADHD), 3 had a physical disability, 3 had Developmental Language Disorder (DLD) and 24 had no additional diagnoses. The non-autistic sample was 52 in total. Among them 16 had ADHD, 1 had DLD, 1 had ODD (Oppositional Defiance Disorder) and 33 had no additional diagnoses.

Table 1.

Participants' Characteristics

	Autistic	Non-Autistic
N	47	52
Mean Age	10.12	11.38
Sex		
Boys	41	23
Girls	5	29
Unknown	1	0
Additional Diagnoses		
ADHD	16	16
Physical disability	3	0
DLD	3	1
ODD	0	1
No diagnoses	24	33

Note. ADHD=Attention Deficit Hyperactivity Disorder, DLD=Developmental Learning Disorder, ODD=Oppositional Defiance Disorder

Measures

Loneliness in School

Loneliness in School was measured with the self-report questionnaire Children's Loneliness Scale (CLS). From this questionnaire, 16 items out of 24 were used due to their focus on children's feelings of loneliness (sample item: I feel left out of things in school). Children responded to the items on a 5-point scale, how much each statement is a true description of themselves (always true, true most of the time, true sometimes, hardly ever true, not true at all). The scale ranged from 1 (not true at all) to 5 (always true) (Maes et al., 2017).

School Environment Factors

In order to measure *physical connection*, Total Time in Social Contact was measured in seconds with Proximity sensors (Radio Frequency Identification Device, RFID) with two base stations (Beagle-Bone Black minicomputer augmented with custom OpenBeacon hardware) (Nasri et al., 2022). First, the children received an instructional video on what the sensors do and how to use them. Then, after receiving consent from the parents' the children received a bag with the sensors which they would ultimately wear on a belt during recess. The sensors captured face-to-face contacts up to 1.5 meters distance. Throughout the recess, RFID sensors continuously tracked social contacts and sent data wirelessly to the base stations, which registered information sent by the sensors up to 25 meters away and received signals four times per second. After that, Total Time in Social Contact was measured by adding up the total amount of time in seconds when a child was detected interacting with classmates during recess. The amount of time each child was detected by the base stations during the break was used to correct for the total time in social contact. With this adjustment, the value becomes comparable for all students, even though their break times varied. This computation was carried out for every break each child had. Most children had a total of four breaks. The ratios (time in social contact/time detected) from these four breaks were then averaged to obtain the final variable.

Two types of *emotional connection* variables were measured for this study. The first variable, *perceived emotional connections*, was measured with the friendship nomination, which indicated the number of peers a child nominated as friends. The children were asked to nominate their best friends in school and a maximum of 5 friends could be named (Pijl et al., 2008). The second variable, *received emotional connections*, was measured with the "Like to play with" (LITOP) questionnaire (Symes et al., 2010). This questionnaire presented the names of participating classmates to the children, who were then asked to indicate whether they enjoyed playing with each classmate by ticking one of four options: 'Yes', 'Sometimes', 'No', or 'I do not know'. Received emotional connections is defined as an index of social acceptance, calculated by dividing all the 'yes' responses by all other responses. Thus, the acceptance index is expressed as a proportion ranging from 0 to 1.

Lastly, *recess enjoyment* was measured with Lunchtime Enjoyment of Activity and Play Questionnaire (LEAP) (Hyndman et al., 2013). The original questionnaire consists of 39 items that are designed to measure school-based physical activities. It includes three Component Scores, the

Intrapersonal, the Interpersonal and the Physical Environment. Example items for each Component respectively are “At school how much do you enjoy playground activities”, “How much do you enjoy playing with friends during lunch”, and “How happy are you playing in the school playground when it is hot?”. There are six categories within the Intrapersonal Component (ex. school break activity), one category within the Interpersonal Component (ex. social play) and six categories within the Physical environment component (ex. playground size). However, for this current study, in order to focus on overall enjoyment experienced by each child, only five items about their recess time activities on the playground were used. With these items the goal was to identify the levels of children’s enjoyment of recess time. The children rated the items on a five-point Likert scale (1 = very unhappy; 2 = unhappy; 3 = not sure; 4 = happy; 5 = very happy). Example items included “At school how much do you enjoy playing at recess?” and “How much do you enjoy playing outside at lunchtime?”.

Procedure

In each school, researchers collected data over a two-week period, conducting sessions during two break-time periods on consecutive days for each class. Every measurement lasted between 15 to 50 minutes, depending on the age distribution of the play group. A film was produced to teach kids about the project's specifics, the functions of sensors they would be using, and how to properly use the sensors. Data from the sensors was collected in schoolyards during playtime. Data on the Total Time in Social Contacts were acquired in this manner: Children wore at their waist the proximity sensors. The belts that held the sensors were colored differently according to the type of participation: blue was for students who had no consent, yellow was for students who had consent for both sensors and video observations, and green was for student who had consent only for sensors. The sensors detected face to face interactions between subjects during breaktime and registered each other over Bluetooth at a distance up to 1,5 meters. Children had the option to reject the sensor belt for the duration of the trial if they felt uncomfortable wearing it.

About the procedure of the questionnaires, the students were led by either the class teachers or by the researchers when filling out the questionnaires online (Qualtrics) on tablets. They received help on how to fill out the questionnaires in the form of an instructional video at the beginning and they were also able to ask questions while they answered the questionnaires. The students filled out the questionnaire in the classroom when the teachers took over this part of the project, or in a quiet room in small groups when the researchers took over.

Statistical Analysis

For the analysis, the IBM SPSS Statistics program (version 29) was used. In this study, there was missing data across responses to various questionnaire items for all variables of interest. Specifically, 21 cases had missing data from the CLS, 23 cases were missing from Total time in social contact, 30 cases from the friendship nomination measure for perceived emotional connections, 13 cases from the LITOP questionnaire for received emotional connections, and 19 cases from the LEAP questionnaire for recess enjoyment (see Appendix A). To address the issue of missing data we performed multiple

imputation. For this study 10 imputations were performed in order to reduce bias and help increase the validity of the results (Enders & Mansolf, 2018). Constraints were set to ensure that imputed values fell within plausible range for each variable. After generating 10 imputed datasets, a pooled dataset was created by combining these imputed datasets. The analysis reported below were based on this pooled dataset.

To test the strength of the relationship between feelings of loneliness and the four school environment factors (Hypothesis 1), and whether the relationship between feelings of loneliness and the four school environment factors was stronger for autistic than for non-autistic children (Hypothesis 2), a regression analysis was conducted. Model 1 included loneliness as the dependent variable, and the four school environment factors and autism status (ASD: 0 = non-autistic, 1 = autistic) as the independent variables. Model 2 added the interaction terms ASD x Physical Connection, ASD x Perceived Friendships, ASD x Peer Acceptance, ASD x Recess Enjoyment.

Lastly, in order to test Hypothesis 3, about differences in the scores of autistic and non-autistic children on loneliness and the four school environment factors, a series of independent samples t-tests were conducted. The independent samples t-tests compared the mean scores between the two groups for each variable, with significance assessed with Bonferroni correction for multiple comparisons, at $p < 0.05/5 = 0.01$.

Results

The goal of this thesis was to investigate the relationship between feelings of loneliness and various school environment factors among children, specifically focusing on physical connection, perceived emotional connections, received emotional connections and recess enjoyment. Additionally, this study aimed to investigate whether this relationship differs between autistic and non-autistic children.

Table 2 provides an overview of the descriptive statistics of all the above variables classified by autism diagnosis.

Multiple Regression Analysis

To investigate the relationship between loneliness and the four school environment factors, and specifically to determine if stronger feelings of loneliness in children could be predicted by less physical connection, fewer perceived connections, fewer received connections, and lower levels of recess enjoyment, while also accounting for the effect of ASD status, a multiple regression analysis was conducted.

The assumptions for the multiple regression were met. Regarding multicollinearity the r values representing the relationship between the predictors is less close to 0 than 0.7 and -0.7. The Tolerance values were above 0.1 and the VIF values were all below 10. About the assumption of Independence, the Durban-Watson was between 1 and 3 (2.128) meeting the assumption of independence. For the assumption of homoscedasticity, the patterns of the residual plots were checked revealing random

scatter points and suggesting homoscedasticity. Lastly, the values of the residuals were normally distributed evident by the dots on the Normal P-P plot that were close to the line.

In model 1 of the multiple regression analysis, perceived emotional connections ($\beta = -.267, t = -2.625, p = .010$) and recess enjoyment ($\beta = .216, t = 2.124, p = .036$) were significant predictors of loneliness, with lower perceived emotional connection and higher recess enjoyment being associated with greater feelings of loneliness. Received emotional connections ($\beta = .046, t = .462, p = .645$), physical connection ($\beta = -.187, t = -1.777, p = .079$), and ASD ($\beta = -.072, t = -.696, p = .488$) were not significant predictors of loneliness. Overall, Model 1 was significant, ($F(5, 93) = 2.61, p = .03$), explaining 12,3% ($R^2 = .12$) of the variance in the outcome variable.

Table 2.

Descriptive Statistics for the School Related Factors Stratified by Autism Diagnosis

Autism diagnosis	School Factor	Mean	Std. Deviation
Autistic (N = 52)	Loneliness	30.18	11.377
	Peer Acceptance	.42	.279
	Perceived Friendship	3.24	1.487
	Physical Connection	.53	.221
	Recess Enjoyment	17.45	4.975
Non-Autistic (N = 47)	Loneliness	30.31	13.030
	Peer Acceptance	.38	.189
	Perceived Friendship	3.24	1.025
	Physical Connection	.69	.234
	Recess Enjoyment	17.40	5.639

Note. N=Sample size

In model 2 after including the interaction terms, the effect for physical connection becomes highly significant ($\beta = -.409, t = -3.040, p = .003$). This suggests that, in non-autistic children, higher levels of physical connection were associated with lower levels of loneliness. The interaction between ASD and physical connection was also significant ($\beta = .596, t = 2.236, p = .028$), indicating that the effect of physical connection on loneliness was weaker and in a positive direction in autistic children. The effects for perceived emotional connection ($\beta = -.063, t = -.394, p = .694$) and received emotional connection ($\beta = -.048, t = -.293, p = .770$) were not significant, indicating that these variables have a non-significant impact on loneliness. The interaction between ASD and perceived emotional connections ($\beta = -.348, t = -1.112, p = .269$), ASD and received emotional connections ($\beta = .177, t = .727, p = .469$) were also not significant, indicating a lack of relationship in the two groups alike.

The effect of recess enjoyment ($\beta = .333, t = 2.690, p = .009$) remained significant, indicating that higher levels of recess enjoyment are associated with higher levels of loneliness. However, the interaction term between ASD and recess enjoyment ($\beta = -.516, t = -1.438, p = .154$) was not statistically significant suggesting that the relationship between recess enjoyment and loneliness does not differ between autistic and non-autistic children.

Model 2 was significant, ($F(9, 89) = 2.88, p = .00$), explaining 22.6% ($R^2 = .23$) of the variance in the outcome variable (loneliness). Overall, the inclusion of the interaction terms significantly improved the model ($\Delta R^2 = .103, p = .024$). The results indicate that Model 2 significantly improves the prediction of loneliness compared to Model 1, which includes only the main effects. However, the interaction terms themselves varied in significance. Only the interaction between ASD and physical connection was found to significantly moderate the relationship between ASD and loneliness. Specifically, for non-autistic children, an increase in physical connection significantly reduced loneliness. However, for autistic children, the effect was weaker and in a positive direction, indicating that physical connection impacts loneliness positively but to a lesser extent. (see Table 3).

Independent Samples T-Test

Lastly, a series of independent samples t-tests was conducted to compare the scores of autistic and non-autistic children on loneliness and the four school factors. Lavene's test indicated that the assumption of homogeneity of variance was met for loneliness ($F = 1.196, p = .277$), physical connection ($F = .216, p = .643$), and for recess enjoyment ($F = .836, p = .363$). The assumption of homogeneity of variance was not met for perceived emotional connections ($F = 9.035, p = .003$) and received emotional connections ($F = 5.900, p = .017$). Therefore, independent samples t-tests assuming equal variances were conducted for loneliness, physical connection and recess enjoyment, while Welch's t-tests were conducted for perceived emotional connections and received emotional connections. Given the multiple comparisons, a Bonferroni correction was applied, setting the adjusted significance threshold at 0.001 ($\alpha = 0.05/5$).

Table 3*Multiple Regression Analysis Results Predicting Loneliness*

Model	Predictors	β	t	p	F	Difference (ΔR^2)
Model 1	Intercept		5.225	.001	2.61 (5, 93), p = .030	.103, p = .024
	ASD status	-.072	-.696	.488		
	Physical Connection	-.187	-1.777	.079		
	Perceived Emotional Connections	-.267	-2.625	.010		
	Received Emotional Connection	.046	.462	.645		
	Recess Enjoyment	.216	2.124	.036		
Model 2	Intercept		3.647	<.001	F 2.88 (9,89), p = .005	
	ASD status	-.012	-.022	.983		
	Physical Connection	-.409	-3.040	.003		
	Perceived Emotional Connections	-.063	-.394	.694		
	Received Emotional Connection	-.048	-.293	.770		
	Recess Enjoyment	.333	2.690	.009		
	ASD x Physical Connection	.596	2.236	.028		
	ASD x Perceived Emotional Connections	-.348	-1.112	.269		
	ASD x Received Emotional Connection	.177	.727	.469		
	ASD x Recess Enjoyment	-.516	-1.438	.154		

Note. Intercept= the value of the dependent variable (loneliness), β = beta coefficient: The change in the dependent variable for a one-unit change in a predictor variable, t= t-statistic: A value used to determine whether a particular coefficient in a regression model is significantly different from zero,

p= p-value: The probability that the observed results occurred by chance under the null hypothesis, F= F-statistic: A value used in ANOVA to determine whether there are significant differences between group means, ΔR^2 = how much additional variance in the dependent variable is explained by the addition of Model 2.

The independent samples t-test and Welch's t-test revealed the following: between autistic ($M = .539$, $SD = .221$) and non-autistic children ($M = .695$, $SD = .234$) there was a significant difference in physical connection ($t(97) = 3.393$, $p = .001$). There was no significant difference in perceived emotional connections ($t(80.597) = .004$, $p = .997$), received emotional connections ($t(79.637) = -.963$, $p = .338$), recess enjoyment ($t(97) = -.044$, $p = .965$), and loneliness ($t(97) = .054$, $p = .957$) (see Table 2). The analysis indicates that autistic children reported significantly lower levels of physical connection compared to non-autistic children. However, there were no significant differences between the groups in terms of loneliness, perceived emotional connections, received emotional connections and recess enjoyment.

Discussion

The purpose of this study was to investigate the differences in social and emotional experiences at schools between autistic and non-autistic children. More specifically, we aimed to examine the relationship between feelings of loneliness and four other factors typically encountered in schools: time of physical contact (physical connection), perceived numbers of friends (perceived emotional connection), peer acceptance (received emotional connection) and the self-perception of recess enjoyment. We also aimed to compare these relationships between the autistic and non-autistic children, and to compare the levels of each variable between the two groups. The findings can enhance our understanding of the challenges faced by autistic children and help create interventions that can better support their social inclusion and emotional well-being by reducing feelings of loneliness.

Overall, the results indicated that shorter time in physical contact and higher levels of self-perception of recess enjoyment were significant predictors of more loneliness, whereas the perceived number of friends and the peer acceptance were not. Moreover, the presence of autism moderates the effect of physical contact on loneliness, where longer physical contact is related to less loneliness in non-autistic children, but to more loneliness in autistic children. Lastly, autistic children reported significantly lower levels of time of physical contact than non-autistic children, but no significant differences were found in loneliness, perceived numbers of friends, peer acceptance or the self-perception of recess enjoyment between the two groups.

The findings of this study regarding the relationship between feelings of loneliness and the four other school factors are partly consistent with previous research, and partly opposed to previous research. Starting with the relationship between feelings of loneliness and the time of physical contact, previous research suggested that proximity with peers is a reliable predictor for developing social relationships in general (Birdwhistell, 2015) and that loneliness could be alleviated by physical social connections

(Weiss, 1973). This is consistent with our findings where longer physical contact time is related to less feelings of loneliness in non-autistic children. Surprisingly, our results seem to also challenge findings from previous research as we found that longer physical contact is related to stronger feelings of loneliness in autistic children. This seems to be in line with more recent research on autistic children, showing that physical contact may not be sufficient to form meaningful connections, and that physical contact alone cannot reduce feelings of loneliness (Birdwhistell, 2015). Also, a recent study found that autistic children who are involved in the same activity with one or more children reported increased loneliness (Dean et al., 2023). This might be because social challenges and peer rejection are more pronounced in autistic children (Locke et al., 2010), and despite being motivated to form social connections, their social initiations are not always successful (Grace et al., 2022; Whitehouse et al., 2009). Thus, the time autistic children spend trying to connect with their peers could be a very challenging time, requiring a lot of effort to connect with others and perhaps most often failing at such a task, which increases feelings of loneliness.

Next, our findings suggested no significant relationship between feelings of loneliness and the perceived number of friends or peer acceptance, for both autistic and non-autistic children. It was previously found that autistic children report having friendships but that are not always confirmed by their caregivers (Calder et al., 2013). We also know that non-reciprocal friendships can result in feelings of loneliness (Locke et al., 2016). This suggests that the mere perception of friendship may not accurately reflect the social reality which could explain why perceived friendships do not significantly impact loneliness. It was also found that they put less emphasis on emotional closeness and more on companionship when reporting about friendships (Bauminger et al., 2003). This could suggest that being in the company of someone else physically, may be more critical in alleviating loneliness than the perception of having an emotional connection with others. For the non-autistic children of our sample, who are also neurodivergent and attend special education school, similar principles may apply. Research indicates that neurodivergent children (ADHD, learning disabilities etc.) could also have impaired social functioning (Day et al., 2022). Therefore, our results may similarly reflect the importance of companionship over emotional closeness in our non-autistic sample.

Lastly, the results indicated that more recess enjoyment is related to more feelings of loneliness in both groups. These counterintuitive findings suggest a need for cautious interpretation and further investigation. A potential explanation could involve the complexities that surrounded the context in which the questionnaire was completed. The responses of the children to the questions regarding their enjoyment during recess might have been influenced by their immediate context and desires (Wahlström et al., 2021). They might be thinking about how much they want to be outside playing. So, rather than their actual enjoyment of recess, their responses could reflect their longing for enjoyment during recess time, which they may not necessarily experience. An alternative explanation could include a response bias. Both the loneliness and recess enjoyment questionnaires used 5-point Likert scales, which can sometimes lead to bias: The children could have been more prone to choosing the extreme

ends of the scale (Weijters et al., 2021). This response pattern could have skewed the results, potentially leading to higher reported enjoyment of recess and loneliness.

Previous research consistently highlights that autistic children often face greater difficulties in social interactions and relationships compared to their non-autistic peers (Bottem-Beutel et al., 2019; Chamberlain et al., 2007; Whitehouse et al., 2009). It has also shown that autistic children tend to have fewer friends (Galanaki et al., 2018; Zeedyk et al., 2016) and experience higher levels of peer rejection (Dean et al., 2023). Our results, that autistic children report significantly lower levels of physical connection compared to non-autistic children is largely consistent with the previous research, and it also highlights the importance of targeted interventions and opportunities for autistic children to enhance their social connections in schools.

Strengths Limitations and Future Suggestions

One of the key strengths of this study is the unique focus on autistic children in a special education setting. This environment leads to different social behaviors and interactions from regular schools allowing for a better understanding of autistic children's experiences and needs. By observing autistic children in an environment designed to meet their needs, this study provides valuable insights into their capacity for social connections and helps reduce the stereotypical assumptions that autistic children prefer being alone or are incapable of forming friendships. Furthermore, this study explored multiple school environment factors in relation to loneliness, thus providing an in-depth understanding of these interactions. By carefully examining these factors, the study provides a multidimensional view of how these factors contribute to school-aged children's loneliness. Such an approach increases our understanding of the factors that contribute to loneliness and reveals the intricate nature of the school environments. Additionally, by including autistic and non-autistic children in the study allowed for meaningful comparisons and for understanding the distinction and differences between loneliness experiences and the impact of school environment between these groups. Insights gained from comparing autistic and non-autistic children can support the development of targeted interventions and eventually enhance the effectiveness of interventions aimed at reducing loneliness in school settings.

As for limitations, a notable one is the predominance of boys in the autistic sample with 41 boys and only 5 autistic girls. This could have influenced the outcomes as research shows that boys and girls often display different social behaviors. For example, boys may show more overt social difficulties whereas girls can sometimes mask their difficulties (Dean et al., 2014). This should be taken into consideration when interpreting the findings and their implications. Furthermore, the self-report measures used in the study introduce potential bias and different interpretations among the participants. If the measurements are based on subjective experiences of the individuals, they may be influenced by social norms and contextual factors. The consistency of outcomes overtime could also be affected, as the reported data may vary depending on the individual differences and mood variations of the participants. Also, conducting the study in two special education primary schools in the Netherlands, the findings may not generalize universally due to the specific focus on special education settings. The

class sizes, teaching approaches and the cultural differences in educational practices in general could be substantially different and affect the experiences of loneliness and of the other factors. Therefore, caution is needed when generalizing these findings to other educational settings or cultures beyond Dutch special education environments.

Future research should strive for a more balanced representation of genders to ensure a comprehensive understanding of the experiences of all autistic children. Also, the application of mixed methods by gathering both quantitative information about loneliness and qualitative insights about the experiences of children, parents, and educators could enrich the study's data. Qualitative methods such as interviews could explore the experiences of children through the eyes of their parents and teachers when the children are not in a position to take part in the interviews themselves. Combining with quantitative data could provide a more complete understanding of loneliness and related factors among the autistic and non-autistic children. Lastly, designing and implementing interventions based on the findings could serve as a practical approach to evaluate and refine the results, enabling us to identify and correct any errors in previous findings or methods. This process would also facilitate continuous improvement and provide valuable insights for future research and interventions.

Conclusion

This study examined the role of four school environment factors: physical connection (i.e., the quantity of physical interactions during recess), perceived emotional connections (i.e., the perception of friendships), received emotional connections (i.e., peer acceptance), and recess enjoyment (i.e., self-rated overall enjoyment of recess activities) in feelings of loneliness in school-aged children, and how these relationships differ between autistic and non-autistic children. Furthermore, this study sought to examine how the levels of loneliness and the levels of the four school environment factors differ between autistic and non-autistic children. Overall, the findings indicated a significant impact of physical connection and recess enjoyment on loneliness. Moreover, physical connection is related to less feelings of loneliness in non-autistic children and to more feelings of loneliness in autistic children. These unexpected findings highlight the need for more research, while more understanding of the effect of education setting and the inclusion of a more balanced gender distribution remains essential. Based on the findings of this study, several suggestions can be made for schools and future researchers to enhance the understanding of the unique social needs of autistic children: Teachers should receive training to understand the diverse social needs of autistic children. This training should help teachers with strategies to recognize the different ways children may express loneliness and whether focusing more on companionship rather than emotional closeness is more beneficial for them. Researchers should continue to explore the social relationships of autistic children, particularly focusing on how different aspects of friendships impact feelings of loneliness. Longitudinal studies could provide deeper insights into how these relationships evolve over time and influence their mental well-being.

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Appendix A

Table A.

Missing data

	Autistic	Non-Autistic	Unknown Diagnosis
Loneliness	7	8	6
Interaction Time	11	6	6
Perceived Friendship	8	16	6
Peer Acceptance	2	11	0
Breaktime Enjoyment	10	8	1