

Ecological Features of Preschools and the Social Engagement of Children With Autism

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One way to support the social engagement of children with autism spectrum disorders (ASD) is by identifying features of natural environments that increase the likelihood of social interaction. This descriptive study was an examination of the (a) social engagement of 68 preschoolers with ASD in classrooms, (b) ecological features of classrooms that promoted social engagement, and (c) relationships between social engagement and ecological features using the Code for Active Student Participation and Engagement–Revised, an ecobehavioral observational system. Overall, children without ASD were most likely to be socially engaged with peers in the Books and Food/Snack classroom areas, when participating in book or large motor behaviors, in small groups with peers or large groups with an adult, and during child-initiated activities. Implications for practice and future research are highlighted.

Keywords: *autism; peers; social engagement; classroom ecology; preschool*

Kanner, in his original documentation and description of autism, identified a lack of interest in social interactions as a defining feature of autism (Kanner, 1943). Current research confirms that children with autism spectrum disorders (ASD) tend to have deficits in social competence, which includes difficulties in the areas of (a) communicative abilities, (b) responsiveness to others' emotions and needs, and (c) peer interactions (Sigman & Ruskin, 1999). Furthermore, children with ASD are less likely to initiate or respond to social initiations by others when compared with their peers who are not diagnosed with developmental delays (Mundy, Sigman, Ungerer, & Sherman, 1986). As a result of these social skill deficits, children with ASD may be at an increased risk of social isolation and rejection by their peers (Odom et al., 2006).

Although many current treatment approaches involve interventions designed to support the development of specific social skills in early childhood environments (see McConnell, 2002; Rogers, 2000; Strain, Schwartz, & Bovey, 2007), there may be features of the early

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childhood classroom environment itself that can provide opportunities for further social development (Boyd, Conroy, Asmus, McKenney, & Mancil, 2008). The purpose of the current study is to explore the relationship between features of preschool classrooms designed for children with ASD and the social engagement of these children with their peers. The features of interest in this study include the activity area where the child is working/playing, the behavior in which the child is engaged, the group arrangement, and the initiator of the activity (i.e., child, adult, peer).

Social Engagement of Preschool Children Who Are Typically Developing

Innocenti et al. (1986) found that for preschoolers who were typically developing, peer interactions occurred most often when children were in activity areas related to free play. Peer social interactions tended to be most common when children were participating in sociodramatic/pretend play activities in preschool classrooms (Odom & Peterson, 1990; Sontag, 1997) and less common during more structured activities such as snack/lunch (Innocenti et al., 1986).

In addition, peer interactions among children who were typically developing occurred most frequently during activities when teachers were not involved (Harper & McCluskey, 2003). Moreover, a higher adult-to-child ratio was associated with fewer peer interactions, lower rates of social initiations, and lower levels of social play with peers (e.g., more parallel play; Hauser-Cram, Bronson, & Upshur, 1993). Finally, children who were typically developing were more likely to engage socially with peers during child-initiated activities than during teacher-directed activities (Innocenti et al., 1986).

Social Engagement of Preschool Children With ASD

Little is known about the social engagement patterns of children with ASD, and the relationship between engagement and specific features of preschool classrooms. Findings related to the potential influences of the activity area on the social behaviors of children with disabilities and children who are typically developing, however, may not extend to children with ASD. Children with ASD may not participate as frequently in pretend play due to delays in the development of pretend play skills that are often exhibited by children with ASD (Chawarska & Volkmar, 2005; Loveland & Kotoski, 2005). Kim et al. (2003) found that children with disabilities engaged in more solitary play behaviors and nonplay behaviors than peers who were typically developing. In addition, children with developmental disabilities tended to engage in more symbolic, complex play when they were alone rather than when peers were present (Lieber & Beckman, 1991), indicating that when social interactions with peers are possible, children with developmental disabilities like ASD may not participate in socially oriented play behaviors, thus missing opportunities to engage in social interactions.

Group arrangement during activities may also have an impact on the potential social interactions between children. Children with disabilities are more likely to talk with their

peers when they are in small group settings rather than large group settings (Sontag, 1997). Similarly, preschool-aged children with ASD tended to engage in more social initiations (verbal or gestural behaviors) and social interactions with peers when in small group (2 to 4 children) settings rather than large group arrangements (Boyd et al., 2008). The potential influence of adult presence in these groupings on the social behaviors of children with ASD has not been examined.

In contrast to their peers who are typically developing, children with disabilities were more likely to receive adult support in the classroom (Brown, Odom, Li, & Zercher, 1999) and more likely to interact socially with adults than with peers (Brown et al., 1999; Sontag, 1997). Adult behaviors toward children may decrease children's future interactions with peers because after an interaction with an adult, regardless of the interaction type (i.e., caregiving or play), children were more likely to attempt another interaction with that adult rather than initiating a new interaction with a peer (Harper & McCluskey, 2003). Finally, Brown et al. (1999) found that children with disabilities were more likely to be involved in adult-initiated activities than child-initiated activities in early childhood classrooms. In addition, research suggests that, during adult-initiated activities, children with disabilities tend to interact more with adults than with their peers (Tsao et al., 2008). Social initiations and social interactions tended to occur at higher rates for preschool children with ASD when they were engaged in child-directed (child or peer selected and structured activity) rather than in adult-directed activities (Boyd et al., 2008).

There have been several similar studies of the relationship between the ecological features of an environment and social development of children with disabilities (e.g., see Brown et al., 1999; Brown, Odom, & Holcombe, 1996; Sontag, 1997; Tsao et al., 2008), but to our knowledge, no studies have focused exclusively on the relationship between ecological features and social engagement of children with ASD. Given that children with ASD may be especially at risk for difficulties in social development, this study is especially important.

The purpose of our study was to examine the relationship between the contextual features of preschool classrooms and the social behaviors of children with ASD. The specific research questions are as follows:

1. In what activity areas are children with ASD more likely to engage in social behaviors with peers?
2. During what types of child engagement are children with ASD more likely to engage in social behaviors with peers?
3. In what group arrangements are children with ASD more likely to engage in social behaviors with peers?
4. Are children with ASD more likely to be socially engaged with peers during child-initiated or adult-initiated activities?

Method

Data for this study were collected as part of a larger study comparing the efficacy of school-based, comprehensive treatment models, the ASD Treatment Comparison Study. Each child was enrolled in one of the two comprehensive treatment models: Learning

Table 1
Participant Demographic Data

Item	Total (%)
Gender	
Male	58 (89.00)
Female	7 (11.00)
Ethnicity	
Asian	5 (7.35)
Black	4 (5.88)
White	55 (80.88)
Multiracial	2 (2.94)

Note: Demographic data were collected using a separate demographic form, some of which were missing during data analysis, so the exact numbers may not match the total number of children enrolled.

Experiences: Alternative Programs for Preschoolers and Parents (LEAP) or Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH), or enrolled in a control condition or Business As Usual (BAU) classroom. A comparison of the various treatment models is beyond the scope of this study, as the purpose is to present a broad picture of the social engagement of children with ASD across any preschool environment. Data were collected across three states (North Carolina, Colorado, and Florida) at the beginning of the school year.

Participants

A total of 68 children in 24 classrooms participated in this study. Out of these, 58 (89%) were male. In all, 55 children (80.88%) were White, 4 (5.88%) were Black, 5 (7.35%) were Asian, and 2 (2.94%) were multiracial. Overall, 22 children (33%) lived in North Carolina, 16 (24%) in Colorado, and the remaining 30 children (43%) lived in Florida. A total of 30 (44.18%) children followed the TEACCH model, 18 (26.47%) followed the LEAP model classroom, and 20 (29.41%) were in a BAU classroom. The mean chronological age of participants at data collection was 3.86 years ($SD = 0.54$). Demographic data for participants are available in Table 1.

The ASD diagnosis for each child was confirmed by research-trained project staff using the *Autism Diagnostic Observation Schedule* (ADOS; Lord, Rutter, DiLavore, & Risi, 1999). Additional descriptive data on each participant were gathered using the *Childhood Autism Rating Scale* (CARS; Schopler, Reichler, & Renner, 1988), the *Social Responsiveness Scale for Preschoolers* (SRS-P; Constantino & Gruber, 2007), the *Mullen Scales of Early Learning* (Mullen, 1995), and the *Preschool Language Scale, 4th Edition* (PLS-4; Zimmerman, Steiner, & Pond, 2003). Assessment data for participants are available in Table 2.

Each participant was enrolled in a public preschool classroom with a licensed special education teacher. Classrooms varied in total number of students (3 to 21), presence of peers who were typically developing (0 to 13 per class), length of school day (half to full day), and number of full-time staff (2 to 8 staff members). Data on classroom demographics can be found in Table 3.

Table 2
Participant Assessment Data

	<i>M (SD)</i>
Assessment scores	Range
ADOS 1 total score (<i>n</i> = 45)	18.91 (4.44) 11-27
ADOS 2 total score (<i>n</i> = 21)	13.86 (4.00) 6-21
CARS total score	33.13 (5.62) 21-44
SRS-P <i>t</i> score	79.77 (12.05) 44-90
Mullen standard score	63.24 (18.82) 49-117

Note: ADOS = Autism Diagnostic Observation Schedule; CARS = Childhood Autism Rating Scale; SRS-P = Social Responsiveness Scale for Preschoolers.

Procedure

Data collection. Research staff videotaped each participating child for 30 min during center time in their preschool classroom. Researchers were instructed to videotape the focal child and his/her context in the classroom during center time for a full, continuous 30 min.

The Code for Active Student Participation and Engagement–Revised (CASPER III; Tsao, Odom, & Brown, 2001) was used to analyze the observational data. CASPER III is an ecobehavioral observational system that has been used to assess features of classroom programs, children’s behavior in these programs, children’s social engagement, and adult behavior (Tsao et al., 2008). CASPER III is organized into seven variables with behavioral categories within each variable (variables and behavioral categories are listed below). Behavioral categories are mutually exclusive; only one behavioral category for each variable was coded for each interval (e.g., a child could be coded manipulating or participating in book activities but not both). CASPER III uses a momentary time sample coding system in which observational categories are coded at a specific point in time. For this study, the video data were coded every 10 s using the PROCODER observational system (Tapp & Walden, 1993)

Operational definitions. The specific variables of interest from CASPER III include (a) Child Social Behavior, (b) Activity Area, (c) Child Behavior, (d) Group Arrangement, and (e) the Initiator of the Activity. Any intervals coded as “Can’t Tell” were excluded from further analyses. The Child Social Behavior variable is the primary variable of interest in this study. This variable represents “any socially directed motor/gestural or vocal/verbal behavior that the focal child directs to a person (or persons)” (Tsao et al., 2001, p. 20) during the observation. This code includes verbal and nonverbal social behaviors. The behavioral categories in the Child Social Behavior variable include (a) social behavior directed

Table 3
Classroom Demographic Information

Item	Total
Number of children	
With ASD	
<i>M (SD)</i>	3.72 (2.28)
Range	1-9
Typically developing	
<i>M (SD)</i>	5.03 (3.85)
Range	0-13
With other disabilities	
<i>M (SD)</i>	2.03 (2.41)
Range	0-7
Total in class	
<i>M (SD)</i>	10.49 (3.40)
Range	3-21
Number of full-time staff	
<i>M (SD)</i>	3.36 (1.29)
Range	2-8
Length of day (in hours)	
<i>M (SD)</i>	3.00 (1.17)
Duration/time of day	
Full day (5 or more hours)	10
A.M. half day	11
A.M. half day	3

Note: ASD = autism spectrum disorders.

to adult, (b) negative social behavior directed to adult, (c) social behavior directed to peer, (d) negative social behavior directed to peer, (e) social behavior from a peer, (f) negative social behavior from a peer, and (g) no social behavior. Negative social behaviors to and from a peer are very rare, generally occurring less than 1% of the time (Tsao et al., 2008), and thus were not included in the analyses. The criterion variable of interest in this study was peer social engagement. The peer social engagement variable was created by aggregating the data from two categories: social behavior directed to a peer and social behavior from a peer. The two categories were combined to represent the social involvement of the focal children, regardless of who initiated the interaction. As social behavior to a peer and from a peer tend to be infrequent for children with ASD, combining these two categories provides a broader picture of the overall social engagement of children with ASD in pre-school classrooms.

The Activity Area variable

represents information about the location of the focal child within the physical ecology of an early childhood setting . . . activity area codes will be determined by where the child is within an early childhood setting rather than what the child is doing. (Tsao et al., 2001, p. 9)

Table 4
Observational Categories

Variable	Observational categories
Activity Area	Art Books/story time Circle/large group time Computer activities Food/snack/meals Large blocks Large motor Manipulative play Preacademics/3 Rs Pretend/sociodramatic play Self-care/self-help Sensory Transition
Child Behavior	Art Books Clean up Dance/music/recitation Games with rules Large motor behavior Manipulating Not engaged Preacademics/3 Rs Pretending/sociodramatic play Self-care/self-help behavior Stereotypic/repetitive behavior
Group Arrangement	Solitary 1:1 with an adult Small group with one or two peers Small group with adult and one or two peers Large group with three or more peers Large group with adult and three or more peers
Initiator of Activity	Focal child initiated Adult initiated

Note: 3 Rs = reading, writing, and arithmetic.

The Child Behavior variable is used to indicate “when the focal child is attending to, engaged in, or involved in an activity” (Tsao et al., 2001, p. 16) during the observation. Many of the observational codes for Activity Area and Child Behavior overlap, but these are two distinctly different variables. Activity Area refers only to the physical setting in which the focal child is located. The Child Behavior variable describes the activities of the child. The codes for these categories might match in some cases (e.g., the focal child is reading while in the Book Area of the classroom would be coded as “Books” for Activity Area and “Books” for Child Behavior) or differ in other cases (e.g., the focal child is working on a

puzzle while in the Book Area would be coded as “Books” for Activity Area and “Manipulating” for Child Behavior). The Group Arrangement variable represents the children or adults who are in proximity (i.e., in the same activity area) to the focal child at the time of observation. The Initiator of Activity variable indicates the “person (or persons) who selected the activity area where the focal child is located or the activity in which the focal child is involved” (Tsao et al., 2001, p. 14). The corresponding observational categories for each of the variables are available in Table 4.

Interobserver agreement. All videos were coded by one of three trained raters. Training included familiarization with the CASPER III training manual for observers (Tsao et al., 2001) and practice observations with analysis and discussion until all raters reached consensus with at least an 85% agreement (i.e., the number of agreements divided by the number of agreements plus disagreements) or a kappa of at least .80 for each variable.

In addition, 20% of the observations were coded by an additional rater to establish interobserver agreement. For this study, the interobserver agreement was calculated for each variable (e.g., Activity Area, Group Arrangement). The average interobserver agreement (Agree/Agree + Disagree) and kappas were calculated for the following categories: Group Arrangement (.89, range = .85-.95, κ = .81), Activity Area (.93, range = .89-.98, κ = .90), Initiator of Activity (.90, range = .67-.99, κ = .67), Child Behavior (.74, range = .64-.83, κ = .52), and Child Social Behavior (.94, range = .85-.98, κ = .44). The kappas for Child Behavior and Child Social Behavior were lower than the kappas for the other variables, whereas the Agreement / Agreement + Disagreement scores remained high. This is not an uncommon finding when using kappas, as documented by Feinstein and Cicchetti (1990), among others. The disparity may simply be an artifact of the calculations of kappa (e.g., the counts of behaviors in the margins of the kappa matrix were asymmetrical and converted to a smaller value for kappa).

Data Analysis

The corresponding codes, as described above, were analyzed to determine the associations between the occurrence of social behaviors and the other contextual ecological features in the classroom. The criterion variable in this study was the social engagement of the focal children with peers (peer social engagement). The predictor variables were the ecological features of the classroom.

Following the model of analysis of ecobehavioral variables used by Odom and Peterson (1990), first, a base rate of the key variables of interest (i.e., the proportion of total observation time in which children were coded as engaged in a category of social engagement, also called the *unconditional probability*) was calculated. To analyze differences in social behavior across the ecological features, a *conditional probability* of peer social engagement given an individual ecological feature was calculated. To calculate the conditional probability of peer social engagement, the intervals in which a specific activity occurred were selected (e.g., intervals in which the child was engaged in pretend/sociodramatic play). Then, the proportion of intervals in which peer social engagement occurred was calculated from the selected intervals containing that activity (e.g., intervals during which the child demonstrated peer social engagement while engaging in pretend/sociodramatic play).

Table 5
Summary of Social Engagement

Engagement type	Frequency	Proportion
Peer social engagement	204	0.0184
TEACCH classrooms	41	0.008
LEAP classrooms	50	0.018
BAU classrooms	113	0.035
Social engagement with adults	549	0.0496
TEACCH classrooms	212	0.044
LEAP classrooms	189	0.068
BAU classrooms	148	0.046
Can't tell/negative	129	0.0120
No social engagement	10,175	0.9200
Total	11,057	1.0000

Note: Children were enrolled in either Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH), Learning Experiences: Alternative Programs for Preschoolers and Parents (LEAP), or in a control condition or Business As Usual (BAU) classroom.

A *z*-score analysis was used to compare the conditional probability of social engagement given a specific activity with the base rate of social engagement across all activities. The formula for the *z*-score analysis was:

$$z = [p(R_i / A_i) - p(R_i)] / [p(R_i)(1 / m_i + 1 / m_o)]^{[1/2]},$$

where $p(R_i / A_i)$ = the proportion of response (R_i) given arrangement (A_i), $p(R_i)$ = the proportion of response (R_i) given all sequences (i.e., base rate level), m_i = the frequency of (A_i), and m_o = the frequency of all sequences (Greenwood, Delquadri, Stanley, Terry, & Hall, 1985). A Bonferroni adjustment was used to minimize the Type I error rate, which increases with the number of comparisons in an analysis. Using this correction, the alpha level (.05) was divided by the number of comparison tests. Significance indicates that children with ASD were significantly more, or less, likely to display the social behavior of interest in this behavioral category than the other possible behavioral categories addressed in the research question.

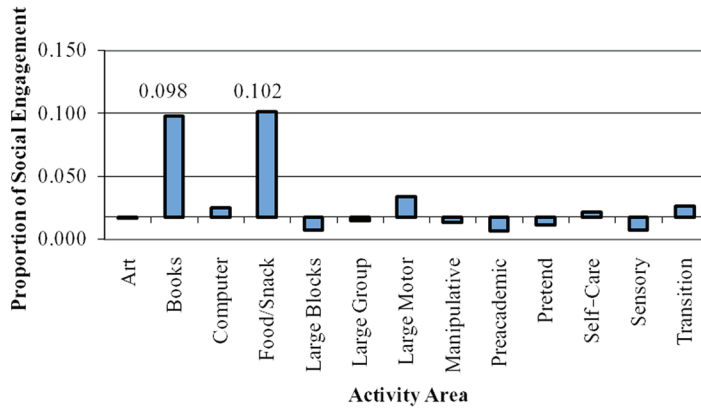
Results

We examined in this study the relationship between the contextual features of preschool classrooms and the social behaviors of children with ASD. Overall, social engagement with peers occurred in approximately 1.84% of observed intervals. Summary data on all social behaviors are available in Table 5. The specific research question and results follow.

Activity Area

The proportion of social engagement with peers in each activity area was compared with the base rate of peer social engagement across all activity areas. Using the Bonferroni

Figure 1
Activity Area and Peer Social Engagement



Note: Values are displayed only for categories found to be significantly different from the base rate.

adjustment with a total alpha of .025 for a two-tailed test, p values greater than or less than .0019 (or .025 divided by the 13 possible categories) were considered to be significant. This alpha level corresponded to a critical z score of ± 2.89 for a two-tailed test of significance. As shown in Figure 1, the proportion of peer social engagement significantly exceeded the base rate in the Books area with a proportion of .098 ($z = 11.18$) and in the Food/Snack area with a proportion of .102 ($z = 6.886$). In the figure, the exact proportion of social engagement is shown only for categories found to be significantly different from the base rate.

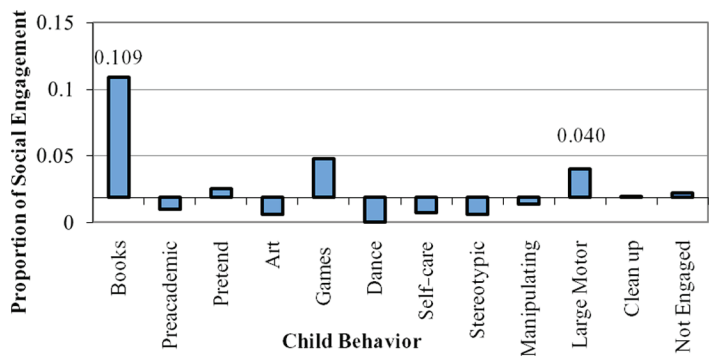
Child Behavior

In the analysis of the Child Behavior category, using the Bonferroni adjustment, p values that exceeded .0021 (.025 / 12 categories) corresponded to a z score of ± 2.865 for a two-tailed test of significance. As shown in Figure 2, the proportion of peer social engagement exceeded the base rate when children were engaged with books with a proportion of .109 ($z = 4.14$) and when children were engaged in large motor behaviors with a proportion of .040 ($z = 2.91$). Although it appears from the figure that the Games category should be significant, it is not statistically different from the base rate. The z -score formula accounts for the number of intervals in a given category, and due to the low incidence of intervals in this category, it is not significant.

Group Arrangement

For Group Arrangement, the critical p value was .0042 (.025 / 6 categories) and had a corresponding critical z score of ± 2.638 for a two-tailed test of significance for group arrangement. As shown in Figure 3, the proportion of peer social engagement significantly

Figure 2
Child Behavior and Peer Social Engagement



Note: Values are displayed only for categories found to be significantly different from the base rate.

exceeded the base rate when children were in a small group with 1 or 2 peers with a proportion of .045 ($z = 7.07$) and in a large group with 3 or more peers and an adult with a proportion of .028 ($z = 2.78$). In addition, and logically, children engaged in significantly fewer social behaviors to or from peers when solitary with a proportion of .0019 ($z = -4.56$) or when 1:1 with an adult with a proportion of .004 ($z = -4.39$).

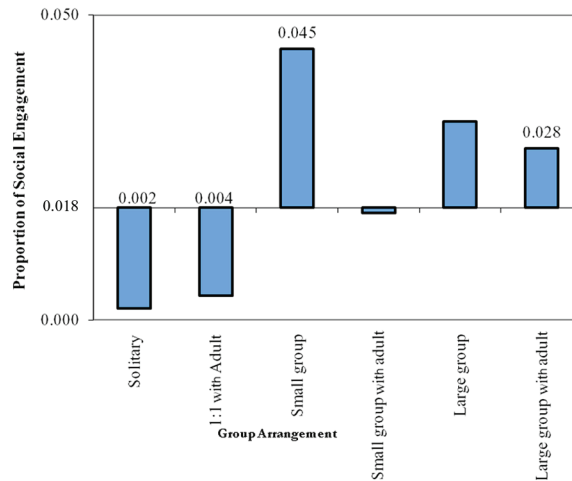
Initiator of Activity

In the Initiator of Activity category, p values that exceeded ± 0.0125 ($.025 / 2$ categories) corresponded to a z score of ± 2.39 for a two-tailed test of significance. As shown in Figure 4, the proportion of peer social engagement exceeded the base rate during child-initiated activities with a proportion of .034 ($z = 4.90$).

Discussion

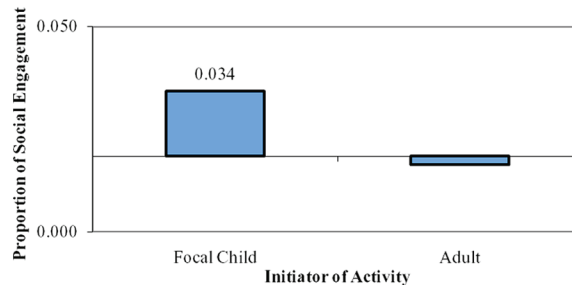
The purpose of our study was to examine the relationship between ecological features of preschool classrooms and the social behaviors of children with ASD. In this study, which focused only on children with ASD, social engagement with peers occurred in approximately 1.8% of observed intervals. This proportion is considerably lower than expected based on previous research suggesting that children with disabilities spend approximately 8% to 11% of their time in peer-directed social behavior (Brown et al., 1999; Tsao et al., 2008), and children who are typically developing spend about 18% of their time participating in peer-directed social behaviors (Brown et al., 1999). However, given that all the children in this study had an ASD diagnosis, lower levels of social engagement with peers would be expected due to the characteristic deficits in social engagement among children

Figure 3
Group Arrangement and Peer Social Engagement



Note: Values are displayed only for categories found to be significantly different from the base rate.

Figure 4
Initiator of Activity and Peer Social Engagement



Note: Values are displayed only for categories found to be significantly different from the base rate.

with ASD (Chawarska & Volkmar, 2005; Loveland & Kotoski, 2005; Sigman & Ruskin, 1999). The small proportions of social engagement make understanding the conditions under which these behaviors occur even more important.

The results indicate that although social engagement of young children with ASD was quite low, there are features of the environment that are likely to enhance and increase social interaction. Each of these features and their relationships to children's social engagement with peers are discussed in the following sections. Results from the Activity Area and Child Behavior questions are addressed together, as the two questions are related.

The first two research questions addressed whether children with ASD showed higher rates of social engagement in some activity areas and during certain child behaviors or activities when compared with the base rate of social engagement with peers across all areas and behaviors. Data indicate that children with ASD engaged in significantly more social behaviors to or from a peer when they were in the Books area and engaged in book-related activities. Books may provide a more concrete basis for initiating and sustaining interactions (e.g., showing pictures or discussing topics from a book) than materials requiring more imaginative play. In addition, children may select books that relate to their interest areas; interest areas of children with ASD are related to joint attention and engagement with others (Adamson, Deckner, & Bakeman, 2010). Furthermore, books and book materials are often used in shared or cooperative play by children who are typically developing (Hendrickson, Tremblay, Strain, & Shores, 1981).

In addition, social engagement with peers was greater when children were in the Food/Snack area of the classroom than the expected base rate of peer social engagement across all areas of the classroom. Although preschoolers who are typically developing engage in fewer peer interactions during structured activities such as meal times (Innocenti et al., 1986), meal times may be a prime opportunity for children with ASD to sit with their peers and adults, allowing for more potential time for interactions with fewer distractions. Research suggests that children with ASD may make more attempts at social interactions during socially structured times, such as meals, due to the “forced proximity” of meal times (Bauminger, Shulman, & Agam, 2003; Hauck, Fein, Waterhouse, & Feinstein, 1995).

These findings are in contrast to previous research around the social engagement of children who are typically developing and those with other disabilities. One of the most common areas for cooperative, social play among children who are typically developing is the pretend play area (Odom & Peterson, 1990; Sontag, 1997). Materials associated with sociodramatic or pretend play (e.g., dress-up clothes, housekeeping materials) tend to be used in shared or cooperative play by children who are typically developing and children with disabilities other than ASD (Hendrickson et al., 1981). However, children with ASD may not participate in pretend play as easily or as frequently as children who are typically developing (Chawarska & Volkmar, 2005; Loveland & Kotoski, 2005), so the context of pretend play itself may serve as a barrier for social engagement for this population.

Social engagement was more frequent when children were engaged in large motor behaviors (e.g., swinging on swings, riding tricycles, pushing and pulling wagons and other wheel toys). Research has indicated that large motor activities can assist in increasing appropriate play behaviors in children with ASD (Schlelen, Heyne, & Berken, 1988) and often are preferred activities for them (Case-Smith & Kuhaneck, 2008; Dominguez, Ziviani, & Rodger, 2006), which may have been a contributing factor to this finding. Similarly, addressing the needs of children with ASD during motor play (e.g., appropriate physical challenges, boundaries, supports for social and imaginative play) has been linked to increased social play and social initiations (Yuill, Strieth, Roake, Aspden, & Todd, 2007).

With regard to group arrangements, children showed a greater proportion of social engagement with peers when in a small group with one or two peers. Contrary to previous research that has asserted that children with disabilities, including children with ASD, are more likely to interact with peers in small group settings (Boyd et al., 2008; Sontag, 1997), children also showed greater social engagement with peers when in a large group with an

adult and three or more peers. This discrepancy may be explained by the presence of the adult, who may have actively facilitated or arranged for children to interact with one another during large group or whole classroom activities. By providing positive, responsive interactions when they are present, teachers can promote the development of children's social competence (Kontos & Wilcox-Herzog, 1997).

Social engagement with peers occurred more often than the base rate during child-initiated activities, and the level of social engagement in adult-initiated activities was close to the base rate. This finding is in agreement with previous research stating that social initiations and social interactions tend to occur at higher rates for preschool children with ASD, and other disabilities, when they are engaged in child-directed rather than adult-directed activities (Boyd et al., 2008). Allowing children to choose their activities and providing opportunities for self-direction may be especially important in promoting the development of independence for children with disabilities (Hauser-Cram et al., 1993) and social interactions among children with disabilities and their peers (Tsao et al., 2008).

Limitations

One potential limitation to our study is that the data were coded from videotaped samples. Thus, it was not always possible to know who initiated the activity at the beginning of the tape, as children often were already engaged in activities when the observation began. In this case, data were coded "Can't Tell" until a clear initiator could be identified (i.e., a new activity began with a clear initiator or the data collector announced the initiator of the activity). In the Initiator of Activity analysis, approximately 28% of the intervals were coded as "Can't Tell" and were excluded from the analyses because any patterns present could not be interpreted.

An additional limitation is the use of momentary time sampling methods to collect data on low-incidence behaviors, such as social engagement for children with ASD. It is possible that some social engagements were not coded because they did not occur at the exact moment when data were coded (i.e., they occurred in-between the 10-s observation intervals), thus underrepresenting the behavior (Odom & Ogawa, 1992; Sackett, 1978). However, a recent study indicated high correlations between low-incidence behaviors coded using three coding methods (momentary time sampling, interval coding, and event recording), suggesting that less data are "lost" than previously thought (Sam, Reszka, & Odom, 2011).

Implications for Future Research

The purpose of our study was to provide a broad picture of the relationships between features of preschool classroom environments and the social engagement of children with ASD. However, future research should examine possible relationships among child characteristics and social behaviors across environmental features (academic skills, social skills, age, other developmental characteristics). It is possible that the patterns found in this study are representative of the social behaviors of only some of the children and may not extend to children with different characteristics. It is also possible that patterns for some of these children may have been masked in the data because data were examined at the group level rather than at the individual child level. Just as there is no perfect intervention

that is effective for all children, there may be different classroom features that can be used to facilitate social engagement for different children based on their personal preferences and developmental levels.

Furthermore, researchers should examine the more complex patterns across multiple classroom features as well as the relationships between features of the classroom and social engagement and possible sequences of behaviors. For example, “Are there specific classroom areas, behaviors, and group arrangements that, in combination, are associated with higher rates of social engagement (e.g., when children are in the Book Area, participating in book activities, and in small groups, is social engagement higher?)?” Other ecological factors such as the number of adults and peers in the classroom, classroom arrangement, and the length of the school day may also be investigated as potential factors related to children’s social engagement.

Implications for Practitioners

In conclusion, information from our study contributes to the knowledge base surrounding the social development of young children with ASD. Findings from this study suggest that features of the classroom environment can play a key instructional role in their social engagement (Boyd et al., 2008). Thus, it is important that teachers and other professionals evaluate various aspects of the environment to ensure that opportunities are available to encourage social interactions among children with ASD and their peers.

Teachers and other professionals must understand that what drives children who are typically developing to interact socially is often different from what motivates children with ASD (e.g., pretend play often is difficult for children with ASD and often does not inspire social interactions with peers as it does with children who are typically developing; Chawarska & Volkmar, 2005; Loveland & Kotoski, 2005). The low incidence of peer social engagement in our study confirms that only creating activity areas and setting up materials is not sufficient to promote social interactions. Adults may need to provide additional supports for children’s play and interactions (e.g., offering suggestions for play activities, ensuring that materials are appropriate and interesting to the children, and ensuring that the children know how to use the materials; Lewis & Boucher, 1995; Ziviani, Boyle, & Rodger, 2001). Environmental arrangements that help facilitate the social engagement of children with ASD may be more effective when combined with other strategies shown to support children’s social engagement, such as peer-mediated models or other interventions targeting various aspects of children’s development that may be applied to social engagement (see Odom et al., 2003; McConnell, 2002; Rogers, 2000).

Classroom features identified as being related to social interactions should be present in classrooms serving children with ASD. To promote social engagement, children should be allowed to choose activities during free play, book materials and large motor activities should be available, and children should be encouraged to play in small groups with their peers. Finally, the very low rates of social engagement with peers underscore the need for a specific focus on the relationship between the environment and social development of children with ASD. Thus, the influences of the environment cannot be overlooked and must be a priority in programs serving children with ASD.

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