Communication Input Matters: Lessons From Prelinguistic Children Learning to Use AAC in Preschool Environments

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Abstract

This study reports on the communication produced by 30 children learning to communicate with AAC in their preschool classrooms, as well as the communication input provided by educators. All of the children were communicating with less than 20 different words, symbols, or signs at the time of observation. Characteristics of participants’ preschool classrooms were also measured with the ECERS-R. Relationships between ECERS-R scores, communication input to children, and child communication rate were explored through correlation analyses. Results indicated that child communication rates in their classrooms were low and that the majority of child communication was in response to educators’ initiations. Only the amount of adult input to children was significantly related to child communication rates. ECERS-R scores were not related to any observed communication variables. Results provide a base of comparison for future studies as well as demonstrating need to provide more communication input within preschool classrooms.

Keywords

AAC; preschool; ECERS-R; input

Introduction

Young children who are still in the beginning stages of learning to communicate are exposed to a world of new communication opportunities when they enter preschool classrooms. From the child’s point of view, each new person that they meet is likely to communicate differently than family members and other communication partners from playgroups, childcare, and other social settings. In addition, each new communication partner is also likely to respond differently to communication attempts by the child.

New contexts and new people in preschool provide rich opportunities for children’s communication to grow. For children learning to use augmentative or alternative communication (AAC), such as pictures, speech generating devices, natural gestures, or signs, these additional opportunities can also prove challenging because of the potential “newness” of their AAC systems. AAC is often first introduced in preschool and thus children may be faced with the multiple demands of learning their new communication system, and learning how to function in a school environment.

Communicating with AAC can take more time than speech. Therefore, communication partners, such as teachers, need to show patience and encouragement to help overcome these
additional challenges. Teachers of preschool children learning to use AAC may not be familiar with AAC, however, and therefore need to learn how to incorporate AAC into the instructional milieu of preschool classrooms. For these reasons, the number and type of communication opportunities in preschool classrooms deserves further attention by researchers.

The Preschool Classroom

As is the case with most children in school settings, variables within the preschool classroom itself can affect communication by preschool children learning to use AAC. Kent-Walsh and Binger (2009) use the term external (as opposed to internal to the individual child) to describe factors such as the curriculum, environment, and characteristics of the communication partner that are likely to affect a child’s communication at preschool. It is widely recognized that to study a child’s development, one must consider not only the child but also the context in which development occurs. Studies of these external factors have pointed to parameters such as classroom size, safety, and accommodating features as well as variables of communicative interaction such as activity contexts and language stimulation techniques (e.g., use of open ended questions or time given allowing children to communicate) (Turnbull, Anthony, Justice, & Bowles, 2009).

Interest regarding how these aspects of the preschool environment may affect child communication development is not unique to children learning to use AAC. A growing body of research focuses on documenting how variables within preschool classrooms promote communication (Kaczmarek, 1985; Thurm, Lord, Lee, & Newschaffer, 2007; Von Tetzchner, Merete Brekke, Sjøthun, & Grindheim, 2005). Teachers have been encouraged to interact in ways that promote child communication, including waiting for children to communicate (Bunce, 1995; Kaiser, Ostrosky, & Alpert, 1993), structuring activities to provide predictable routines (Hancock & Kaiser, 2006; Kashinath, Woods, & Goldstein, 2006) encouraging peer interaction, and encouraging participation by all children (Odom, 2000).

Interest in the preschool environment has led to the development of a number of environmental rating scales (Sylva et al., 2006). One of the goals of these rating scales is to describe characteristics of the preschool classroom. Various aspects of the preschool environment, thought to contribute to children’s outcomes are observed, measured and described, including interaction strategies, teacher-child ratios, as well as the physical layout of the classroom. For example, one widely used measure of preschool environments is the Early Childhood Environmental Rating Scale-Revised (ECERS-R) (Harns, Clifford, & Cryer, 1998). It requires observing at least two hours of a preschool day and completing an interview with a teacher. The ECERS-R is administered by trained observers who have been taught to document the presence of certain aspects of the preschool classroom, such as toys, safe equipment, and use of particular educational components. Rating scales such as the ECERS-R provide a comparative score of a child’s preschool environment.

Language Input

Rating scales such as the ECERS-R provide information about the preschool environment, but do not provide detailed information about the communication input provided to children in their classrooms. Research shows that the amount of communication directed to a child in everyday interactions directly relates to the child’s communication and language attainments (Hart & Risley, 1995; Landry, Smith, Swank, & Guttentag, 2008). For example, a recent study by Warren, Brady, Sterling, and Fleming (2010) found that responsive interactions by mothers of children with fragile X syndrome contributed significantly to children’s language outcomes. Specifically, children whose mothers commented and responded more to them...
during home interactions had better language scores measured concurrently and three years later. Similarly, in a study with over 500 low birth weight children, parental input as measured through a responsivity rating scale at 30 months predicted verbal IQ of the same children at 5 years of age (Fewell & Deutscher, 2002). Parental responsivity was a significant factor even after differences in initial vocabulary comprehension were considered.

In addition to home environments, the language input experienced at school significantly relates to children’s language development (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Vasilyeva, Huttenlocher, & Waterfall, 2006). Although the importance of observing children in actual preschool classrooms is widely acknowledged, such observations are difficult to conduct (Walker, Carta, Greenwood, & Buzhardt, 2008). In vivo online measurement of children’s communication attempts and the communication addressed to children by their teachers requires extensive training and practice.

A few studies have collected and reported in vivo language data with preschool children learning to use AAC. Johnston, Nelson, Evans, and Palazolo (2003) measured communication during free-choice activities using an interval recording system in three preschool children with autism. Prior to intervention, the children communicated to teachers with symbolic communication (including speech) between 3 to 5% intervals. In a study with slightly older children, Rowland (1990) measured the communication cues offered to children with dual sensory impairment by teachers in classrooms. Cues were deliberate attempts to elicit a specific communicative behavior. Six children were followed for an entire class day. Results showed that between 4 and 23% of intervals provided communication cues. Furthermore, teachers were more likely to provide cues to children who initiated communication more often. In this same article, Rowland presents comparative data from a head start classroom. Approximately 28% of intervals contained communication cues in the head start classrooms. However, it should be noted that the coding system used in this study included instructions delivered to a group of children or the entire class (in addition to communication presented to an individual child).

**Purpose of the Current Study**

The current study reports on two potentially relevant sets of variables relating to communication rates by preschool children learning to use AAC—the preschool classroom and language input provided within that classroom. We used a well-known measure of the preschool classroom, the ECERSR and employed in vivo coding to capture actual language input and child communication output throughout typical preschool classes. We hypothesized that children who participate in highly rated classroom environments and that experience high rates of educator input will communicate more compared to children experiencing less ideal environments and less educator input. In addition, because our data reflect actual communication rates by children learning to use AAC and their educators across many different preschool classrooms, our results may provide a base of comparison for future studies.

**Methods**

**Participants**

Thirty children (22 boys) were observed interacting in their preschool classrooms in the greater Kansas City area. The average chronologic age of the children was 51.4 months, ranging between 37 and 71 months. All of the children qualified for early childhood services in both Kansas and Missouri. Five children were African American, 1 child was Latino, 2 were Middle Eastern, and the remaining children were white. Participants were selected for
this study based on expressive language levels. Specifically, we recruited and selected children ages 3 to 5 years who produced less than 20 different functional words at the time of the initial observation, according to parent and teacher report and verified in our initial observation. This word limit included speech, sign, and symbol selection. In addition, at least one goal on each participant’s individual education plan (IEP) addressed the use of AAC to communicate. In this study, all of the children were learning to use some form of speech generating device, typically a single-switch device that played one recorded message. However, several children were learning to use more complex devices. The children also communicated with natural gestures and some speech. Thus, all of the participants could be characterized as beginning communicators who were in the early stages of learning to use AAC.

Eleven children had confirmed diagnoses of autism and four children had Down syndrome. The remaining children had various diagnoses including Prader-Willi syndrome, Kabuki syndrome, hydrocephalus, or general delays not associated with a specified diagnosis. Twenty-one of the children were ambulatory and nine of the children used a wheel chair or other form of assistance to walk. All of the children had upper body movements adequate to directly select symbols.

The children in this study typically attended preschool four days a week for about three or four hours each day. Almost all of the preschool classrooms followed a daily schedule; however, schedules varied from day to day due to circumstances such as absent staff, equipment availability, or special activities. Ten children were in classrooms that only included other children with disabilities. The remaining children were in classrooms that included at least one child without any disabilities. There were between 1 and 5 staff members in each class and the number of children varied between 5 and 9.

**Procedures**

For this investigation we analyzed children’s communicative interactions with adults’ and environmental factors in the children’s preschool classrooms to environmental variables that we hypothesized to relate to child communication. In order to describe differences in children’s language and cognition we also used standardized measures. The following sections describe the standardized measures, classroom observations measuring child and adult communication, and environmental rating scales in this study.

**Standardized Test Scores**

Cognitive development was measured with the Mullen Scale of Early Learning (MSEL) (Mullen, 1995). The MSEL is composed of five scales and the results from the following four scales combine to yield a learning composite score: visual reception, fine motor, receptive language, and expressive language. The Visual Reception Scale assesses a child’s abilities in the areas of visual discrimination and visual memory. The Fine Motor Scale provides a measure of visual-motor ability with items involving visual-motor planning and control. The Receptive Language Scale is a measure of ability to process language input including auditory comprehension, memory, organization and sequencing as well as spatial concepts. The Expressive Language Scale assesses the ability to express with words, vocalizations, and gestures. The MSEL also includes a Gross Motor Scale but it does not contribute to the composite score and was not administered in this study. Participants’ average Composite Learning Score on the MSEL was 48.42 based on a mean of 100 and a standard deviation of 15, although this average is somewhat misleading because most children received a standard score of 48, which is the lowest score possible. Information about the range and standard deviations of MSEL scores is presented in Table 1.
Expressive and receptive language was also measured with the Preschool Language Scale (PLS-4) (Zimmerman, Steiner, & Evatt Pond, 2003). The PLS-4 was developed for children from birth through 6 years, 11 months, and the standardization was based on a sample of 1,534 children. Results from the PLS-4 are evaluated relative to a total language score as well as an auditory comprehension and expressive communication subscale scores. In terms of early language testing, the PLS-4 has some advantages, compared to the MSEL, in that it includes more items that test earlier acquired skills. Therefore, we present the raw scores from the PLS-4 as an indication of language variability across participants in Table 1.

**Observational Measures**

On a typical school visit, one or two observers (trained graduate research assistants) entered the child’s classroom to code with handheld PDA devices. Each hand-held PDA is equipped with the software package Pocket Observer by Noldus™. Behaviors, described below, were recorded by tapping the screen with a stylus. The adults and children were usually quite busy and little if any attention was given to the observers. The observers maintained this “invisibility” throughout the duration of the observation; not interacting with adults or children in the room. The children in this study and their peers in the preschool classrooms almost never noticed or engaged the observers working in the room. The observers positioned themselves within an audible and visible distance from the child and began coding. Coding could be paused for bathroom breaks, poor positioning, or if the communication was inaudible due to the classroom noise level. Also, coding was paused or stopped if the activity prevented relatively normal communication such as a movie, nap time, illness, or extended disruptive behavior.

An observer from our lab scheduled two one-hour visits on two different days and times at the convenience of the children’s teachers. The first and second hours of observation were intentionally scheduled during different periods of the preschooler’s day. This ensured the broadest sample of the preschooler’s day within the two total hours of observation. The activities during the observed time were not planned or adapted to our visit in any way. Thus, it can be said that the sample of communicative behavior is random and represents a broad range of activities. Our goal was to capture a typical day in each child’s preschool environment.

Each child was observed in their preschool classroom during regularly scheduled activities. The average class size for each child was 8 children and three staff. Sixteen classrooms could be described as inclusive because they included one or more typically developing peers integrated into all aspects of the preschool classroom. Our goal was to observe a total of 120 minutes for each child distributed over two different days. The mean number of minutes of actual observation was 127 minutes, with a range of 108 to 155 minutes.

**Communication Behaviors**

Observers recorded each child communication behavior directed toward or in the proximity of adults and any adult communication directed toward the child using a system for recording communicative behaviors in vivo (online). Behaviors were recorded on a handheld personal digital assistant (PDA) using software created by Noldus Information Technology (2002).

Child communication was recorded whenever it appeared to be intentional and directed to one of the teaching staff. Intentionality was determined based on directionality of behavior toward a communication partner and ability to identify a plausible referent. Child communication included non-symbolic gestures, speech, and AAC directed toward an adult communication partner. For example, if the child selected a symbol for “grape” when
presented with several food choices at snack the behavior would be recorded. However, if the child continuously selected “grape” in a context where grape was not relevant, child communication would not be recorded. Child communication directed toward a peer was not recorded in this study for two reasons. First, communication toward peers was rarely observed. Second, the low frequency of occurrence resulted in low measurement reliability when we attempted to measure peer interactions in pilot phases of this study. Echolalic speech also was not recorded.

Child communication was further described as an initiation or a response. Response was indicated if the child’s communication followed an educator’s question or prompt for communication. All other child communication was recorded as initiations.

Educator communication directed toward the target child by any of the adult teaching staff was recorded, but communication by peers toward the focus child was not recorded. Other examples of communication that was not coded included communication by an adult to a group of children that was not directed specifically to the focus child, and the entirety of a rapid drill or flashcard exercise. Drills were excluded because we were attempting to capture communication directed toward children in communicative exchanges. In addition, as only some children experienced these drills, we felt that including drill data could inflate the rates of input and output for some children.

Adult communication was further described as either initiation, prompt, or response. A prompt was recorded if the adult provided a specific prompt for child communication, such as, “show me grape” (referring to a symbol for grape) or if the adult used a physical prompt for communication (e.g., hand over hand prompting). A response was recorded if the adult’s communication followed a child’s initiation and maintained the same topic as the child. For example, if the child communicated “grape” at snack time and the adult responded, “OK, you can have a grape,” the adult’s communication would be recorded as a response. All other communication acts were recorded as initiations.

If either the child or adult did not respond to their partner within three seconds, a no response code was entered. To summarize, child communication was described as either an initiation or a response and adult communication was described as an initiation, response, or prompt. Both child and adult communications were further described according to modality (speech, gesture, symbol selection, speech generating device, vocalization, or combination) for future analyses. Abbreviated definitions of the behavior codes included in the current study are presented in the Appendix and a complete coding guide is available from the first author upon request.

Classroom Environment Measure

The Early Childhood Environment Rating Scale-Revised (ECERS-R) is a tool for rating program quality in early childhood classrooms. It has 43 items divided over the following subscales: space and furnishings, personal care routines, language-reasoning, activities, interaction, program structure, and parents and staff. The ECERS-R has been used extensively over the past 25 years to assess overall quality of preschool programs in the United States and internationally (Karrby & Giota, 1994; Munton, Rowland, Mooney, & Lera, 1997; Sheridan, 2000; Statham & Brophy, 1992). Munton and colleagues reported that the ECERS-R has adequate validity when used as a tool for research and evaluation purposes. Although each area is in itself important, it is the overall score derived from combining the total scores across these areas that is most directly linked to child outcomes. As noted by Cryer and colleagues, “It is the average total score that is related to positive child development, but not any of the single requirements by themselves” (2003). Hence,
each child’s total score from the ECERS-R was used in our analyses. The maximum total score for the ECERS-R is 301.

The ECERS-R was administered by a research staff member (affiliated with the current project) that received training by a certified ECERS-R administrator. Training activities included: (a) reading the manual and materials, (b) practicing with a trained staff member in an early childhood setting, and (c) administering a practice assessment in an early childhood setting and comparing those results with the certified administrator. Staff members were considered to be trained on the ECERS-R when their ratings were at least 80% in agreement with the certified administrator. To complete the ECERSR, research staff observed each classroom for a minimum of 2½ hours and completed a teacher interview that lasted approximately 20 to 30 minutes. Observations occurred during times when the students were present and active, and included both play/learning times and routines.

**Interobserver Agreement**

Interobserver agreement was calculated for both the Observational data and for the ECERS-R ratings. Observers were trained to a criterion of 80% agreement across all categories of observed behaviors across three different training sessions prior to completing observations of participants in this study. These training sessions were conducted in classrooms with students that were similar to our participants and in classrooms similar to those in which we collected actual data.

Once this criterion was met, two coders independently coded child communicative behaviors and ECERS-R for 10 different children who were randomly selected for reliability coding. Following the independent coding, transcripts and ratings were compared. To determine the interjudge reliability for each behavior coded, intraclass correlation coefficients (ICCs; using the consistency definition) (Shrout & Fleiss, 1979) were calculated for each measure. ICC’s reflect the amount of variance in scores that may be attributable to differences in raters. This measure was selected because the data analyzed were frequencies of each measure, a continuous measure. ICCs is a better measure of reliability for continuous measures (as opposed to categorical) than is the Kappa statistic (Bartko, 1991). ICCs for each measure were high: Child initiation .96, child response .87, child no response .98, adult initiation .96, adult prompt .85, adult response .97, and adult no response .78. ICC for the total score of the ECERS was .96. These strong correlations indicate good agreement across coders.

**Results**

Our results focus on the descriptive measures for rates of communication observed in classrooms during real activities and the range of ECERS-R scores obtained. Additionally, relationships between the ECERS-R total score, rates of adult communication (initiations, responses and prompts), and rates of child communication (initiations and responses) observed in the classroom were explored through correlational analyses.

Scores from the ECERS-R can be considered in terms of the total score obtained as well as subscale scores. The mean total score was 196.83 with a range of 142 to 256. We used this total score in the correlations with observed communication variables, described below. Table 2 presents the means and ranges of scores for each subscale. Each subscale is evaluated with a 7 point scale with 7 as the highest average score available. As can be seen in Table 2, a range of scores were obtained, although most scores can be interpreted as indicative of high-quality environments.
The descriptive statistics for the communication variables collected through in vivo observation are presented in Table 3. As can be seen, by far the majority of communication episodes were initiated by adults. The average rate of child-initiated communication observed in their classroom settings was .134 communication acts per minute and responses occurred at an average rate of .494 per minute. In other words, on average, children were initiating communication (via any mode of intentional communication) a little more than once every 10 minutes and responding about once every 2 minutes over the course of the observations. By contrast, adult-initiated communication averaged 1.62 communication acts per minute.

In order to determine if children's rates of communication related to adult communication and/or scores from the ECERS-R, Pearson correlations between child total communication and other variables were calculated. The intercorrelations between these variables are given below in Table 4.

Significant correlations (those with \( p \) values less than .05) were found between child communication and adult communication input. Specifically, child initiations were significantly correlated with adult response rate, and child response rate was significantly correlated with both adult initiation and adult response rate. The patterns in these correlations, when considered with the rate data presented in Table 3, suggest that most communication episodes were initiated by adults and also that the amount of initiations toward children was related to the amount of child communication. The correlations between child initiations and adult responses also suggest that adults tended to respond to child initiations, even though child initiations occurred infrequently.

Interestingly, we did not find any relationship between scores on the ECERS-R and child or adult communication, even though there was sufficient variance within each of these measures. Apparently the characteristics of preschool classrooms captured by the ECERS-R do not correlate with the rates of communication input or output as measured with our in vivo observation system, when each measure is collected concurrently. The ECERS-R has been linked to child performance outcomes over time, however, and future analyses may indicate the predictive value of ECERS-R score for predicting growth in child communication rates.

**Discussion**

One of our primary outcomes was to identify the rate of communication observed in beginning communicators in preschool classrooms. Children in our study initiated communication at a rate of only .133 per minute. Response rate was much higher however, indicating that most child communication was in response to adult questions. These data were collected on 30 children, observed in everyday contexts throughout typical preschool classrooms. Hence, they are likely to be representative of the communication environments experienced within preschools by children in the beginning stages of learning AAC. The data presented here could be considered as a base of comparison for future studies and for interventions, as there are no similar data available in the current literature.

In addition to providing a base of comparison, our data suggest that there is a considerable gap between the communication opportunities currently presented in preschools and recommended practices. For example, recommendations for early intensive interventions for children with autism include providing between 20 to 40 hours per week of intervention (Howlin, Magiati, & Charman, 2009). In intensive early intervention programs, children typically are presented with hundreds of teaching opportunities per day. Only some of the
children in the current study had autism, yet intensive interventions are likely to benefit all children at the beginning stages of communication learning.

Although early intensive intervention models have traditionally relied on 1:1 teaching formats, several other early intervention models focus on increasing communication throughout the day. For example, milieu teaching approaches include teaching preschool teachers and parents how to recognize and encourage communication in young children (Hancock & Kaiser, 2006). The Scerts model developed for children with autism focuses on teaching social partners as well as the child (Rubin, Laurent, Prizant, & Wetherby, 2009).

The current findings indicate the need to systematically investigate variables that may contribute to increasing input and opportunities within preschool classrooms. Clearly, it is important to provide sufficient language input as well as provide communication opportunities in preschool classrooms. Although early intervention programs emphasize providing specific opportunities or cues for children to communicate, research has also shown that the sheer quantity of input provided to children has important implications for language (Hart & Risley, 1995; Huttenlocher et al., 1992). Our findings are more closely related to research on quantity of input because we didn’t distinguish between input that contained cues for communication versus comments directed to children. For children learning to use AAC, the importance of increasing input that incorporates AAC as well as providing opportunities to use AAC also have been emphasized (Romski et al., 2010).

There are several limitations to the current study. We only looked at correlations between child and adult communication behaviors at a single point in time. Therefore, we are unable to make any causal inferences about the directionality of effects. Future studies are needed that include longitudinal analyses and more sophisticated sequential analyses of sequences of initiations and responses between partners. The most compelling case for the importance of increased communication input in preschool classes will be made through intervention studies that demonstrate significant increases in child communication outcomes following increased input and increased communication opportunities.

All modes of communication (e.g., gestures, AAC, speech) were combined in our current analyses; however, different effects of input may be associated with specific modes. One direction for future study is to more closely examine the modalities of communication by children as well as input to children. For example, it would be interesting to know if adults respond more to the use of symbols with or without speech output from SGDs, compared to gestures and vocalizations; and conversely if variations in adult input modalities correspond to differences in mode of child communication. Studies of early parent-child interactions indicate that parents respond more often with verbal input following clear communicative signals (e.g., points) by the child compared to more ambiguous vocalizations (Goldin-Meadow & Bucher, 2003; Tomasello & Farrar, 1986), but similar studies in preschool classrooms have not been reported.

Although we hypothesized that variability in classroom characteristics captured by the ECERS-R would also correlate to child communication rate, our findings did not support this hypothesis. The amount of input was the only variable significantly related to child communication rate in our study. These findings are contrary to earlier studies showing a positive relationship between scores on the ECERS-R and certain attainments by children (Burchinal, Roberts, Riggins, Zeisel, Neebe, & Bryant, 2000; Sylva et al., 2006). There are several possible interpretations of these results. It is possible that the classrooms attended by the study participants were all sufficiently conducive to child communication. In other words, we may have found some ceiling affects because all the classrooms were designed to promote communication. All of our class sizes were relatively small and Turnbull and
colleagues reported that educators were more likely to use language stimulation techniques in smaller groups (2009). In addition, our results were obtained from a single time-point rather than across multiple observations. However, the current body of data was collected as part of a longitudinal study; thus, we will be able to investigate predictive relationships in future analyses.

Overall, our findings reflect the importance of adult communication input for child communication attainments. An encouraging aspect of this outcome is that input conducive to intervention (Brady, Warren, & Sterling, 2010; Girolametto & Wieitzman, 2006). Interventions that emphasize input toward the child learning to use an AAC system appear to specifically address this important variable (Romski & Sevcik, 1996).

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Appendix

Brief Definitions of Communication Categories

Adult Initiation

An adult begins a communication episode directed toward the focus child either 3 seconds after the last communicative act, or at a significant topic change. When multiple adults are communicating only the last adult to communicate is coded. During group activities, only adult communication clearly directed to the focus child is coded.

Example: Adult asks the child if they want more snack and signs “more.”

Adult Response

An adult responds to the focus child’s communicative act within 3 seconds Example: Child vocalizes and points at the window and gives a picture of the swing to the adult. Adult responds with “Not yet,” and a sign for “No.”

Adult Prompt

An adult gives the focus child a specific and direct prompt to help the child use words, signs, symbols (PECS), gestures, or an SGD. A prompt must specifically use: hand-over-hand guidance, or expressions such as, “Say …,” “Give me the symbol for …,” “Tell me …”

Example: Adult says, “Give me the picture for snack.”

Adult No Response

Adult does not respond to communicative act within 3 seconds after the child communicative act ended.

Example: Child points to a container of milk and says, “Milk,” and after 3 seconds the adult does not respond

Child Initiation

A child begins a communication episode directed towards an adult either 3 seconds after the last communicative act, or initiates a new topic.
Example: Child looks at adult and signs “more,” to request more snack.

**Child Response**

A child responds to an adult’s communicative act within 3 seconds.

Example: Adult asks child, “Do you want a snack?” Child responds with head nod for “yes” within 3 seconds.

**Child No Response**

Child does not respond to communicative act within 3 seconds after the adult communicative act ends.

Example: Adult asks child, “Do you want a snack?” and the child does not respond.
Table 1

Descriptive Data Obtained from Standardized Tests, Classroom Communication Observations, and Environmental Rating Scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Range</th>
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<tr>
<td><strong>Standardized Measures</strong></td>
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<td></td>
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</tr>
<tr>
<td>MSEL Composite</td>
<td>48.42</td>
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<td>48–56</td>
</tr>
<tr>
<td>PLS-4 Total raw score</td>
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<td>9.69</td>
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<td>PLS-4 Auditory composite raw score</td>
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<td>PLS-4 Expressive composite raw score</td>
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<td>4.75</td>
<td>11–31</td>
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<tr>
<td>Subscale</td>
<td>Mean Score</td>
<td>Range</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>-----------------------</td>
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</tr>
<tr>
<td>Space and Furnishings</td>
<td>4.71</td>
<td>3.5–5.75</td>
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<td>Personal Care</td>
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<td>Language and Reasoning</td>
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<td>3.00–7.00</td>
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<td>Program Structure</td>
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<td>3.0–7.0</td>
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<td>Parents/Staff</td>
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Table 3
Child and Adult rates of Communication Recorded in Preschool Classrooms

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<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Standard Deviation</th>
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<td>Child response rate</td>
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<td>Adult initiation rate</td>
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<td>.559</td>
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<tr>
<td>Adult response rate</td>
<td>.511</td>
<td>.386</td>
</tr>
<tr>
<td>Adult prompt rate</td>
<td>.110</td>
<td>.119</td>
</tr>
</tbody>
</table>
Table 4

Intercorrelations Among Child Communication, Adult Communication, and Environmental Rating Scale Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Child Initiation Rate</th>
<th>Child Response Rate</th>
<th>Adult Initiation Rate</th>
<th>Adult Response Rate</th>
<th>Adult Prompt Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child response rate</td>
<td>.382 *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult initiation rate</td>
<td>.095</td>
<td></td>
<td>.367 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult response rate</td>
<td>.499 *</td>
<td>.981 *</td>
<td>.369 *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adult Prompt rate</td>
<td>−.120</td>
<td>.029</td>
<td>.209</td>
<td>−.066</td>
<td></td>
</tr>
<tr>
<td>ECERS-R total score</td>
<td>.029</td>
<td>−.024</td>
<td>.138</td>
<td>−.020</td>
<td>.275</td>
</tr>
</tbody>
</table>

* Indicates p values <.05.