International Journal of Arts and Humanities; Vol. 12 No.1; February 2026
ISSN 2415-122X (Online), ISSN 2415-1491 (Print)
Published by Center for Global Research Development

Assessing Language Modeling in Pre-K Classrooms: A Quantitative Analysis Using the Classroom Assessment Scoring System (CLASS)

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Abstract

This quantitative study examined the relationship between specific teacher-child interaction behaviors and language modeling quality in Pre-K classrooms using the Classroom Assessment Scoring System (CLASS) framework. Data were collected from structured observations in 11 Pre-K classrooms in Southeast Virginia during spring and summer 2024. The Language Modeling dimension was assessed through five key indicators: frequent conversations, open-ended questions, repetition and extension, self and parallel talk, and use of advanced language. Descriptive statistics, bivariate correlation, and regression analyses were employed to examine relationships between observed teacher behaviors and overall language modeling scores. Results revealed weak and statistically non-significant correlations across all variables, with no individual teacher behavior serving as a strong predictor of language modeling quality. These findings suggest that effective language modeling is a complex, multidimensional process that cannot be captured through analysis of isolated behaviors (Pianta et al., 2008; Hamre et al., 2013).

Keywords: language modeling; teacher-child interactions; early childhood education; Pre-K; CLASS framework; quantitative assessment

Introduction

Early childhood language development serves as a foundation for later academic and social achievement. High-quality teacher-child interactions foster rich language experiences that are critical for literacy and cognitive development (Snow, 2010; Whitehurst & Lonigan, 1998). In Southeast Virginia, recent assessments of Pre-K classrooms revealed that approximately 75% of children were rated as "proficient" or "advanced" in language modeling. While encouraging, this data also indicates significant variability in classroom practices, underscoring the need for more consistent and effective instructional strategies.

Language modeling, as measured by the Classroom Assessment Scoring System (CLASS), supports language acquisition through frequent conversations, vocabulary enrichment, and emotionally supportive teacher-child interactions (Pianta et al., 2008). This work is grounded in developmental theories emphasizing social interaction and cognitive growth (Vygotsky, 1978; Piaget, 1952).

The development of language skills during early childhood represents a cornerstone of lifelong academic and social success. This study utilizes a quantitative approach to investigate how specific teacher behaviors relate to overall language modeling quality as measured by the Pre-K CLASS framework. By examining observable classroom interactions, this research aims to identify which teacher behaviors most strongly predict high-quality language modeling practices in Pre-K settings.

Theoretical Framework

The Classroom Assessment Scoring System (CLASS) serves as a research-based framework for operationalizing developmental theories within real-world classroom settings (Pianta et al., 2008). The Pre-K CLASS tool assesses the quality of teacher-child interactions across three domains: Emotional Support, Classroom Organization, and Instructional Support. This study focuses on the Instructional Support domain. Within the Instructional Support domain, the Language Modeling dimension evaluates how teachers use strategies such as frequent conversations, open-ended questions, repetition, self- and parallel talk, and the use of advanced vocabulary to enrich children's language experiences (Hamre et al., 2013). CLASS provides a structured, evidence-based method for assessing and enhancing instructional quality, translating abstract concepts into observable teacher behaviors that are directly linked to student outcomes.

The Language Modeling dimension reflects how teachers intentionally support and promote children's language development through five key indicators. Frequent Conversations assess sustained, back-and-forth exchanges between teachers and children. Open-Ended Questions evaluate the use of prompts that encourage elaboration, reasoning, and higher-order thinking. Repetition and Extension examine instances where teachers repeat or build upon children's verbalizations to model more complex language structures. Self- and Parallel Talk measures narration of teachers' own actions or those of the children to reinforce word-object associations. Advanced Language assesses the deliberate use of rare or domain-specific vocabulary, descriptive language, and complex syntax (Pianta et al., 2008; Hamre et al., 2013).

Methodology

Research Design

This study employed a quantitative research design using structured classroom observations to assess the quality of teacher-child interactions. The Pre-K Classroom Assessment Scoring System (CLASS) served as the primary data collection instrument, providing standardized measurement of language modeling practices across multiple classroom settings.

Participants

The study included 11 Pre-K teachers working in different classrooms within preschool centers located in Southeast Virginia. Participants ranged in age from 18 to 60 and were actively engaged in classroom instruction during the spring and summer of 2024. All participants had received professional development aligned with the Pre-K CLASS framework, specifically focusing on language modeling practices.

Demographic data revealed that all 11 participants identified as female. The ethnic composition included 46% African American, 36% Hispanic, and 18% Caucasian participants. Age distribution showed 18% between 18-25 years old, 36% between 26-35, 10% between 36-45, and 36% between 46-60 years old. Teaching experience varied: 10% had fewer than 3 years, 10% had 3-5 years, 26% had 5-10 years, 18% had 10-15 years, and 36% had over 15 years of classroom experience.

Item	Details	Frequency	Percent
Gender	Female	11	100%
Ethnicity	African American	5	46%
	Hispanic	4	36%
	Caucasian	2	18%
Age	18-25 years	2	18%
	26-35 years	4	36%
	36-45 years	1	10%
	46-60 years	4	36%
Teaching Experience	<3 years	1	10%
	3-5 years	1	10%
	5-10 years	3	26%
	10-15 years	2	18%
	15+ years	4	36%

Table 2: Descriptive Analysis of Pre-K Teacher Demographics (Hernandez et al., 2025)

Data Collection Procedures

Observations were conducted using a structured protocol that included four 20-minute observation cycles, resulting in 80 minutes of observation per classroom (Pianta et al., 2008). This format follows best practices recommended by CLASS developers, enabling observation of classroom dynamics across diverse instructional contexts and times of day. Each observation aimed to identify and score specific teacher behaviors linked to high-quality language modeling.

The observer used the Pre-K CLASS 7-point scoring scale to rate each indicator, with scores representing both the frequency and quality of observed teacher behaviors. Higher scores signify greater intentionality, developmental appropriateness, and integration of language modeling strategies throughout the instructional day.

Data were collected through systematic classroom observations using the Pre-K CLASS tool, which assesses dimensions of Emotional Support, Classroom Organization, and Instructional Support, with particular emphasis on Language Modeling. The observational data were enhanced with detailed field notes. The quantitative component of the study focused on evaluating observable teacher-child interactions using the Pre-K CLASS framework, emphasizing the Language Modeling dimension. Observations were conducted across three Pre-K CLASS domains - Emotional Support, Classroom Organization, and Instructional Support, with language modeling assessed through five key indicators: frequent conversations, open-ended questions, repetition and extension, self and parallel talk, and the use of advanced language. Descriptive statistics were utilized to identify patterns in implementation across classrooms, while bivariate correlation and regression analyses examined the relationships between specific interaction behaviors and overall language modeling scores. The results of these analyses are presented below, providing a foundational understanding of how language modeling is implemented and measured in Pre-K classrooms.

Data Analysis

Quantitative data were analyzed using descriptive statistics, bivariate correlation, and simple linear regression analyses. Descriptive statistics examined the frequency and variability of language modeling practices across classrooms. Correlational and regression analyses explored the relationship between specific teacher-child interaction behaviors and overall language modeling scores, providing insight into which strategies might be most predictive of high-quality language support.

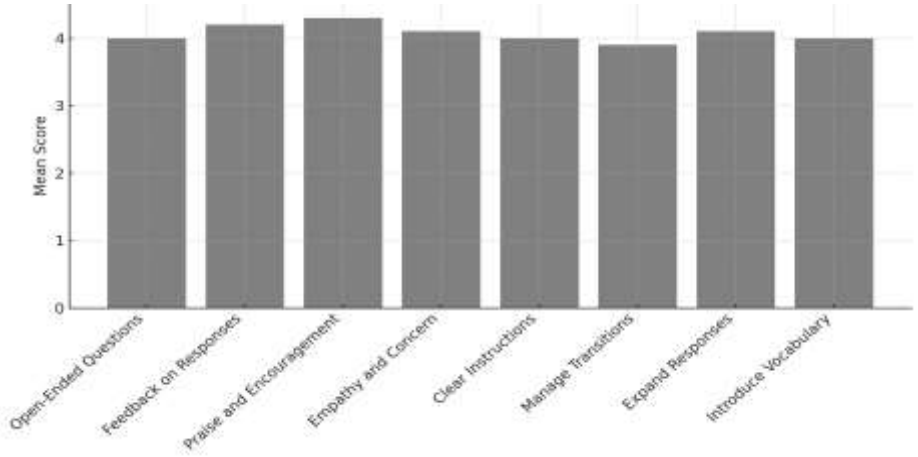
Results

Descriptive Statistics

The quantitative analysis focused on evaluating observable teacher-child interactions using the Pre-K CLASS framework, emphasizing the Language Modeling dimension. Language modeling was assessed through five key indicators: frequent conversations, open-ended questions, repetition and extension, self and parallel talk, and the use of advanced language. Descriptive statistics revealed patterns in implementation across classrooms, though considerable variability existed in how teachers employed these strategies.

Language Modeling was observed through the five key indicators across classrooms, showing variability in implementation (see Graph 1).

Graph 1 - *Descriptive Statistics for Language Modeling Indicators*



This bar graph titled "*Descriptive Statistics for Language Modeling Indicators"* displays the mean scores for observed language modeling behaviors across the selected teacher-child interaction categories.

Bivariate Correlation Analysis

Pearson correlation coefficients were calculated to determine the strength and direction of associations between Pre-K CLASS language modeling scores and specific teacher-child interaction behaviors. The analysis revealed weak and statistically non-significant correlations across all variables. Open-ended questioning exhibited a negative correlation with language modeling scores ($r = –0.145$, $p = 0.671$), while feedback on children's responses ($r = 0.183$, $p = 0.590$) and praise and encouragement ($r = 0.193$, $p = 0.569$) indicated weak positive associations.

Additional observed behaviors, such as demonstrating empathy, managing transitions, providing clear instructions, introducing new vocabulary, and expanding on children's statements, also exhibited low correlation coefficients ($r < .20$) with non-significant p-values ($p > .05$). These findings suggest a lack of strong linear association between any single teacher behavior and overall language modeling scores.

Regression Analysis

To further explore predictive relationships, a series of simple linear regression models was constructed. Each model assessed the extent to which a specific teacher behavior predicted variance in Pre-K CLASS language modeling scores. The resulting regression coefficients were minimal, ranging from $\beta = –0.006$ to $\beta = 0.045$. Among the behaviors examined, "empathy and concern" produced the highest positive regression coefficient ($\beta = 0.045$), while "open-ended questions" resulted in a slightly negative coefficient ($\beta = –0.006$). Despite some positive directional trends, none of the regression models yielded statistically significant results ($p > .05$).

Model Performance

The performance metrics of the regression models further supported the lack of statistical significance. R^2 values ranged from 0.019 to 0.037, indicating that the predictor variables explained less than 4% of the variance in language modeling scores. Moreover, all adjusted R^2 values were negative, suggesting potential overfitting and limited generalizability of the models to other contexts. The F-statistics across models were low, with all corresponding p-values exceeding the .05 threshold for statistical significance.

Discussion

The results of this quantitative analysis demonstrate that no individual teacher behavior, as observed in this study, was a strong or statistically significant predictor of language modeling quality as assessed by the Pre-K CLASS tool. Although certain behaviors, such as empathy and feedback, showed positive trends, the relationships were weak and inconsistent. These findings suggest that language modeling in Pre-K classrooms may be shaped by a complex array of instructional factors and interaction patterns that are not easily captured through linear analysis of isolated behaviors.

The quantitative findings highlight a crucial reality in early childhood education research: effective language modeling is a dynamic, multidimensional, and context-sensitive process. The lack of statistically significant correlations between individual teacher behaviors and language modeling scores suggests that no single strategy can solely account for the quality or effectiveness of language-rich interactions. This outcome reinforces the idea that language modeling is not a discrete or formulaic task, but rather a composite of intertwined relational, cognitive, and pedagogical practices.

Instead of viewing teacher behaviors in isolation, the data indicate that the synergistic effect of emotional attunement, instructional depth, and linguistic responsiveness is crucial to fostering meaningful language development in young children. Open-ended questioning, often recognized as a best practice, may not produce measurable benefits unless embedded in emotionally supportive contexts, paired with scaffolding techniques like repetition and elaboration, and delivered in a developmentally appropriate manner.

Implications for Professional Development

These results carry significant implications for the design and implementation of professional development programs and instructional coaching in early childhood education settings. Training should emphasize the intentional integration of multiple language modeling strategies, equipping educators with skills to adapt their language use fluidly based on the needs, interests, and responses of each child. Instead of prescribing a checklist of behaviors, professional development should encourage deeper understanding of how language supports cognition, identity development, and social connection.

Instructional coaching should promote reflective practice by encouraging teachers to critically assess how their interactions support or hinder children's language acquisition and cognitive development. The refinement of observation tools and assessment metrics is warranted. The limited explanatory power of the regression models suggests that existing instruments may not sufficiently capture the nuanced, moment-to-moment dynamics of high-quality language interactions (Hill et al., 2012).

Limitations

Several limitations must be acknowledged in this quantitative study. The small sample size of 11 classrooms limits generalizability of findings. Each classroom was observed for 80 minutes, which may not fully capture the dynamic nature of teacher-child interactions over time. The cross-sectional design captures only a snapshot of instructional practices rather than developmental progression (Burchinal et al., 2010). Additionally, the study focused exclusively on observable behaviors measured by the CLASS framework, potentially missing other influential variables that exist outside this structured assessment system.

Conclusion

While the quantitative analyses did not reveal statistically significant predictors of language modeling quality, they provide critical insight into the complexity of teaching and learning in early childhood settings. These findings prompt a reevaluation of how interaction quality is conceptualized and measured, highlighting the importance of preparing educators to engage in intentional, responsive, and emotionally attuned language practices. The interconnected nature of language, relationships, and pedagogy suggests that instructional strategies must be not only evidence-based but also adaptable to the diverse realities of Pre-K classrooms.

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