# The Impact of a Language-Based Intervention with Individualized Coaching in Early Childhood Education Classrooms

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# Contents

# Background Information

Oral language skills play a critical role in child development (Golinkoff et al., 2019; Huttenlocher et al., 2002). Children's oral language skills in kindergarten predict school achievement through fifth grade (Durham et al., 2007; Pace et al., 2019). Oral language skills are also related to self-regulation (Roben et al., 2013), executive function (Matte-Gagne & Bernier, 2011), and early literacy (NICHD Early Child Care Research Network, 2005). One of the most powerful ways to increase children's oral language abilities is through adult-child interactions or conversational turns (Zimmerman et al., 2009; Romeo et al., 2018). However, studies suggest that children's early experiences and interactions may be highly variable (Huttenlocher et al., 2010). Some children experience much lower language exposure in their homes (Hart & Risley, 2003) and early childhood education settings (Pelatti et al., 2014). For example, Pelatti and colleagues (2014) found that preschool teachers spend an average of 18 minutes daily on language instruction. Therefore, to increase the quality and quantity of language instruction in early childhood classrooms, many language interventions are paired with professional development, including coaching (Assel et al., 2007; Hamre et al., 2010).

A large body of research suggests that providing coaching to preschool teachers can significantly improve instructional practices (Yoshikawa et al., 2013). Specifically, several studies have indicated that individualized coaching can strengthen teachers' abilities to embed new strategies in their instruction (Hsieh et al., 2011) and that these effects are above and beyond that of professional development alone (Neuman & Cunningham, 2009). For example, Neuman and Cunningham (2009) found that a group of teachers

## RESEARCH QUESTIONS

### 01.
Did children in classrooms that participated in LENA Grow experience an increase in adult words and conversational turns?

### 02.
After participating in LENA Grow, did LENA Grow teachers change their beliefs about language development, job satisfaction, and self-efficacy compared to non-Grow teachers?

### 03.
After participation in LENA Grow, did children in LENA Grow classrooms make significant gains in developmental domains (language and literacy) compared to children in non-Grow classrooms?

who received professional development and coaching significantly improved their language instruction after 15 weeks. In contrast, the group that only received professional development did not. These findings suggest that coaching supports teachers in incorporating new knowledge into their practice. Therefore, in the current study, we aimed to evaluate the efficacy of a language-based program targeting conversational turns for early childhood educators that included individualized coaching called LENA Grow.

# Method

## Participants

Children (n = 106) in eight classrooms participated in the evaluation study. Teachers were randomly assigned to Grow or non-Grow groups. The analysis sample includes all children present at the start of the study (Grow, n = 58; non-Grow, n = 48). The subsamples were largely balanced for the child's age, caregiver education, and household language. The Grow and non-Grow children had similar distributions for child's age, with the average being 38 and 41 months, respectively. In terms of children's race and ethnicity, the two groups were relatively balanced as well. The majority of non-Grow children, 65%, identified as African American, whereas the majority of Grow participants, 52%, identified as white – though neither proportion was significantly different (AA: $\chi2(1)$ = 2.83, p =

0.093; white: $\chi2(1)$ = 3.62, p < 0.057). For caregiver education, the groups were also balanced. non-Grow children had a slightly higher percentage of caregivers with a high school diploma or less, 25% vs. 12%, but the difference was not significant ($\chi2(1)$ = 2.99, p < 0.084). For most Grow and non-Grow families, English was the language most often spoken at home.

Twenty birth to three and preschool teachers participated in the evaluation (Grow n = 9; non-Grow n = 11). Grow teachers tended to have less educational attainment than their non-Grow counterparts, such that 44% had only a high-school diploma or equivalent, whereas all the non-Grow teachers had some college or more. Despite this discrepancy, a majority in both groups reported that some or most of their college coursework was related to early childhood education. In terms of a child development associate (CDA) credential, a higher percentage of Grow teachers (56% vs. 27%) either had or were pursuing certification, although this difference was not significant ($\chi2(1)$ = 1.65 p = 0.20). For years of teaching experience, most teachers were very experienced (15+ years). Only a few teachers in both groups had less than five years of teaching experience. Regarding race and ethnicity, there were equal proportions of both Grow and non-Grow teachers that identified as African American or white. For language, all the teachers in both groups reported English as their primary language. Likewise, all the teachers identified as Female.

# Procedures

## LENA Grow

LENA Grow is a strengths-based professional development program for early childhood education teachers. Children wear a LENA recorder in the classroom once a week for 10 weeks, which captures their language environment and automatically generates actionable reports for teachers. After each recording day, teachers meet with a coach to interpret the data, discuss strategies for increasing quality interactions, and set goals for the next LENA day. The reports are designed to promote equity in the classroom by helping teachers identify the children who are interacting the least, with a primary focus on coaching to increase interactions with them.

## LENA Technology

The LENA technology is designed to measure the language children experience and give teachers actionable data about how often they interact with children during the day. A lightweight digital recorder fits into the child's clothing, capturing their language experience for up to 16 hours. The audio file is then uploaded and analyzed using advanced speech-processing algorithms. Each millisecond of the audio file is analyzed to identify when the key child (child wearing the recorder) or an adult in their environment is speaking. Immediately after processing, the audio file is deleted to protect participants' privacy; there is no way to listen to it. The automated processing

results are summarized into feedback reports that include three core metrics: Adult Word Counts, Child Vocalizations, and Conversational Turns.

**Adult Word Count.** Adult word count is the number of words spoken near the child (within 6-10 feet). Words are not recognized, but they are estimated based on acoustic information such as duration, syllable counts, and consonant distributions. LENA adult word counts are strongly correlated with human coding (Gilkerson et al., 2017).

**Child Vocalization Count.** Child vocalization count is the frequency with which the key child vocalizes. Vocalizations can be any sound generated from the child's vocal tract except fixed signals (cries, screams) and output related to respiration or digestion (breath, burps). Child vocalizations include words, babbling, or a sentence of any length, separated by at least 300 milliseconds of silence or other sounds.

**Conversational Turns.** Conversational turns are the number of back-and-forth interactions between the key child and an adult. Turns must contain at most one initiation and one response within 5 seconds. If a child says something and an adult responds within 5 seconds, that is one conversational turn. Similarly, if an adult vocalizes and a child responds within 5 seconds, that is one turn.

## Measures

### Teacher Perception Survey

The Teacher Perception Survey consists of 14 questions divided into three domains, including beliefs and actions that support equitable language development (6 items), job satisfaction (4 items), and self-efficacy (4 items). The beliefs and actions that support equitable language development domain included items on (a) the frequency of book reading, (b) talk during mealtimes, (c) family engagement around language development, (d) the importance of back and forth exchanges, and (e) how connected they feel towards different children. The job satisfaction domain included items on (a) how often teachers feel stressed during the day, (b) how often they tell their friends that they enjoy their job, (c) how comfortable they feel talking about challenges, and (d) how valued they feel as a professional. The self-efficacy domain included items on (a) how confident they are their children will do well, (b) how confident they are in interpreting graphs, (c) if they know more about child development than other teachers, and (d) if their expertise puts them on the cutting edge of the workforce. Each question was scored on a 1-5 scale. Items are summed to create the domain score, with higher scores indicating more positive responses. Several questions (stress during the workday; less connected to some children; correct children's behavior) were reverse-coded to match the direction of the other questions.

### Teaching Strategies Gold

Formative assessment is at the heart of Teaching Strategies Gold. This tool allows teachers to document learning regularly and determine where they fall in a developmental progression. Collecting evidence during regular activities, rather than through direct assessments, allows teachers to assess more authentically. The main goal is for teachers to understand children's progress through observation, plan instruction, and support the child in their learning. Cronbach's alpha is .97-.99, indicating high reliability. Teaching Strategies Gold scaled scores are domain-level (e.g., language, literacy) instead of item-level scores. The range is between 0-1000. Children's scaled scores are expected to increase with age. Unlike raw scores, which have a different number of items per objective, increases in scaled scores are similar across ages and objectives. Based on Teaching Strategies Gold's nationally representative sample, the average winter-to-spring change is roughly +30 points across age bands and objectives.

# Results

## RQ 1

To answer the first research question, did children in classrooms that participated in LENA Grow (n = 51) experience an increase in adult words and conversational turns, we

examined two of the LENA core metrics: adult word count and conversational turns. During the first two LENA days, children in LENA Grow classrooms experienced an average of 895 adult words per hour. During the last two LENA days, children experienced a 10% increase in adult words per hour; however, this was not a significant increase. For conversational turns, children in LENA Grow classrooms experienced 21.9 conversational turns per hour during the first two LENA days. By the end of the LENA Grow program, there was a significant increase in conversational turns by 13% (See Table 1). Conversational turns are the most predictive measure for language and cognitive outcomes (Gilkerson et al., 2018), as well as early childhood brain structure and function (Romeo et al., 2018).

It is important to note that an average of 21.9 conversational turns per hour is higher than the national average of 15 conversational turns per hour. We then examined changes in adult words and conversational turns for any child that started at or below the national average of 15 turns per hour (n = 12). These 12 children experienced an average of 755 adult words per hour for the first two LENA days. By the end of the LENA Grow program, the average adult words per hour increased by 27% to 959 words per hour. For conversational turns, these children experienced 11.2 conversational turns per hour for the first two LENA days. At the end of the program, conversational turns significantly increased by 80% to 20.1 per hour. Thus, children with lower language inputs and interactions at

the beginning of LENA Grow experienced a significant increase in the language they were engaged in.

## RQ 2

To answer the second research question, first we examined change in teachers' scores on each domain of the Teacher Perception Survey. After participation in LENA Grow, Grow teachers experienced increases in 11 of 14 items on the Teacher Perception Survey. Furthermore, Grow teachers experienced a significant positive change in the job satisfaction domain, whereas non-Grow teachers did not (See Table 2). Notably, the job satisfaction domain included the item on teacher stress. Given the small sample size and inherent variation in responses, it is notable that there are significant gains for the treatment group, at all.

Second, we examined whether or not Grow teachers made any significant gains in their beliefs, job satisfaction, or self-efficacy in comparison to non-Grow teachers by completing three linear regression models. For the first model examining gains in teacher beliefs, after controlling for a teacher's pre beliefs score, treatment status was not a significant predictor of a teacher's post-score ($r2$ = .42). When examining the second model for job satisfaction, after controlling for teachers' initial job satisfaction score, Grow teachers had significantly higher job satisfaction than non-Grow teachers (3.7 points more; $r2$ = .53). Finally, in the third model, after controlling for teachers' initial self-efficacy

**Table 1. Changes in Adult Words and Conversational Turns for Children Participating in LENA Grow (n = 51)**

|  | First 2 LENA Days | Last 2 LENA Days | Change | % |
|---|---|---|---|---|
| Adult Word Count | 895 | 987 | +92 | +10% |
| Conversational Turns | 21.9 | 24.7 | +2.7* | +13%* |

*significant change

score, treatment status was not a significant predictor of a teacher's post score (r2 = .50). Though the treatment variable was trending, it was not significant at the p < 0.05 level. See Table 3 for full results.

## RQ 3

To answer the third research question, did children in LENA Grow classrooms make significant gains in developmental domains (language and literacy) compared to children in non-Grow classrooms, we examined the change in children's language and literacy scaled scores. After removing one child outlier from the control that had very negative changes, children who participated in Grow experienced, on average, a significantly positive and greater increase in language scaled scores when compared to non-Grow children: +49 compared to +10 (t = 6.89, df = 39, p = .01).

The same was true with respect to literacy, with the Grow children gaining +39 (t = 7.50, df = 39, p = .01) and non-Grow children decreasing by -2. See Figure 1.

These positive movements for the treatment group are reinforced visually in the domain-level scatterplots. With respect to language, almost all of the Grow children, 90%, land on or above the solid no-change diagonal, meaning they either stayed the same or increased their score (Figure 2). Even better, 60% of Grow children are above the +30 dotted diagonal, meaning their changes were greater than the average domain-level increase in Teaching Strategies Gold's nationally representative sample. The control group looks markedly different, with more data points below the diagonals; only 23% experienced a change greater than +30. With respect to the literacy domain, the positive changes for

**Table 2. Mean Score Change for non-Grow and Grow Teachers**

|  | non-Grow Teachers (n = 11) | | | | | | | Grow Teachers (n = 9) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Pre | Post | Change | % | t | df | p | Pre | Post | Change | % | t | df | p |
| Beliefs | 20.82 | 21.36 | 0.54 | 3% | 0.67 | 10 | 0.52 | 22.67 | 22.89 | 0.22 | 1% | 0.33 | 8 | 0.75 |
| Job Satisfaction | 13.00 | 12.82 | -0.18 | -1% | -0.17 | 10 | 0.87 | 14.22 | 16.78 | 2.56 | 18% | 3.00 | 8 | 0.02 |
| Self-efficacy | 15.27 | 15.00 | -0.27 | -2% | -0.54 | 10 | 0.60 | 14.78 | 16.33 | 1.55 | 11% | 2.03 | 8 | 0.08 |

**Table 3. Predicting Change in Beliefs, Job Satisfaction, and Self-efficacy**

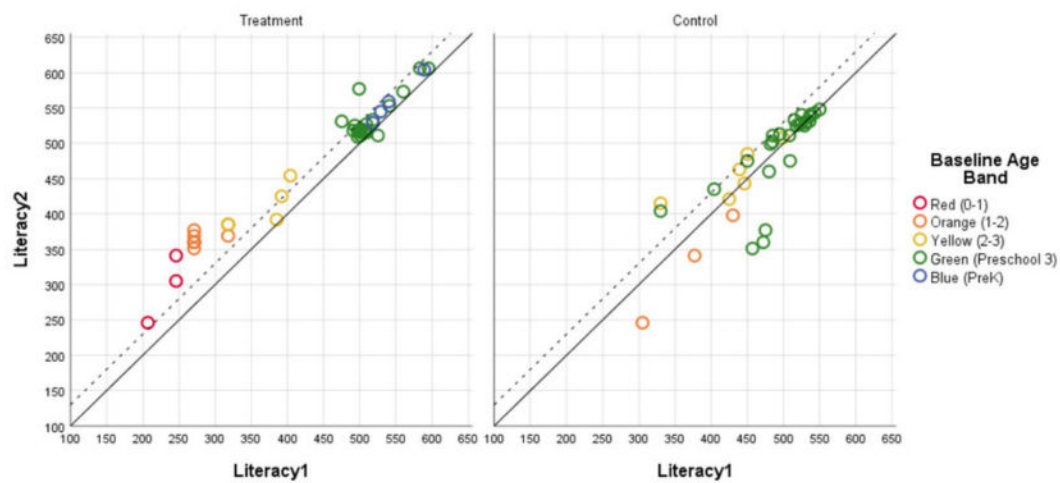|  | Teacher Beliefs | | | |
|---|---|---|---|---|
|  | Coefficient | SE | t | p |
| Constant | 6.19 | 4.79 | 1.29 | 0.21 |
| Pre Beliefs | 0.73 | 0.23 | 3.21 | 0.01 |
| Treatment | 0.18 | 1.16 | 0.15 | 0.88 |
|  | Job Satisfaction | | | |
| Constant | 9.60 | 2.29 | 4.20 | 0.01 |
| Pre Job Satisfaction | 0.25 | 0.17 | 1.47 | 0.16 |
| Treatment | 3.66 | 0.99 | 3.69 | 0.01 |
|  | Self-efficacy | | | |
| Constant | 10.06 | 3.27 | 3.08 | 0.01 |
| Pre Self-efficacy | 0.32 | 0.21 | 1.53 | 0.15 |
| Treatment | 1.49 | 0.73 | 2.05 | 0.06 |

**Figure 1.**
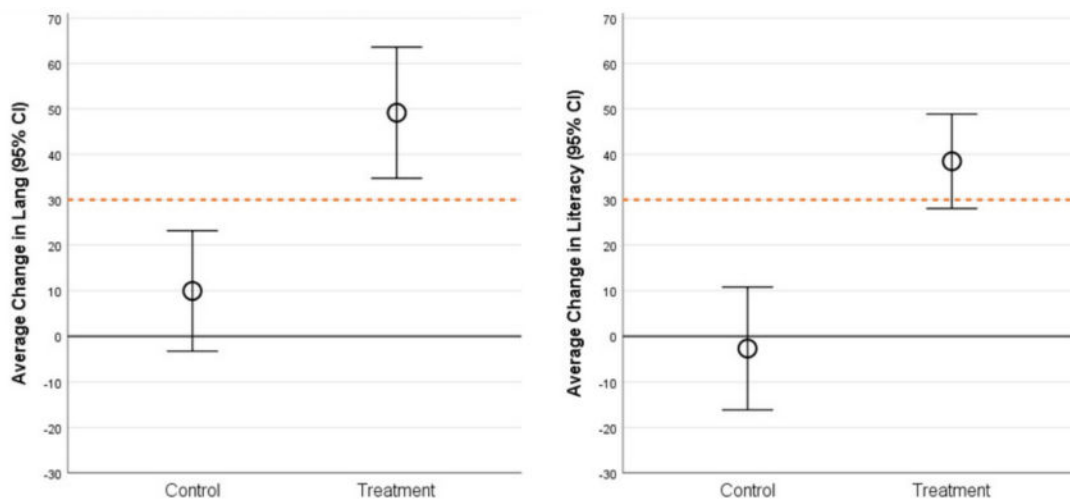


**Figure 2.**
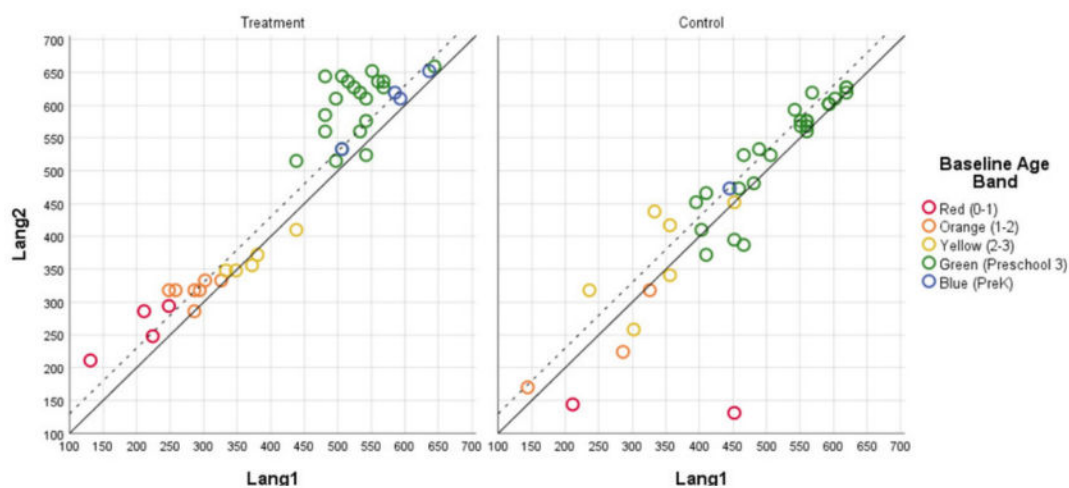


**Figure 3.**

Grow children were similar, with 45% of children experiencing increases of over +30 (Figure 3). Only 11% of non-Grow children had literacy gains over +30.

# Discussion and Conclusion

The current study aimed to evaluate the efficacy of LENA Grow. Results indicated that there were three main findings. First, Grow teachers increased their conversational turns after participating in the LENA Grow program that included individualized coaching. This finding is encouraging, given that conversational turns can be incredibly powerful in closing gaps in children's oral language skills (Zimmerman et al., 2009; Romeo et al., 2018). Moreover, this finding strengthens other research showing that individualized coaching can improve instructional practices and change teacher behavior (Yoshikawa et al., 2013). Second, Grow teachers increased their job satisfaction compared to non-Grow teachers. This finding is particularly compelling given that the job satisfaction domain included an item on teacher stress. Teacher stress has become an important area of focus in early childhood since the start of the COVID-19 pandemic. High rates of stress among early childhood educators may be related to high turnover rates. Even before the pandemic, early childhood teachers had one of the highest turnover rates in education: nearly one-third of early childhood teachers turn over annually

(Caven et al., 2021), which is approximately three times higher than K-3 teachers (Cramer & Cappella, 2019; Schaack et al., 2020). Third, children who participated in LENA Grow significantly increased their language and literacy skills compared to children in non-Grow classrooms. Children in Grow classrooms made significant gains above and beyond what would be expected based on national averages in language and literacy. This finding is particularly intriguing given oral language's role in academic achievement through fifth grade (Durham et al., 2007; Pace et al., 2019). Furthermore, several research studies have shown that children from low-income homes may not be experiencing a rich language environment at home and school (Hart & Risley, 2003; Pelatti et al., 2014). The findings from this study suggest that participation in LENA Grow in early childhood classrooms may help to close the gap in children's oral language skills.



*Children wearing the LENA device inside their blue vests.*

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