# LENA®

# LENA Grow and Early Literacy

#### What you'll learn in this paper:

- The importance of early literacy skills for long-term outcomes
- LENA as a solution for measuring children's language environments
- Research tying children's language environments to early literacy development
- The impacts LENA Grow<sup>®</sup>, a professional development program for early educators, has on children's literacy skills

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#### The state of reading proficiency

The U.S. faces a literacy crisis. According to the Nation's Report Card, only 32% of fourth graders were considered proficient in reading in 2022.1 Post-pandemic, reading achievement scores have dropped to their lowest levels since the 1990s, reversing decades of steady progress. This decline is alarming because around fourth grade, children make the transition from *learning to read to reading* to learn.<sup>2</sup> So, it's no surprise that proficiency during this period is a strong predictor of future academic and career success. Unfortunately, there are limits to the impacts of intervention in elementary school, as children who struggle with reading in elementary school are more likely to struggle with reading in middle school.<sup>3</sup> They're also four times more likely to drop out of high school<sup>4</sup> — leading to higher rates of unemployment and lower lifetime earnings.<sup>5</sup>

#### Early language and literacy

Although the reading crisis is often measured in elementary school proficiency rates, its roots go deeper. A child's journey to reading proficiency does not begin in fourth grade, or even in kindergarten. Instead, the foundations of literacy are laid in the early years, when children are first learning to communicate.

One widely accepted framework that captures this idea and explains the skills necessary for reading proficiency is Gough and Tunmer's "Simple View of Reading."6 In this theory, commonly referred to as "SVR," reading comprehension is the product of decoding and language comprehension. As the equation suggests, children need to have strong skills in both to become strong readers. Each input is comprised of different and various components.<sup>7</sup> Decoding components like phonological awareness and phonics allow children to efficiently recognize written words. Language comprehension components — like having a robust vocabulary, understanding syntax and grammar, and developing background knowledge — allow children to make sense of *what* they read. These skills begin to form in infancy and toddlerhood, through everyday interactions children have with their caregivers and early

educators. For instance, parents engage children in *conversations* at the grocery store, pointing out and naming foods, expanding vocabulary while modeling syntax and grammar. This happens even before children are speaking words or sentences. Later, in preschool, early educators may read a book aloud about how plants grow, gesturing to letters to develop alphabetic awareness all while supporting background knowledge.

It's difficult to overstate how important these foundational skills truly are. Research on the Matthew Effect in reading speaks to how the gap between those with and without strong foundational skills may widen over time.<sup>8</sup> Before kindergarten, differences may appear relatively small. However, children with these strong underpinnings can continue to build upon their existing foundation. Those without these skills may have a harder time expanding their vocabulary and finding joy in the process. Thus, there's an urgency to reinforce these skills early and often.

In addition to Gough and Tunmer's "SVR", there are other frameworks — such as the five pillars of reading<sup>9</sup> — that reinforce a similar idea: Early language skills, and how they are nourished, are fundamental in the journey towards reading proficiency.

#### Quantifying the early language environment

This principle that language and literacy skills are intertwined has long been accepted in academic and professional circles. However, the idea that the *amount of language* a child experiences having a profound impact years later is a relatively new concept. In the mid-1990s, researchers drew connections between the quantity of words a toddler heard and various developmental outcomes, such as vocabulary growth and IQ.<sup>10</sup>

This research — and its potential for expansion and widespread application — inspired Terry and Judi Paul to found LENA (Language ENvironment Analysis). LENA set out to develop technology that automatically quantified details of children's naturalistic language environments. How many adult words do children typically hear? How many vocalizations do they themselves make? How many adult-child interactions do they experience?

The formation of LENA's technology has provided researchers with the unprecedented ability to gather information on children's language environments guickly and efficiently. Children wear the LENA device in clothing designed for optimal audio capture. During a "LENA Day," the device identifies and counts vocalizations made by the key child and nearby adults. But it does not identify what is being said. By the late 2000s, researchers had validated LENA technology's accuracy in multiple languages. Instead of relying on time-consuming human transcription, LENA has equipped researchers with hundreds of thousands of hours' worth of language environment data, resulting in more than 250 scientific publications using LENA technology around the world. The insights gleaned from this data continue to shape our understanding of just how important language is in a child's first five years.

#### The power of conversational turns

One of the most impactful findings from the research that uses LENA technology has been the unique and predictive power of conversational turns. Conversational turns are verbal alternations between an adult and child. Sometimes referred to as "serve-and-return interactions," conversational turns in young children have been linked to brain structure<sup>11</sup> and function<sup>12</sup>, and social-emotional development.<sup>13</sup> They even predict later language outcomes and IQ scores longitudinally, over and above the influence of sheer word exposure.<sup>14</sup> It's not only about how much an adult talks to a child but how much they talk *with* a child. The research is clear: Conversational turns help build children's brains.

## How are conversational turns related to literacy skills?

But where do conversational turns fit in with respect to children's literacy development? How are these early back-and-forth interactions between children and adults related to reading skills?

With the help of LENA technology, researchers have set out to answer these very questions. A longitudinal study from the University of Washington tracked a group of children from infancy to kindergarten.<sup>15</sup> They found that there was a statistically significant



and positive correlation between the number of conversational turns a subset of these children experienced at 14 months and their letter sound knowledge at 5 years old. In other words, the more interactions a child had in early toddlerhood, the stronger their pre-literacy skills were four years later.

Like other studies that have underscored the power of conversational turns, these researchers also found a relationship between early turns and structural differences in the "language regions" of children's brains. Establishing this connection between conversational turns and brain development is no small feat. Child development experts have long theorized language environments would foster healthy brain development. Now there's quantitative evidence to support those beliefs.

## What about conversational turns in preschool classrooms?

While most language environment research has historically focused on the home environment with parental caregivers, what about children's interactions



in child care? Among children under the age of six, nearly 70% have all available parents in the workforce who can't provide care for the full week.<sup>16</sup> Close to half of three- and four-year-olds are enrolled in a formal preschool program.<sup>17</sup> And on average, these children spend 35-40 hours per week in these programs.<sup>18</sup> So it begs the question: Do conversational turns in early education classrooms also predict early literacy skills? According to a recent study from Purdue University that collected LENA data on 91 preschoolers, the answer is yes.<sup>19</sup> After accounting for differences in demographic characteristics, these researchers found that children who experienced more conversational turns with their preschool teachers had higher vocabulary scores. This research represents an important breakthrough in our understanding of how preschool language environments shape a child's journey towards literacy. While vocabulary skills are not synonymous with a child's ability to read, early vocabulary capabilities are strongly predictive of future literacy scores.<sup>20 21 22</sup> This finding suggests that the quality and quantity of interactions in child care settings, particularly through conversational turns, play a crucial role in building the foundational skills that lead to reading proficiency later on.

## How does LENA Grow support children's conversational turns in the classroom?

Scientists are not the only ones who are taking advantage of LENA's technology. In fact, LENA has designed several data-driven programs centered around its device. These programs help adults boost children's *brain-building* conversational turns.

LENA Grow is LENA's professional development program for early educators. Aimed at increasing interactions between teachers and children in their care, the program follows a five-week cycle of measurement, quantitative feedback, reflective coaching, and practice. During each "LENA Day," children wear an unobtrusive device that gathers information on their classroom language environment. This data is then automatically turned into easy-to-read feedback reports, which highlight children's language experiences at both individual and classroom levels. With these reports in hand, teachers work alongside coaches to develop strategies to increase conversational turns. After coaching sessions, teachers then put these strategies into action. They're able to measure their progress and hone their skills on subsequent "LENA Days."

To date, LENA Grow has been used with tens of thousands of children and educators.<sup>23</sup> As LENA Grow has been implemented across the country and in a variety of settings, its positive impact on conversational turns is consistent and undeniable.<sup>24</sup> Evaluations have shown that the impacts have been greatest for children who began the program with fewer interactions than their classroom peers. On average, these children experience a +40% increase over the course of the program. Moreover, children who began the program below the national median of "15 turns per hour" also experienced a sizeable boost. These children's interactions increased by +56%, on average.

#### **Does LENA Grow impact literacy skills?**

If LENA Grow has been effective at increasing children's conversational turns, has the program also moved the needle on children's early literacy development? Two recent evaluations provide compelling evidence. One study from SproutFive, a child care program in Dayton, Ohio, and one from Next Door, a child care network in Milwaukee, Wisconsin, both suggest that LENA Grow participation can accelerate early literacy development.

## How do these studies measure children's literacy skills?

Both studies use Teaching Strategies GOLD® (TS GOLD®) to chart children's early literacy abilities. TS GOLD<sup>®</sup> is a widely used assessment tool in the field of early education to support the learning and development of young children. During classroom activities and lessons, teachers collect observations on individual children.<sup>25</sup> Teachers then use these observations as datapoints to document, and ultimately score, children's progress in key developmental objectives. These objectives include social-emotional, language, cognitive, and literacy development, among others. Within each objective, there are various dimensions with corresponding age-appropriate benchmarks. Teachers submit their observations during seasonal checkpoints typically, fall, winter, and spring. This means that children receive developmental scores at three timepoints throughout the school year.

These two evaluations from SproutFive and Next Door, which analyze LENA Grow's impact on children's literacy development, leverage TS GOLD®'s seasonal cadence. They compare children's TS GOLD® literacy scores from the seasonal checkpoint *before* participating in LENA Grow to their scores from the checkpoint after participating in LENA Grow. Both studies also benefit from having a non-Grow comparison group. This allows for a more nuanced analysis of the program's effects on literacy development, by comparing the scores of LENA Grow children with those of their non-participating peers.



## Results from SproutFive: A randomized control evaluation

The formal evaluation from SproutFive is uniquely valuable because it was a randomized control study, which minimizes selection bias.<sup>26</sup> Not only did this study design permit researchers to compare impacts for "treatment" and "control" participants, but it also ensured that the teachers and children who completed LENA Grow were not selected due to underlying characteristics (e.g., classrooms where teachers were viewed as more likely to succeed with the LENA Grow program).

SproutFive had eight classrooms, 20 teachers, and 106 children participate. At the start of the study, the eight classrooms, and the teachers and children in them, were randomly sorted into "treatment" or "control" groups. Four rooms (two from each age group – infant/toddler and preschool/pre-K) were randomly selected to participate in LENA Grow, while the other four were selected to participate in the program after the evaluation. There were some minor differences in child and teacher demographic characteristics between the two groups, but by and large, the samples were balanced. More details on participant demographics may be found in SproutFive's white paper on this study.

Out of the 106 children initially involved, 40 LENA Grow and 37 non-LENA Grow children had valid TS GOLD® Literacy scores in both the pre and post periods and could be used to ascertain differences in literacy development trajectories. On average, between the pre and post periods, the control sample declined marginally by -3 points. By contrast, the LENA Grow sample increased significantly by +38 points. This difference of 41 points between the two groups' changes was statistically significant, which indicates that LENA Grow children experienced greater gains in literacy development than their non-LENA Grow peers.

This data from SproutFive speaks to the program's impacts beyond conversational turns. LENA Grow also has a powerful effect on children's early literacy development. Even when comparing children at the same center, those who were randomly selected to participate in LENA Grow experienced bigger strides in early literacy skills.



Pre Period Post Post

**Statistical Note:** mean LENA Grow change = 38 (t(39)=7.498, p < 0.001); mean Non-LENA Grow change = -3 (t(36)= -0.404, p = 0.690); mean change comparison = 41 (t(75)=4.938, p < 0.001). Cohen's d effect size = 1.12.

## What are the results from Next Door — another formal evaluation?

A second evaluation at Next Door Childcare Partnership Program (CCP) in Milwaukee offers further support for LENA Grow's positive effects on early literacy.

This evaluation was similar to that at SproutFive. During the evaluation period, a group of classrooms participated in LENA Grow while another set of rooms did not. This design allowed researchers to compare the outcomes of children who went through the program to those who did not.<sup>27</sup> Unlike SproutFive's evaluation, which took place at one site, Next Door CCP's evaluation was spread across six different centers. Ten rooms at three centers were selected to participate in LENA Grow while ten rooms at three different centers functioned as non-LENA Grow controls. There were 156 children (79 LENA Grow and 77 controls) and 36 early educators (18 LENA Grow and 18 controls) who participated. Even though the classrooms were spread across multiple sites, the 20 rooms served similar populations. All classrooms were receiving Early Head Start or Head Start funding, with the children's families meeting the low-income or public assistance eligibility requirements.<sup>28</sup> While there were some differences between the child and teacher demographic characteristics across the two groups, the samples were largely balanced. For full demographic breakdown, please consult Heilmann and Moyle's white paper summarizing the study.

Nearly 90% of participating children — 70 in the treatment group and 64 in the control group — had valid pre and post TS GOLD<sup>®</sup> Literacy scores.

Between the two checkpoints, the non-LENA Grow children increased by +10, on average. The seasonal gain for LENA Grow participants was substantially larger. The children in classrooms whose teachers did receive LENA Grow coaching increased by a whopping +46 points – 36 points more than their peers. This difference in gains was statistically significant, which mirrors the finding in the SproutFive data – LENA Grow has the power to accelerate children's early literacy development.

Despite these statistically significant results, there are a few caveats with the Next Door CCP sample worth noting. First, the classrooms were not randomly sorted into "treatment" or "control" groups. Second, with respect to pre period TS GOLD® Literacy scores, the LENA Grow sample began nearly 80 points lower than controls. This initial imbalance could have been due, in part, to the LENA Grow sample being slightly younger: 34% of treatment children where in the infant-toddler (0-1 and 1-2) age bands compared to only 27% of control children. However, it did not appear that younger LENA Grow children gained more than older participants. There were instances of strong growth among LENA participants across the age groups.



**Statistical Note:** mean LENA Grow change = 46 (t(69)=3.893, p < 0.001); mean Non-LENA Grow change = 10 (t(63)=-2.052, p = 0.044); mean change comparison = 36 (t(132)=2.719, p = 0.007). Cohen's d effect size = 0.48.

### Conclusion

The nationwide challenges surrounding low reading achievement are complex and multifaceted. Supporting young learners in their journey towards literacy requires reinforcement throughout their development, from their first months as infants to their first months as kindergarteners and beyond.

Given the research connecting early language environments to pre-literacy skills, making sure young children receive plentiful quality interactions in the form of conversational turns is undoubtedly a crucial component. It is particularly critical in child care settings, where young children spend a substantial amount of time, and conversational turn disparities may exist.

LENA Grow presents a promising solution. Not only does this professional development program increase interactions for children in the classroom, but it also shows promise in supporting children during their first chapters towards reading proficiency. Similar conclusions from two separate evaluations in two different settings provide strong evidence of LENA Grow's impact on children's early literacy skills.





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