

Right from Birth

Eliminating the Talk Gap in Young Children

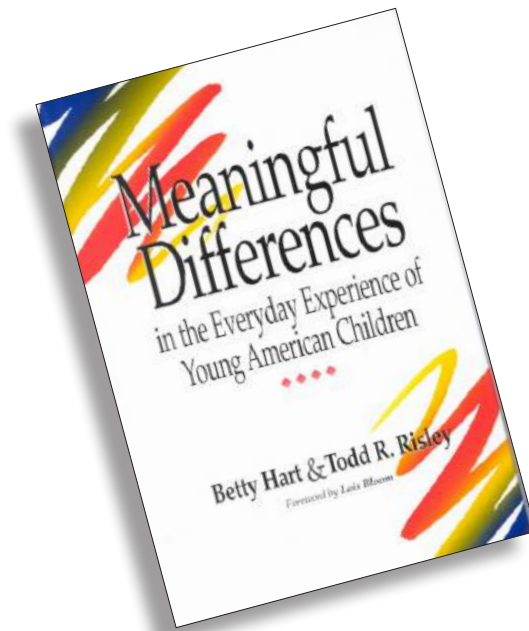
Steven F. Warren, PhD
May 2015

LENA™

Building brains through early talk

Introduction

The purpose of this paper is twofold. First, I describe the challenge presented by the huge “word gap” discovered by Hart and Risley (1995). These researchers first identified an experiential gap that develops over the early childhood period, leaving many children already far behind their age peers when they enter kindergarten. Then, I summarize a small set of strategies that research has shown can enhance young children’s language development if used frequently. These strategies can be employed by parents and other caregivers to close the word gap. They are at the heart of the LENA Start intervention model. If well implemented, this intervention has the potential to eliminate the 30-million-word gap before it ever begins.



The Challenge

Acquiring language is one of the chief accomplishments of early childhood. It is far more than just another important achievement. Language is a means to communicate, a method to encode and store knowledge, and a superb tool for planning and problem solving. It would be difficult to overstate its role in both social and cognitive development.

Most children acquire language without obvious difficulty. Historically, this was sufficient for children to both survive and thrive in agrarian and early industrial societies. But the world we live in today places an increasingly steep premium on the early acquisition of high-level language skills and large, complex vocabularies that are well beyond

Children who start behind in this race to success tend to stay behind.

basic literacy (Neisser, 1998; Flynn, 2012). Today, as early as 30 months of age, the velocity and trajectory at which a child acquires new words can predict their literacy skills and school success from elementary school onward (Rowe, Raudenbush & Goldin-Meadow, 2012). Distressingly, children who start behind in this race to success tend

to stay behind relative to children who are ahead of them at the same age (Walker, Greenwood, Hart & Carta 1994; Stanovich, 1986). The ever-increasing demands of complex, post-industrial societies further increase the potential for lifelong ripple effects associated with a relatively small vocabulary.

The influence of a child's environment on language learning trajectory begins with parent-infant interaction and builds cumulatively hour by hour, day by day across early childhood (Hart & Risley, 1995). Studies

A child's early experience is the key driver for language and cognitive development.

of infant brain development are well along in revealing how a child's early experience serves as the key driver for language and cognitive development (e.g., Kuhl, 2004). What may be most astonishing is the speed at which an infant can learn and absorb meaningful information. During a child's first three years, development takes place at a rate

that far exceeds the rate during any other period of life (National Research Council and Institute of Medicine, 2000).

This relentless process impacts language, cognitive, social, and emotional development and steadily generates relative advantages for many children and growing disadvantages for many others. Even though most parents and caregivers are trying to be "good parents," almost imperceptibly the daily discrepancies in the speed and trajectory at which

different children are acquiring language render significant cumulative differences in vocabulary size within a few short years. The effects of developing differences in vocabulary size and oral language skills cascade forward and by kindergarten predict later literacy skills and school success (Dickinson & Tabors, 2001; Snow, Burns, & Griffin, 1998).

Within the same first grade classroom, children with vocabularies of fewer than 2,000 words may be learning alongside children with vocabularies of 10,000 words (Dickinson, Golinkoff & Hirsh-Pasek, 2010). The cognitive process of learning to read is easier for children with larger vocabularies because they don't have to simultaneously acquire the meaning of new words while learning to match the written form of a word to its phonetic sound pattern (Ouellette, 2006). This is a distinct cognitive advantage that further increases the gap between children entering school with relatively large vocabularies and those entering with much smaller vocabularies.

At a societal level, none of this is news. Science continues to uncover how and why it happens, but the general outline of the problem has been apparent since the 1960s (Zigler & Valentine, 1979). Billions of dollars have been spent in well-intentioned efforts to close the gap through

Too often our efforts are too little, too late, and too diffuse.

early childhood programs. Whether those funds have been well spent has sparked fierce and continuing debates (e.g., Zigler & Styfco, 2004). But the real problem may be that too often our efforts are too little (the interventions are not sufficiently intense), too late (they start at age three or older), and too diffuse (they try to address too many things to be well implemented).

Consequently, for too many children, the gap that starts to grow in infancy is never closed. Once developmental trajectories are established, they become difficult to change without extraordinary efforts (Rowe, Raudenbush, Goldin-Meadow, 2012). Similarly, the kinds of parenting behaviors that hinder or stimulate language development show considerable stability (Dallaire & Weinraub, 2005; Hart & Risley, 1999). In short, our best opportunity to establish robust child language learning trajectories and supportive parent behaviors is during the first two to three years of the child's life.

The Solution

There are many reasons why parents and other caregivers (grandparents, older siblings, other relatives, close family friends, babysitters, etc.) may struggle to create an environment for their child that optimally supports early language development. Nevertheless, these parents and caregivers must be at the heart of any effective solution to this issue. The key is to provide them with a program highly focused on a small set of the most important “active ingredients” that will benefit their child. The complexity found in training programs that try to do too much, influence too many different areas of development, and involve too many professionals, can easily be the enemy of focus (Dickinson, 2011) as well as a primary driver of cost. And irrespective of whatever specific approach is used, measurement, feedback, and progress monitoring are essential for any effort to be successful.

One advantage of intervening right from birth is that this is often a time when new routines are being established in the home because of the infant’s arrival. If routines are established in ways that support extended periods of parent-child interaction daily, their “routineness” can provide the context for the infant to learn and use new behaviors. These routines

These routines become the family infrastructure that supports early language development.

can also enhance attachment, and can be pleasurable, fun, highly reinforcing times for parent-child interaction. In short, the new caregiving routines can provide exactly the type of environment into which simple, yet powerful parenting behaviors can be established. These routines then become the family infrastructure that supports early language development.

By contrast, if such routines are not established early, they may never be. Hart & Risley’s research, corroborated by more recent studies, indicates that the amount of parent talk in a child’s second year essentially mirrors the amount measured in the first 7-9 months. The idea that parents will increase talk when the baby starts talking is generally a fallacy.

Fortunately, there is a small number of powerful scientifically supported strategies that parents and other caregivers may use during the first few years of a child’s life to enhance communication and language development in ways that position children for future success. These strategies were not so much invented as discovered and refined by behavioral scientists who observed versions of them in use by parents of young children (e.g., Bruner, 1975; Landry et al 1997; Nelson, 1989),

and continue to be tested and improved on by researchers seeking ways to enhance communication and language development in children from a wide range of backgrounds. These techniques, and other behaviors that support them, can be easily observed in use by parents and caregivers who frequently interact with young children in a manner that is “highly responsive to the child’s interests.”

They can be observed in use by caregivers who frequently interact with young children in a manner “highly responsive to the child’s interest.”

This general parenting style is associated with accelerated language and cognitive growth in children throughout the world. The importance of this cannot be underestimated (Warren & Walker, 2005; Landry, Smith, & Swank, 2006; Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008). Parental responsiveness is generally defined as “a healthy, growth-producing relationship consisting of such caregiver characteristics as warmth, nurturance, stability, predictability, and contingent responsiveness to child initiations” (Spiker, Boyce, & Boyce, 2002). This parenting style reaches its full potential in terms of enhancing child language development when combined with the specific strategies described below.

While a highly responsive parenting style can be learned by virtually anyone, only occasional use of this general style and accompanying strategies is insufficient to accelerate language and cognitive development. Rather, the impact of a style on development largely depends on how frequently caregivers employ it on a daily basis across the first several years of a child’s life starting soon after birth. Indeed, the frequent daily use of this approach, to the extent that it becomes habitual, is the key to accelerating the early language acquisition process.

The balance of this paper will first outline two strategies central to “responsive” parent-child conversations, then describe two venues in which most parents can readily learn to employ those strategies.

Parent Strategies – “Active Ingredients” for Making a Difference

Two strategies are supported by research that began in the 1970s. A bibliography at the end of this review includes a list of sources that provide detailed evidence of their effectiveness. These strategies are:

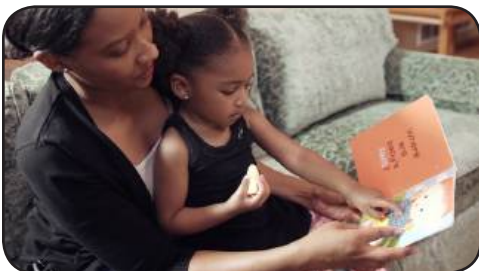
- Following the child’s lead and creating joint attention
- Recasting child vocalizations to enhance vocabulary and language complexity

While these strategies can be used independently, they are easily and often combined by highly responsive caregivers in the contexts of daily interaction with the child.

- Following the child’s lead and creating joint attention can increase child initiations and turn-taking. This strategy may be most useful with infants and toddlers who are in the early stages of communication development.
- Recasting is especially powerful as children begin using words to communicate and can also be used effectively with children who speak in complex 5 and 6 word sentences. This technique can also be employed to teach many different aspects of language.

Strategy 1: Following the Child’s Lead and Creating Joint Attention

To create joint attention, a caregiver simply follows and responds to the child’s attentional lead. Early on, infants indicate their interests through their gaze (what they are looking at), through touching and manipulating objects, through gestures (e.g., pointing, reaching), and through



babbling. Responsive, attentive caregivers should respond to these behaviors by promptly and explicitly showing an interest in them. Parents can indicate their interest to the child through their words and actions including facial expressions, gestures, and words and sentences. The responses should not be random, but rather should be contingent on the child’s action. The interaction should be relaxed, playful, and positive. The more frequently

these interactions occur on a daily basis the better. They can be easily incorporated during feeding, while holding and carrying the child, while playing with objects, and while looking at pictures in a book.

Research has demonstrated that making the adult behavior contingent on the child's behavior is a critical component of creating joint attention (Tamis-LeMonda, Kuchirko, & Song, 2014). For example, in an experiment

by Goldstein and Schwade (2008), infants receiving contingent input from their mothers changed the sound of their babbling to match the mother's input while children in a non-contingent condition did not. In other words, the contingent response by the parent to the child's behavior creates the communication between the parent and child.

Making adult behavior contingent on the child's behavior is a critical component of creating joint attention.

It teaches the child that their behavior can, in a sense, control and modify the caregiver's behavior, essentially creating a simple conversation.

As the child moves into their second year of life and begins speaking, the caregiver responsiveness that began with the parent simply following the child's lead and creating joint attention continues to enhance children's vocabulary growth, the diversity of their communication forms, and the age at which they meet various language learning milestones (Tamis-LeMonda, Bornstein, & Baumwell, 2001). Research indicates similar effects can occur irrespective of who the responsive caregiver is (e.g., mother, father, etc.), though research also indicates that mothers more readily respond to their infant's vocal cues than fathers in the first months of life (Caskey, Rand, Tucker & Vohr, 2014). Regardless, any caregiver and the child may benefit from training soon after the child's birth.

The key is for those who feed, hold, or interact with the infant to follow the child's attentional lead, create joint attention, and engage in responsive interactions with the infant frequently day in and day out. When caregivers frequently follow the child's lead and create joint attention with their child, this typically increases the number of child initiations and turn-taking bouts (Dunham & Dunham, 1992; Landry, Smith, Swank & Guttentag, 2008). These are important developments

because they indicate the child is readily becoming a full conversational partner even if they are just at the very beginning of learning words.

The key is to engage in responsive interactions with an infant frequently, because the child becomes a conversational partner even at the very beginning of learning words.

Sometimes, however, parents need a boost getting started with, or perfecting this method. For example, occasionally a caregiver talks too much or is impatient with the child and does not provide the child sufficient time to initiate and respond about their interests. A well-established technique to remedy these situations is called "time delay" (Charlop-Christy & Carpenter, 2000; Alpert & Kaiser, 1992). This simply means that the caregiver "waits for the child to initiate." If the parent is close to the child and making eye-contact,

child initiations often occur and should be contingently responded to by the caregiver. The child's initiation may be in the form of pointing at some interesting object, or even just turning and looking at the caregiver who is sitting there expectantly.

The contingent response by the caregiver helps the child "make the connection" between their behavior and the adult's response. A variation of this technique is for the caregiver to imitate what the child is doing. This simple technique will typically get the child's attention. It is, in a sense, the most primitive form of a "conversation" in that it can follow a "my turn, your turn, my turn" structure in which the adult simply follows the child's lead by their imitation of the child's behavior.

The overall goal of following the child's lead and creating joint attention is to increase child initiations and length of turn-taking episodes between the caregiver and child. Turn-taking and joint attention are the basic infrastructure of conversations. Caregivers can build on this basic foundation by adding all sorts of rich and varied language about whatever has captured the child's attention. This approach gives the child some control of the "topic of conversation" and immediately makes them a successful communicator.

Strategy 2: Recasting Child Vocalizations

A conversational recast is a response to a child's utterance in which an adult repeats some or all of the child's words and adds new information (e.g., describing the color of the ball that the child initiated about), while maintaining the basic meaning expressed by the child. Recasts



enhance child language development because they provide feedback to the child that highlights linguistic elements (e.g., words, verb tenses) that the child has not yet acquired (Nelson, 1977). Since the recast immediately follows the child's utterance, the child may be more likely to notice the differences between their utterance and the adult's, which aids the learning process (Cleave et al, in press). For example, a young child might say "Baby need milk" in reference to a doll. The parent might respond "Does

she need more milk?" The differences between the adult's statement and the child's original statement help the child learn the meaning and appropriate applications of specific syntactic, semantic, and/or phonological changes in words and sentence structure.

Parents can employ recasts in a flexible manner embedded in an ongoing conversation.

Caregivers can easily and automatically employ recasts simply by responding to the child's original utterance in a naturally conversational manner. Parents can use recasts once the child begins to talk by simply expanding on the child's single word utterances. For example, if the child points at a blue ball and says "ball," as a request for the ball, the caregiver could respond by looking at the child and in a questioning tone say "do you want the blue ball?" As the child's language skills advance in complexity, caregivers can use recasting to help support and accelerate the child's acquisition of more complex ways to modify their speech to accomplish specific tasks (Baker & Nelson, 1984). Most importantly, parents can employ recasts frequently and in a flexible manner that is almost reflexively embedded in an ongoing conversation. Ideally this becomes second nature for the parent.

Recasts can also be corrective: fixing a mistake in the child's utterance, or adding an optional modifier to the child's statement (e.g., child points at the ball and says: "blue ball"; adult says, "yes, the big blue ball"). Recasts can be narrowly or broadly focused. In any of these cases, the caregiver's recast shouldn't disrupt the flow of conversation but should simply be embedded into the stream of back and forth conversational turn-taking or shared book reading with the child (Clark, 2007).

There is a steadily growing research base supporting the effectiveness of recasts, especially for enhancing the grammatical complexity of child language. The strongest evidence comes from studies that have experimentally tested interventions that used adult recasts of child speech to enhance young children's language development (Cleave et al in press). This research also indicates that parents and other adults can be effectively taught to use recasts with young children. Finally, research focused on the typical language acquisition process has repeatedly shown strong relationships between parental recasting and child language development (e.g., Nelson, Welsh, Trup, & Greenburg 2011).

Venues: Shared Book Reading and Conversations

Reading

Reading together with a young child in a way that promotes interaction and turn-taking is among the most important routines that can be built into a child's day. It should be a high priority every day.

Reading, in its simplest form, can and should start in the first few months of infancy. At this early point in the child's development, "reading"

Sharing books serves as a supportive context for conversations.

generally means sharing a simple picture book together and "following the child's lead and creating joint attention" about the pictures. Looking together at picture books serves as a supportive context for conversations. Using a variety of books naturally supports new vocabulary and varied conversations. The child may sit in the caregiver's lap and touch or point at a simple picture, to which the mother might provide a label ("yeah....that's a doggy").

As the child develops, simple stories supported by the book become appropriate. These "stories" can gradually become more complicated to match the child's growing interest and communicative competence (Karrass & Braungart-Rieker, 2005). Children often like to "read" the same book or small set of books repeatedly. Their request to do this should be honored as this "routine" allows for the caregiver to include small novel variations to be noticed by the child. Indeed, the power of routines is that they allow "novelty" to naturally capture the child's attention, which creates an ideal context for learning new words (Aktar, Carpenter & Tomasello, 1996).

Periods of shared book-reading (sometimes called "dialogic reading" to emphasize the conversational nature of the activity) may gradually extend for longer periods of time – the longer the better assuming the child's attention remains high and the adult follows their attentional

It's important that the parent not just read the book to the child, but read it with the child.

lead and cues. The predictable nature of the book reading routine allows children to focus over time on novel aspects of a story. As a result, a single book can be a new source of vocabulary growth despite many repetitions. For this to happen, it's important that the parent not just read the book to the child, but read it with the child, following their lead and at their pace. Ultimately a relatively constant daily diet of shared book reading should lead to longer, more complex stories and increasingly rich and varied conversations.

As a result of its fundamental importance in advancing language and cognitive development, book reading has been the subject of a substantial amount of research (e.g., Bus, van IJzendoorn & Pellegrini, 1995; Mol, Bus, de Jong, & Smeets, 2008; Huebner & Meltzoff, 2005). Much of this research has been conducted with children ages 5 years and older. Unfortunately, some of this research has also shown how difficult it is to reverse gaps in vocabulary development that children sometimes bring with them as they enter elementary school (Scarborough, 2009). These gaps often appear to reflect sub-optimal early language learning environments (Fletcher, Cross, Tanney, Schneider & Finch, 2008). One of the characteristics of such sub-optimal environments is relatively little time spent in joint book reading combined with relatively large amounts of time passively watching television (Christakis, Gilkerson, Richards, Zimmerman, Garrison, Xu, & Yapanel, 2009). While children may learn new language in these sub-optimal environments, the rate of learning is typically substantially slower for these children than for children who cumulatively experience more interactive reading and rich conversations on a daily basis.

Programs like Sesame Street can have some positive effects on vocabulary between ages 3 and 5 (Rice et al 1990), but they can't make up the language gap. Too much television and too little reading and conversation conspire to create the "relative delays" we addressed above. Children who are cognitively capable but who are overexposed to television and underexposed to reading and conversation start out in elementary school well behind other similarly cognitively capable children and they never catch up (Payne, Whitehurst, & Angell, 1994).

Too much television and too little reading and conversation conspire to create "relative delays."

Overcoming experiential deficits in early elementary school compared to children who entered with a vocabulary advantage is not impossible, but it is very difficult to achieve. Thus the extraordinary importance in building shared book-reading and increasingly rich and varied conversations into the daily routine of children from infancy onward.

Amount and Richness of Conversation

The two strategies described above should be embedded in parent-child interaction throughout the day beginning in early infancy. Joint book reading, as mentioned, can introduce a kind of conversational scaffold. Other types of conversations can be incidental to daily activities, and provided by a range of significant people in the child's life including

parents, family, friends, siblings, other relatives, child care providers, and more. These interactions may be any length of time. They can take the form of a simple turn-taking game (e.g., peek-a-boo), a single short joint reading episode, or whatever interests the child for whatever period of time.

The overall amount, variety, and richness of language experienced cumulatively, day in and day out, over months and years is what

Overall amount, variety, and richness of language ultimately creates the complex language skills characteristic of high achievers.

ultimately creates the large expressive and receptive vocabulary and complex language skills characteristic of high achievers in early elementary school and beyond. This is also where the language gap resides. The ultimate goal in remediating this disparity is to provide an opportunity for the child to become fully capable of independently creating their own rich language learning environment through their own conversational skills, to develop confidence in asking questions about things that interest them, and ideally to develop an unquenchable love for reading.

The LENA Start™ Intervention Model

The LENA Start intervention model incorporates into its parenting curriculum the research based strategies, or “active ingredients,” described above. By teaching these strategies to parents through a set of simple techniques LENA calls “The 14 Talking Tips,” and by using the LENA System “talk pedometer” to record the child’s language throughout the day, it is possible to create an optimal, data-driven environment to enhance the language development of children beginning in infancy. It is critical to measure the environment across the child’s development and provide data-driven feedback to caregivers because these strategies will be effective only if they are used frequently and routinely day in and day out.

If well implemented, the LENA Start intervention has the potential to eliminate the infamous “30-million-word gap” in cumulative language experience discovered by Hart and Risley (1995) before it ever begins. This approach has the potential to eliminate costly and often ineffective interventions and “special programs” later in childhood and start children off with a real chance to meet the challenges of the twenty-first century. To apply Hart and Risley’s memorable phrase, accomplishing this would make a real “meaningful difference.”

Appendix: 14 Talking Tips to increase words & turns

...when talking, reading, or singing with your child

Below is a list of “tips” compiled by LENA as part of the LENA Start model, derived from research and from practices in many parenting programs. As indicated by the check marks, most align with the two strategies and two daily venues outlined in this paper.

	TEACHING STRATEGIES		VENUES	
	Following the child’s lead	Recasting	Conversation	Reading
1. Talk about what you’re doing and thinking.			✓	
2. Comment on what they’re doing or looking at.	✓	✓	✓	✓
3. Name things that they’re interested in.	✓		✓	✓
4. Get down to their level: face to face.	✓	✓	✓	
5. Touch, hug, hold.	✓			✓
6. Tune in and respond to what they look at, do, and say.	✓	✓	✓	✓
7. Wait for their response.	✓	✓	✓	✓
8. Imitate them, and add words.	✓	✓	✓	
9. Make faces, use gestures.	✓		✓	✓
10. Take turns – don’t do all the talking.	✓	✓	✓	✓
11. Repeat and add to what they say and do.	✓	✓	✓	✓
12. Follow their lead, do what interests them.	✓	✓	✓	✓
13. Encourage them, be positive.	✓	✓	✓	✓
14. Be silly! Relax and have fun!	✓		✓	✓

References

- Akhtar, N., Carpenter, M., & Tomasello, M. (1996). The role of discourse novelty in early word learning. *Child Development* 67(2), 635-645.
- Alpert, C. L., & Kaiser, A. P. (1992). Training parents as milieu language teachers. *Journal of Early Intervention*, 16(1), 31-52. doi: 10.1177/105381519201600104
- Baker, N. D., & Nelson, K. E. (1984). Recasting and related conversational techniques for triggering syntactic advances by young children. *First Language*, 5(3), 3-21. doi: 10.1177/014272378400501301
- Bornstein, M. H., Tamis-LeMonda, C. S., Hahn, C. S., & Haynes, O. M. (2008). Maternal responsiveness to young children at three ages: Longitudinal analysis of a multidimensional, modular, and specific parenting construct. *Developmental Psychology*, 44(3), 867-874. doi: 10.1037/0012-1649.44.3.867
- Bruner, J. S. (1975). The ontogenesis of speech acts. *Journal of Child Language*, 2(01), 1-19.
- Bus, A. G., van IJzendoorn, M. H., & Pellegrini, A. D. (1995). Joint book reading makes for success in learning to read: A meta-analysis on intergenerational transmission of literacy. *Review of Educational Research*, 65(1), 1-21. doi: 10.3102/00346543065001001
- Caskey, M., Stephens, B., Tucker, R., & Vohr, B. (2014). Adult talk in the NICU with preterm infants and developmental outcomes. *Pediatrics*, 133(3), 1-7. doi:10.1542/peds2013-0104
- Charlop-Christy, M. H., & Carpenter, M. H. (2000). Modified incidental teaching sessions: A procedure for parents to increase spontaneous speech in their children with autism. *Journal of Positive Behavior Interventions*, 2(2), 98-112. doi: 10.1177/109830070000200203
- Christakis, D. A., Gilkerson, J., Richards, J. A., Zimmerman, F. J., Garrison, M. M., Xu, D. & Yipanel, U. (2009). Audible television and decreased adult words, infant vocalizations, and conversational turns: A population-based study. *Archives of Pediatrics & Adolescent Medicine*, 163(6), 554-558.

- Clark, E. V. (2007). Young children's uptake of new words in conversation. *Language in Society*, 36(2), 157-182.
- Cleave, P. L., Becker, S. D., Curran, M. K., Van Horne, A. J. O., & Fey, M. E. (2015). The efficacy of recasts in language intervention: A systematic review and meta-analysis. *American Journal of Speech-Language Pathology*, 1-19. Advance online publication. doi: 10.1044/2015_AJSLP-14-0105
- Dallaire, D. H., & Weinraub, M. (2005). The stability of parenting behaviors over the first 6 years of life. *Early Childhood Research Quarterly*, 20(2), 201-219.
- Dickinson, D. K., Golinkoff, R. M., & Hirsh-Pasek, K. (2010). Speaking out for language: Why language is central to reading development. *Educational Researcher*, 39(4), 305-310.
- Dickinson, D. K., & Tabors, P. O. (2001). *Beginning literacy with language: Young children learning at home and school*. Paul H Brookes Publishing.
- Dunham, P. J., & Dunham, F. (1992). Lexical development during middle infancy: A mutually driven infant-caregiver process. *Developmental Psychology*, 28(3), 414-420. doi: 10.1037/0012-1649.28.3.414
- Fletcher, K. L., Cross, J. R., Tanney, A. L., Schneider, M., & Finch, W. H. (2008). Predicting language development in children at risk: The effects of quality and frequency of caregiver reading. *Early Education & Development*, 19(1), 89-111.
- Flynn, J. R. (2012). *Are we getting smarter? Rising IQ in the twenty first century*. Cambridge University Press.
- Goldstein, M. H., & Schwade, J. A. (2008). Social feedback to infants' babbling facilitates rapid phonological learning. *Psychological Science*, 19(5), 515-523. doi: 10.1111/j.1467-9280.2008.02117
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore, MD: Paul H. Brookes Publishing Co.
- Hart, B., & Risley, T. R. (1999). *The social world of children learning to talk*. Baltimore, MD: Paul H. Brookes Publishing Co.

- Huebner, C. E., & Meltzoff, A. N. (2005). Intervention to change parent-child reading style: A comparison of instructional methods. *Applied Developmental Psychology, 26*(3), 296-313.
- Karrass, J., & Braungart-Rieker, J. M. (2005). Effects of shared parent-infant book reading on early language acquisition. *Applied Developmental Psychology, 26*(2), 133-148.
- Kuhl, P. K. (2004). Early language acquisition: Cracking the speech code. *Nature Reviews: Neuroscience 5*(11), 831-843.
- Landry, S. H., Smith, K. E., Miller-Loncar, C. L., & Swank, P. R. (1998). The relation of change in maternal interactive styles to the developing social competence of full-term and preterm children. *Child Development, 69*(1), 105-123. doi: 10.1111/j.1467-8624.1998.tb06137.x
- Landry, S. H., Smith, K. E., & Swank, P. R. (2006). Responsive parenting: Establishing early foundations for social, communication, and independent problem-solving skills. *Developmental Psychology, 42*(4), 627-642. doi: 10.1037/0012-1649.42.4.627
- Landry, S. H., Smith, K. E., Swank, P. R., & Guttentag, C. (2008). A responsive parenting intervention: The optimal timing across early childhood for impacting maternal behaviors and child outcomes. *Developmental Psychology, 44*(5), 1335-1353. doi: 10.1037/a0013030
- Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. (2008). Added value of dialogic parent-child book readings: A meta-analysis. *Early Education & Development, 19*(1), 7-26. doi: 10.1080/10409280701838603
- Neisser, U. E. (1998). *The rising curve: Long-term gains in IQ and related measures*. Washington DC: American Psychological Association.
- Nelson, K. E. (1977). Facilitating children's syntax acquisition. *Developmental Psychology, 13*(2), 101-107.
- Nelson, K. E. (1989). Strategies for first language teaching. In M. Rice & R. L. Schiefelbusch (Eds.), *The teachability of language* (pp. 263-310). Baltimore, MD: Paul H. Brooks Publishing Co.

- Nelson, K. E., Welsh, J. A., Trup, E. M., & Greenburg, M. T. (2011). Language delays of impoverished preschool children in relation to early academic and emotion recognition skills. *First Language*, 164(2), 164-194. doi: 10.1177/0142723710391887
- Ouellette, G. P. (2006). What's meaning got to do with it: The role of vocabulary in word reading and reading comprehension. *Journal of Educational Psychology*, 98(3), 554-566.
- Payne, A. C., Whitehurst, G. J., & Angell, A. L. (1994). The role of home literacy environment in the development of language ability in preschool children from low-income families. *Early Childhood Research Quarterly*, 9(3-4), 427-440. doi: 10.1016/0885-2006(94)90018-3
- Shonkoff, J. P., & Phillips, D. A., (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academies Press.
- Rice, M. L., Huston, A. C., Truglio, R. & Wright, J. C. (1990). Words from "Sesame Street:" Learning vocabulary while viewing. *Developmental Psychology*, 26(3),421-428.
- Rowe, M. L., Raudenbush, S. W., & Goldin-Meadow, S.,(2012). The pace of vocabulary growth helps predict later vocabulary skills. *Child Development*, 83(2), 508-525.
- Scarborough, H. S. (2009). Connecting early language and literacy to later reading (dis)abilities: Evidence, theory, and practice. In F. Feltcher-Campbell, J. Solar, & G. Reid (Eds.), *Approaching difficulties in literacy development* (pp. 23-38). London, UK: Sage Publications Ltd.
- Snow, C. E., Burns, M. S., & Griffin, P. (Eds.) (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academies Press.
- Committee on the Prevention of Reading Difficulties in Young Children. Washington, DC: National Research Council.
- Spiker, D., Boyce, G. C., & Boyce, L. K. (2002). Parent-child interactions when young children have disabilities. *International Review of Research in Mental Retardation*, 25, 35-70.

- Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 360-407.
- Tamis-LeMonda, C. S., Bornstein, M. H., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child Development*, 72(3), 748-767.
- Tamis-LeMonda, C. S., Kuchirko, Y., & Song, L. (2014). Why is infant language learning facilitated by parental responsiveness? *Current Directions in Psychological Science*, 23(2), 121-126. doi: 10.1177/0963721414522813
- Walker, D., Greenwood, C. R., Hart, B., & Carta, J. J. (1994). Improving the prediction of early school academic outcomes using socioeconomic status and early language production. *Child Development*, 65, 606-621.
- Warren, S. F., & Walker, D. (2005). Fostering early communication and language development. In D. M. Teti (Ed.), *Handbook of research methodology in developmental psychology* (pp.249-624). Oxford, GB: Blackwell, Publishing Ltd.
- Zigler, E., & Styfco, S. J. (2004). *The Head Start Debates*. Baltimore, MD: Paul H. Brooks Publishing Co.
- Zigler, E., & Valentine, J. (1979). *Project Head Start: A legacy of the war on poverty*. New York: Macmillan.
- Zimmerman, F.J., Gilkerson, J., Richards, J.A., Christakis, D.A., Xu, D., Gray, S., & Yapanel, U. (2009). Teaching by Listening: The Importance of Adult-Child Conversations to Language Development. *Pediatrics* 124(1), 342-349.

About the Author



Steven F. Warren is Professor of Speech-Language Hearing: Sciences and Disorders and an Investigator with the Institute of Life Span Studies at the University of Kansas. He serves as a member of both the LENA Scientific Advisory Board and the LENA Board. Dr. Warren's research has focused on communication and language development in children with developmental delays and disabilities. Much of this work has focused on the effects of different types of communication and language interventions as well as the way that children with specific disorders (e.g., Down syndrome) respond to different interventions. Over the past 20 years he and his colleagues have conducted several randomized clinical trials on the effects of these interventions on children's language development. He has published more than 170 papers including several based on data generated using LENA and has edited a dozen books. His work has been supported by grants from the National

Institute of Health and the US Department of Education throughout his career. Dr. Warren has been recognized by career research awards from the National Down Syndrome Congress (1999), the American Association on Intellectual and Developmental Disabilities (2008), and the American Psychological Association (2013).

About LENA

LENA is a 501(c)(3) public charity based in Boulder, Colorado. They provide advanced technology and programs to accelerate the language development of children birth to five and close achievement gaps.

The patented LENA System™ comprises hardware and software that serve as a “talk pedometer,” measuring a child’s natural language environment and providing timely feedback. The hardware is a small recorder the child wears for a day at a time. The software turns the resulting audio file into counts of words, conversations, and other data important for improving language. The new LENA Start™ model integrates motivational video instruction, peer-support, and regular use of LENA system data into parent classes. LENA Online™ is a cloud-based tool for secure access to LENA data, enabling effective program scaling and including text messaging for parent communication.

LENA
5525 Central Ave
Suite 100
Boulder, Co. 80301
Tel: 303.545.9696
www.LENA.org