

Research on Communication and Language Development: Implications for Policy and Practice

Steven F. Warren PhD.
University Distinguished Professor
University of Kansas, Lawrence, KS USA
Email: sfwarren@ku.edu
August 18th, 2016

Disclosure

- I serve as a member of LENA Foundation Board of Directors and the LENA Foundation Scientific Advisory Board. I do not receive compensation for this service. The Foundation's mission is to accelerate language development to improve the cognitive, social and emotional health of children birth to five and close achievement gaps. The foundation is a 501 (c) (3) public charity located in Boulder, Colorado. Prior to the creation of the LENA Foundation in 2010, I served a consultant and advisory board member of Infoture, Inc. Infoture invented the LENA device and software. I received a consulting fee for this service.

Acknowledgements

- Paul Yoder, Marc Fey, Nancy Brady, Joe Reichle, Eva Horn, Kandace Fleming, Jill Gilkerson, Kim Oller, Don Bailey, Audra Sterling and a large number of other colleagues.
- Sustained research funding throughout my career from the US National Institutes of Health
- Hundreds of children and their parents
- The Institute for Life Span Studies at the University of Kansas and the John F. Kennedy Center for Research on Human Development at Vanderbilt University in Nashville

Outline

- The role of language and communication to human development and life long learning
- Eliminating barriers to effective practices and policies
 - Frequently measuring and monitoring learning environments
 - Implementing optimal intervention intensities
 - Optimizing augmentative and alternative communication approaches
- Concluding comments

So why are communication and language development so important?

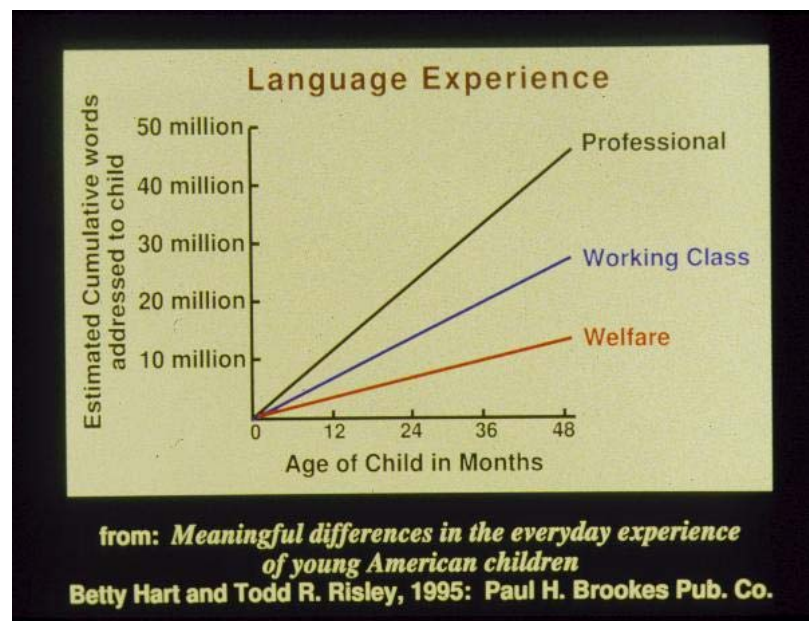
- Human language is the most powerful, creative, and flexible tool in the known universe. Most children master it by age 3. It is the currency of human interaction.
- Language encodes critical information = new words encode new concepts, actions, attributes, etc.
- Communication and language skills play a central role in **cognitive, emotional** and **social** development from infancy onward across the life span
- Communication and language skills play a **major role self-determination, level of adult independence, employment**, and more

Language development is a cumulative process

- The work of the young child is to form healthy attachments and learn to walk and talk.
- If we allow 9 hours out of every 24 hours for sleep – then there are 100 hours available per week for “the work of the child” (no days off!)
- That’s 5,200 hours per year or 78,000 hours over a 15 year period
- Most DIRECT communication/language interventions represent a very tiny fraction of the possible time for communication and language learning

The Cumulative Deficit Hypothesis

Hart & Risley's research revealed the cumulative impact of experience on children's development.



What Hart & Risley discovered has been affirmed in various ways by a numerous studies over the past 20 years.

Eliminating Barriers to Effective Practices and Policies

Eliminating Barriers to Optimal Communication and Language Development

- For the past 50 years we have been in Phase 1 – inventing techniques and testing them under restricted conditions for short periods of time
- Now we are in Phase 2 – the slow but steady use of Clinical Trials and Meta-Analyses to determine truly effective practices and policies
- Many crucial issues remain. I will focus on just 3 due to time constraints.
 - Automatic Measurement
 - Intervention Intensity
 - Advancing AAC

Topic 1: Automatically measuring key
elements of the communication and language
learning environments

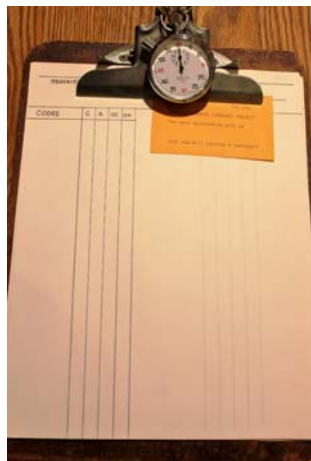
**“You can’t improve
what you can’t measure.”**

- T. D. Paul

Problems with the “landmark Hart & Risley Study”

1. Small only somewhat representative sample size
2. Possible Hawthorne effect due to observer presence
3. Time of day – most observations occurred during the late afternoon – which turns out to be the richest period for parent-child interaction. But extrapolations of the data did not take this into account/
4. The cost and difficulty of conducting the study made it an unlikely candidate for replication.

Betty Hart's clip board.....

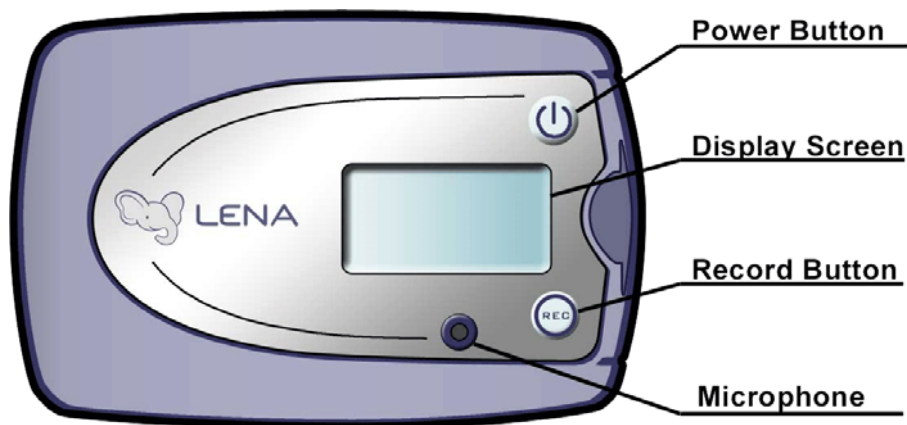


LENA IS BORN!



LENA Overview

- LENA = Language Environment Analysis
- Purpose: To provide scientists, teachers, clinicians, and parents with automatically generated data about a child's natural language environment and language development.
- LENA consists of a Digital Language Processor, a special vest, innovative algorithms, and a powerful microprocessor



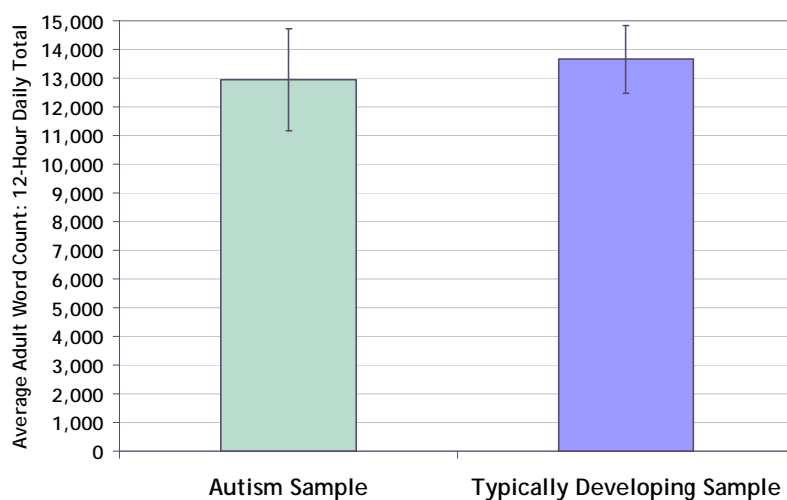


- It took Betty Hart and several assistants **6 YEARS** to transcribe, code, and analyze just **1,318 one-hour tape** recordings of 42 children.
- LENA can **automatically** capture and **analyze 16 hours of data at a time** and analyze it **in less than 3 hours**.
- The LENA Natural Language Database consists of more than **350,000 hours** of in-home recordings from multiple countries in multiple languages
- **LENA doesn't care what language is being spoken** (research has been conducted in English, Spanish, Mandarin, Korean, and Arabic and more)

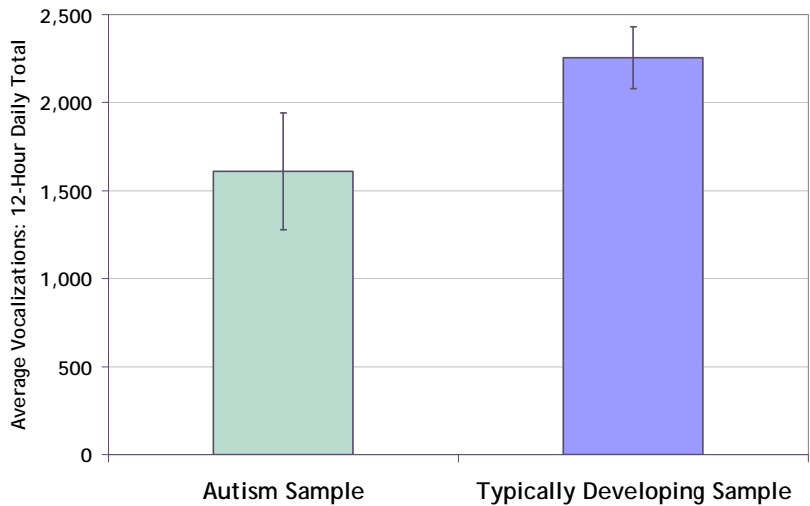
LENA Overview – Key Reports

- **Adult Word Count**
 - Estimates number of adult words the child hears per day and per hour
- **Child Vocalizations**
 - Meaningful child speech separated by 300 ms of silence
- **Conversational Turns**
 - Estimates the number of conversational turns between adult and child

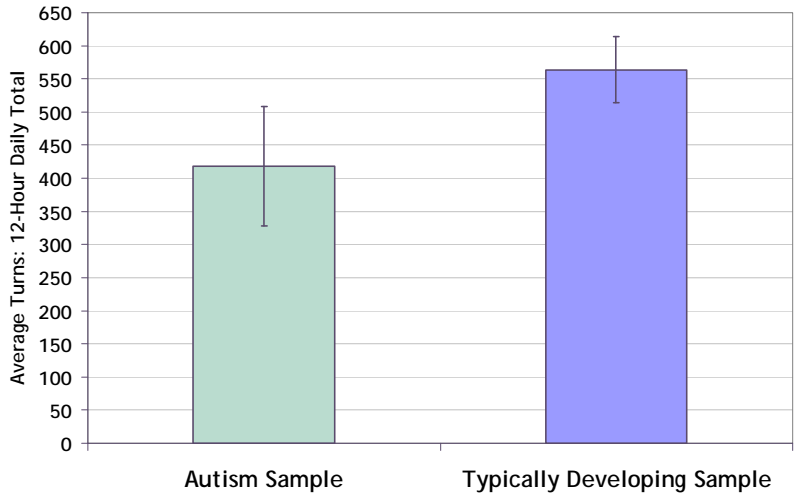
CA Match - Adult Word Count



CA Match – Child Vocalizations



CA Match - Conversational Turns



Implications: The Language Learning Environment of Children with Autism

- Cumulative Impact of Adult Word Count
 - Children with autism hear 1,000 fewer adult words a day: 7,000 fewer per week; **over 1 million fewer words** across three years
- Cumulative Impact of Child Vocalizations
 - Children with autism produce 700 fewer vocalizations a day: 4,900 fewer per week; **765,000 fewer across three years**
- Cumulative Impact of Conversational Turns
 - Children with autism engage in 150 fewer turns a day: 1,050 fewer per week; **164,000 fewer across three years**

FOOD FOR THOUGHT

- Rapid scientific advances often occur following major breakthroughs in measurement (just ask Galileo about his telescope)
- LENA represents one such breakthrough for the **measurement of real world learning environments**
- LENA is a data collection tool – it still represents a limited view of the child and parent
- It is healthy to be skeptical about any new tool and its ultimate value

Topic 2: Taking Treatment Intensity Seriously

- Warren, Fey, & Yoder (2007). Differential Treatment Intensity Research: A Missing Link in Creating Optimally Effective Interventions. *Mental Retardation & Development Disabilities Research Reviews*, Vol 13 (1), p. 70-77.
- Since publication has resulted in special issues of 3 academic research journals and 200+ citations in the literature

A VERY Brief History of IDD Behavioral Intervention Research over the past 50 years

- Phase 1 – Developing interventions and conducting small N studies: Substantial evidence of limited effectiveness of numerous techniques and general approaches (this is mostly complete)
- Phase 2 – Direct comparison studies of different interventions; different intensities of interventions; and combination pharmacological and behavioral interventions

Single subject designs are a power tool but...

- Can only answer short term questions
- They have a variety of limitations that make it difficult to generalize from their conclusions
- Nevertheless they remain very useful research tools and are still relevant for AAC intervention research

We know that the effectiveness of specific Interventions often varies by....

- Whether we do short term vs long term follow-up
- Type of intervention (e.g. massed or distributed practice)
- Focus on proximal or distal variables (generalization)
- The skill domain targeted
- Characteristics of the participants
- Intensity of the intervention

A key difference between drug and behavioral interventions

- When a therapeutic drug is developed, systemic research is routinely and thoroughly conducted on its effects at different dosages.
- So why have behavioral scientists not adopted a similar approach to developing effective interventions?

What is treatment intensity?

- There is no standard definition of treatment intensity in behavioral research

Various published studies have defined treatment intensity as.....

- “The quality and quantity of service delivered over a given period of time”
- “The number of hours of intervention over a period of time”
- “The level of participation in a service offered over time”
- “The ratio of children in a service context”
- “Number of specific teaching episodes per unit of time”

Intensity as “Duration of Treatment”

- The main advantage of defining intensity as the duration of treatment (e.g. hours per day or week of intervention) is that it is **easily understood** by a wide range of audiences including parents, teachers, and policy makers.
- **Unfortunately this tells us nothing** about the treatment intensity of the presumed “**active ingredients**” of various interventions during this period of time

Terminology for Precisely Measuring Behavioral Treatment Intensity

1. Dose
2. Dose Form
3. Dose Frequency
4. Total Intervention Duration
5. Cumulative Intervention Intensity

Dose

- Dose = the number of properly administered treatment episodes during a single intervention period
- A treatment episode contains one or more interventionist acts hypothesized to lead/push the child/adult toward a treatment goal

Dose is the function of 3 subcomponents

1. The average rate of treatment episodes per unit of time
2. The length of the intervention period/session
3. The distribution of treatment episodes over the period/session

Dose Form

- Dose form refers to the task/activity/context within which a treatment episode occurs
- **Example**....to teach word forms an adult might initiate imitation trials; or respond via conversation to child initiations.

Dose Frequency

- The number of times that a “dose of intervention” is provided per day or week.
- For example: a once per week 1 hour session of 1 teaching episode per minute (60 episodes) VS. 5 1-hour sessions of 1 teaching episode per minute (300 episodes)

Total Intervention Duration

- The total time period over which an intervention is delivered (for example, weekly for 6 months, or 9 months, 24 months, etc)

Cumulative Intervention Frequency

- The product of dose X dose frequency X total intervention duration
- Cumulative Intervention Intensity provides a useful general indicator of overall intensity
- Cumulative Intervention Intensity provides relatively uniform metric to compare two different interventions to each other

What can be learned by focusing on treatment intensity?

1. A given treatment that is moderately effective at one intensity level may be more/less effective at another level
2. Changes in intensity may have different effects on individuals with different developmental profiles
3. Some intensity levels may generate unforeseen side effects (e.g. stress, problems behaviors, etc.). Other may be too low to have an sustained effect.

Furthermore....

- Studying treatment intensity highlights the important role of “cumulative intervention intensity”.
- When comparing DIFFERENT interventions, cumulative treatment intensity ideally should be controlled.
- Comparing two treatments that vary in intensity and other variables (e.g. dose form) can lead to flawed conclusions
- The literature is full of these flawed “apples vs oranges” comparisons!

Topic 3: AAC

- Maximizing the potential impact of augmentative and alternative communication technologies and interventions
- AAC has come a long ways in the past 30 years.....but it still has a long way to go to reach its potential

AAC technology development has outpaced AAC application research

- There are well over 100 AAC intervention studies in the literature directly relevant to individuals with severe intellectual and/or severe developmental disabilities.
- However, despite the best intentions of many people around the globe, a large proportion of these studies have substantial limitations (e.g. failure to adequately measure generalization and/or maintenance; lack of fidelity of treatment measures; lack of social validity measures; inadequate procedural detail, etc.)

With technology continuing to improve...its time to launch a major international, multi-disciplinary effort to enhance and expand AAC research

The advances in measurement and the treatment intensity study methods discussed under Topic 1 and 2 can serve as part of the foundation for launching a new era of AAC research.

“No pessimist ever discovered the secrets of the stars
or sailed to an uncharted land or opened a new
heaven to the human spirit.”
Helen Keller



Feel free to contact me:
sfwarren@ku.edu