Early Learning and Brain Development: Language, Literacy, and Bilingualism

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Today's Goals

- It's good to be back! I-LABS spoke to the distinguished members of the WA State Legislature in 2019, describing novel brain measures that would reveal the ***brain mechanisms*** underlying early learning, and *providing* ***material on bilingual language learning.***
- Today I show you ***how early learning changes the brain***, and demonstrate that early brain changes predict a child's future learning, describe a new teacher training program for **dual-language learning**, and describe new work on **reading readiness for 5-year-olds**.
- I will offer 3 recommendations for WA State to enhance language and literacy skills in 0-5 year old children – all evidence-based: (1) **Parent 'Coaching'** for language development, (2) **Teacher-training on SparkLing Bilingual**, a program that ignites dual-language learning in both home and school languages in 0-5 yr-olds, (3) **Reading Camp for 5-year-olds** that prepares children for reading instruction.

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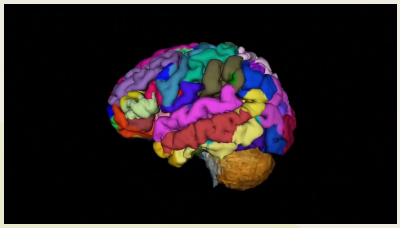
Brain Function

Brain Structure



Interventions that enhance learning and brain development

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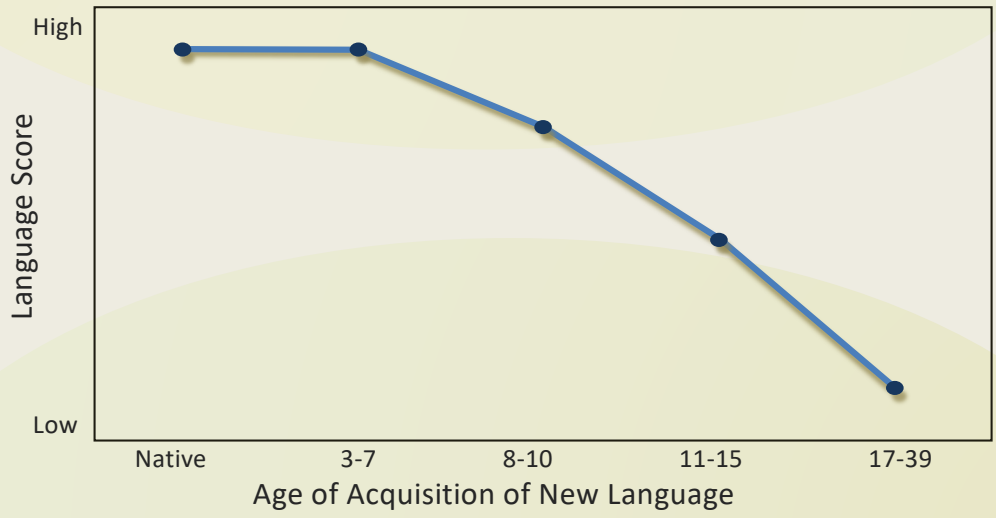
Why Focus on Early Development? There is a 'Sensitive Period' for Language Learning



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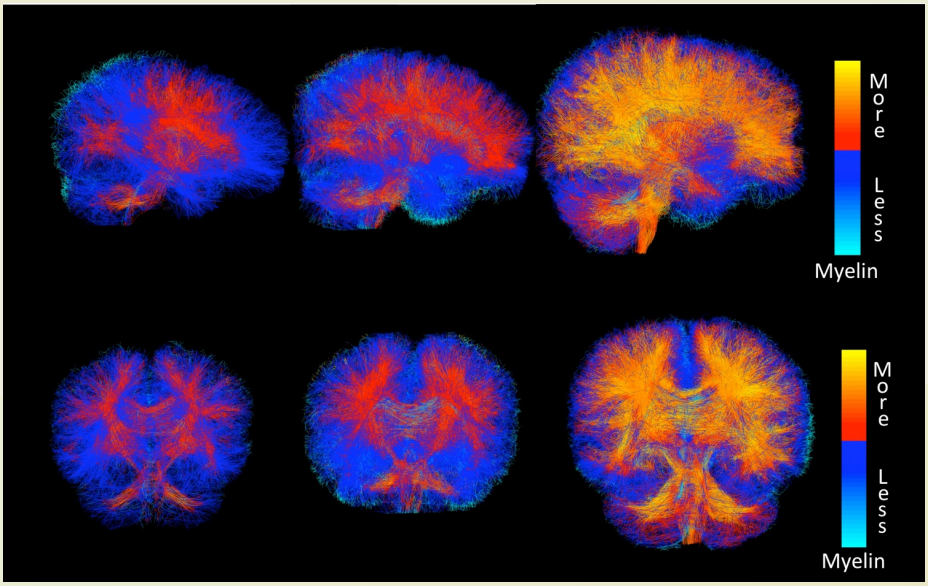
Growth of Baby Brain Connections

7 month old 11 month old 26 month old



Kuhl, Institute for Learning & Brain Sciences, University of Washington

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The Social Brain 'Gates' Learning

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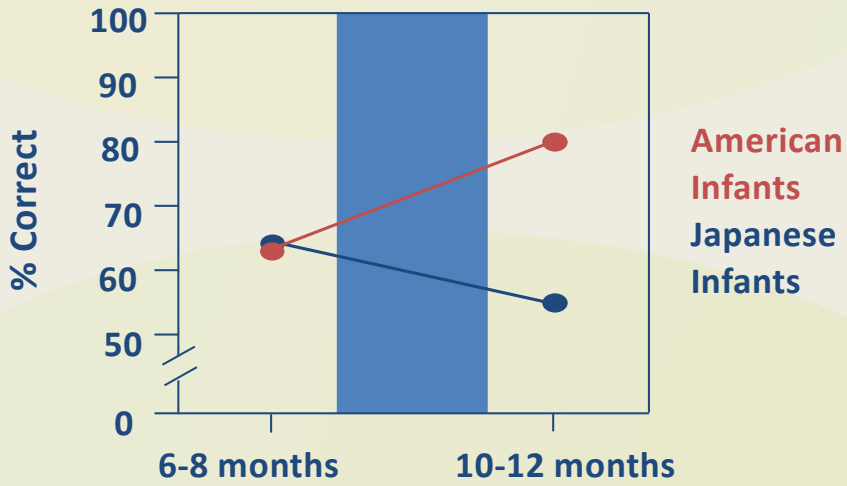
A 'Sensitive Period' for Speech Learning

Infant discrimination of /ra/ vs. /la/



Kuhl et al., *Developmental Science*, 2006

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THE 'SOCIAL' BRAIN

Exposure to a new language at 9 months of age in a social setting produces phenomenal learning; However, exposure via video produces no learning whatsoever!

Kuhl et al., *Proceedings of the National Academy of Sciences*, 2003

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Big Machines for Little Brains (MEG)

Noninvasive, totally safe, and noiseless, MEG brain imaging measures neural activity in the baby brain during cognitive tasks.

Kuhl et al., *Proceedings of the National Academy of Sciences,* 2014)

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Baby MEG

Kuhl, et al., *Proceedings of the National Academy of Sciences*, 2014

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Summary of Social Effect and MEG studies

- When young children experience a 'social' stimulus, their brains 'light up' not only in the sensory areas (visual, or auditory), but also in the motor regions that allow them to respond. This is true at 2 months of age, before infants have the ability to speak
- Example: when 2 month-olds infants (also, 6-mo, 12mo, and adults) hear human speech, but not nonspeech sounds, their brains not only activate the sensory regions, but also the motor regions that allow them to speak.
- Hearing speech prompts the motor system to 'get ready' to respond; the brain begins to imagine 'conversational turns' (CT). CTs predict future language, brain development out to 5 years of age, and predict reading readiness at the age of 5.
- Parents and teachers who encourage active responding (CTs) encourage greater learning and brain development

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Parent 'Coaching' Studies

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Language Input in Infancy

Quantity

Number of words

Quality

'Parentese'

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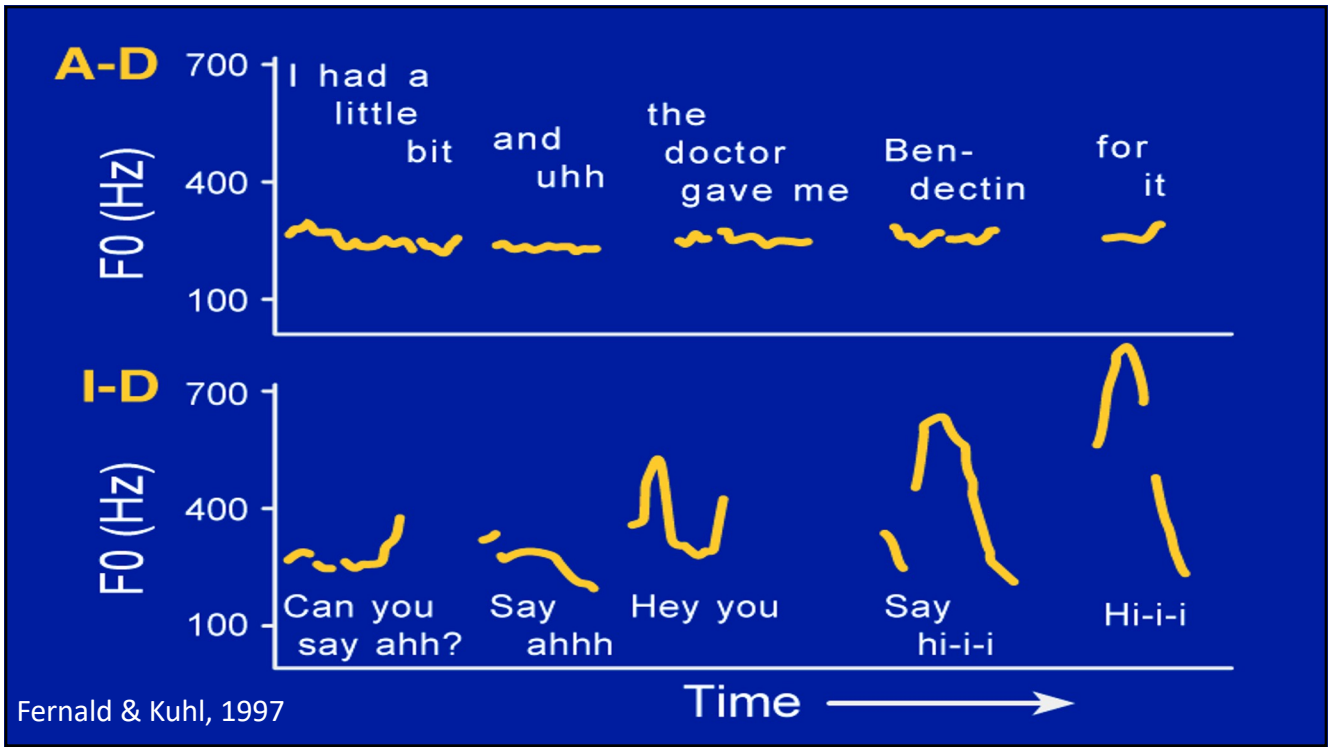

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Parent Coaching Study: Questions

- Can parents be coached to enhance the amount of parentese they use with their child?
- If so, does this have an impact on child language outcomes?

Ferjan Ramírez, Lytle, Fish, & Kuhl, *Dev Sci 2018;*
Ferjan Ramírez, Lytle, & Kuhl, *PNAS 2020*

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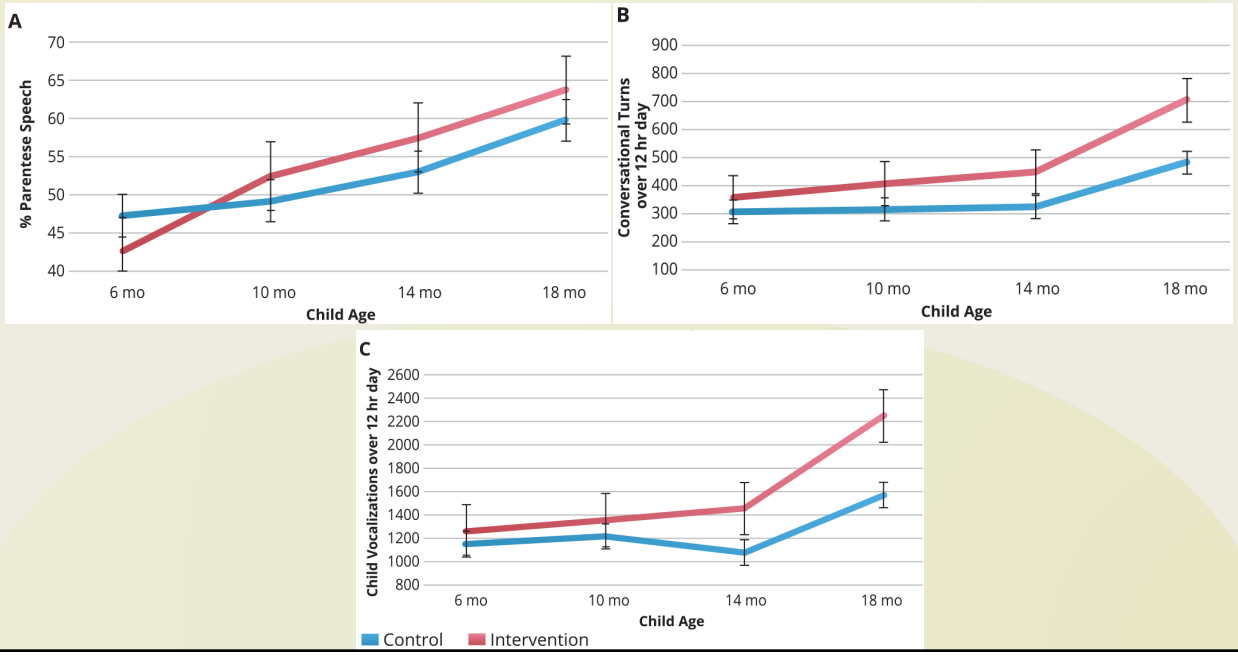
Parent 'Coaching' Increases Parentese, CT, and Language Development



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What About Fathers?

- Fathers not as "chatty," but all produce parentese
- Have different beliefs, attitudes
- Beliefs & attitudes predict paternal parentese
- Paternal parentese predicts child language
- Daddies matter too!!

Shapiro, Hippe, & Ferjan Ramírez, *JSLHR, 2021*; Ferjan Ramírez et al., *Infancy*, 2022

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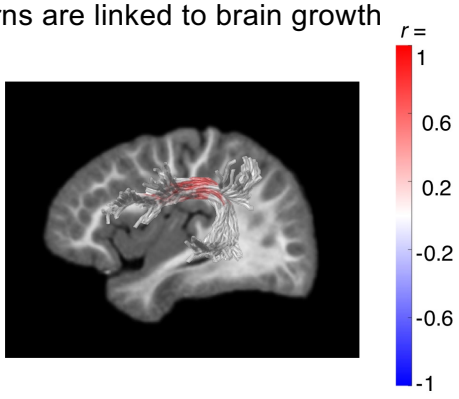
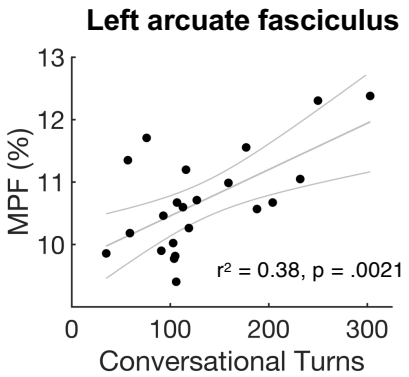
Parentese Input at 6 Months Predicts Brain Connections at 2 Years

At 6 months, conversational turns are linked to brain growth



Conversational turns create stronger connectivity in a critical language pathway



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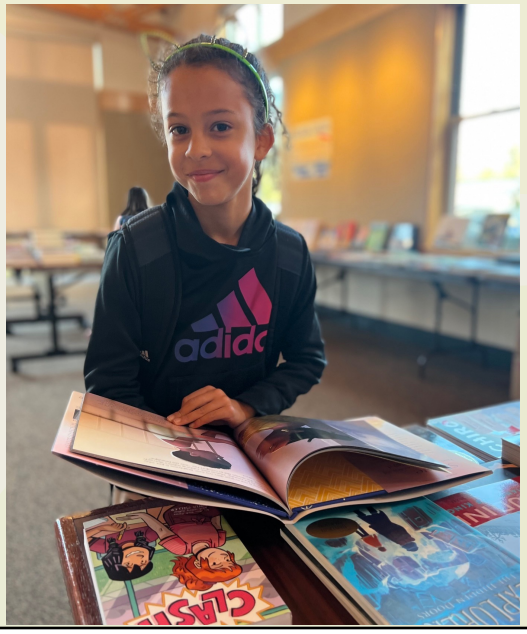
Does the Effect Last? Outcomes at Age 5



At Kindergarten entry, children of parents who used more parentese in infancy:

- Produced longer sentences
- Used a more diverse set of lexical items
- Took more conversational turns with their parents

Ferjan Ramírez, Weiss, Sheth, & Kuhl, *2023*

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Summary of Parent 'Coaching' Studies

- "Coaching' increases Parentese, which in turn increases Conversational Turns, and Children's Language Outcomes from 18-30 months.
- The effects of coaching are still statistically significant at the age of 5 years, with parents and children engaged in more CTs, and children's language skills enhanced when compared to controls.
- The brain mechanism is myelination (strength and speed) of language-related pathways seen by the age of 2.
- Language experience in infancy tunes structural connections in the developing brain that are critical for later learning.

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The Bilingual Brain Studies

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SparkLing Bilingual Intervention: Madrid!

Naja Ferjan-Ramirez & Kuhl, *Mind, Brain, and Education,* 2017

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SparkLing Bilingual is Social Language Learning

I-LABS SparkLing Bilingual in Madrid Spain, 2017

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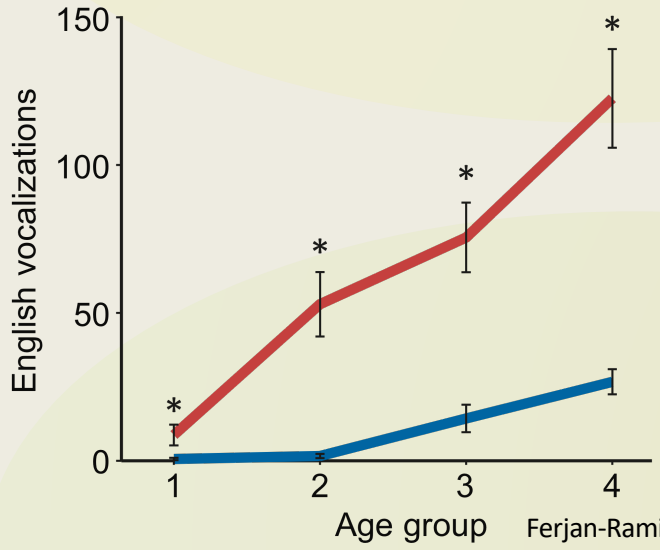
I-LABS bilingual learning in school: 18 weeks, 1hr/day



Intervention
CPC

Age Group
1 - 7-14 months
2 - 14-20.5 months
3 - 20.5-27 months
4 - 27-33.5 months

Children who experienced I-LABS Bilingual Baby method and curriculum show extraordinary gains compared to children who experienced current bilingual teaching methods in use in Madrid.

Ferjan-Ramirez & Kuhl, *Mind, Brain, and Education*, 2017

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SparkLing Bilingual Graduates In Madrid

Ferjan-Ramirez & Kuhl, *Mind, Brain & Education,* 2017

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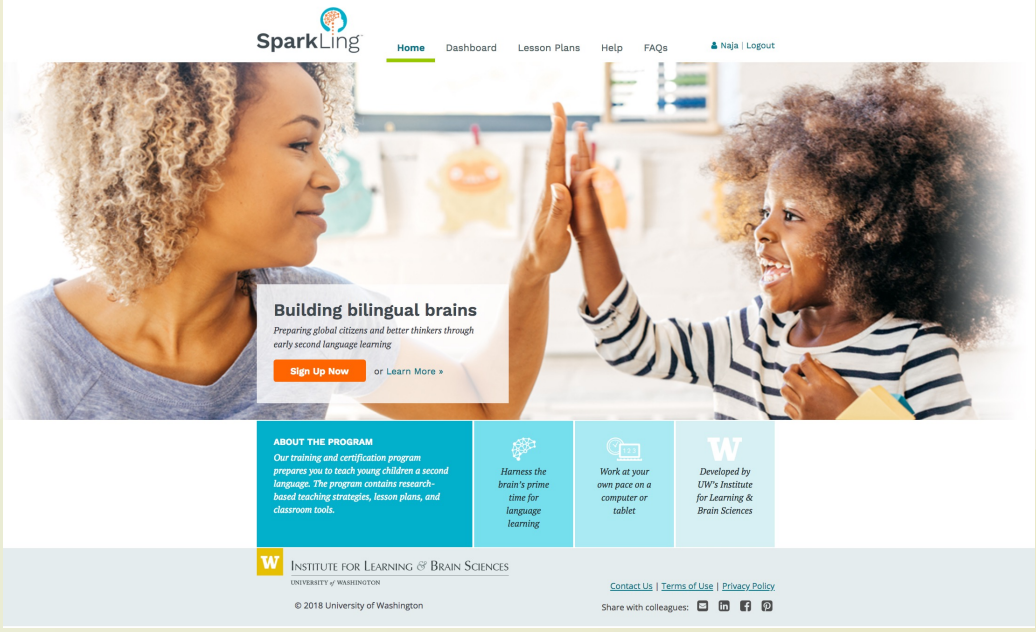
SparkLing Teachers Can Be Trained Online!



Kuhl, 2023

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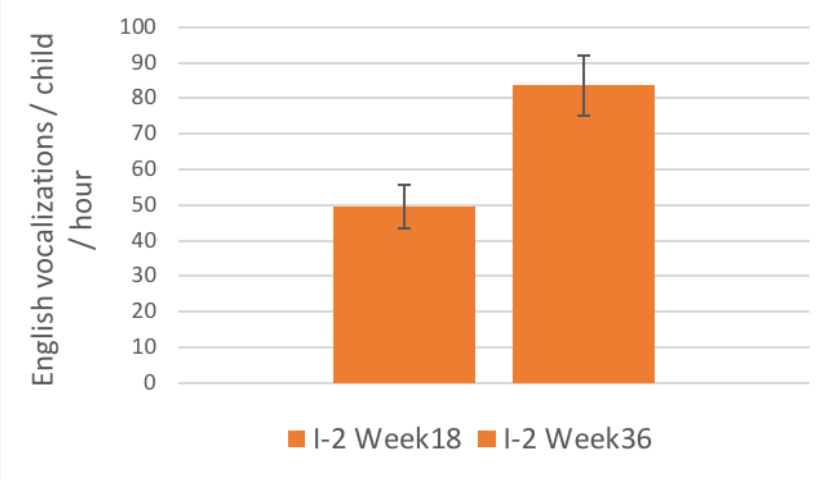
Half-year vs. Full-Year Bilingual Learning Comparison



Ferjan Ramírez & Kuhl, *Proceedings of the National Academy of Sciences*, 2020

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Summary of SparkLing Bilingual Studies

- SparkLing Bilingual is a teaching training and certification program that is the result of 40 years of research on language learning and brain development
- SparkLing consists of a 6-point method and a 32 week curriculum for 1 hour per day of social play-based bilingual language instruction
- SparkLing has been tested in two randomized control studies in Madrid Spain, in 13 schools, and is highly successful across socioeconomic groups (Migrant children of illiterate parents showed fastest learning (6 scholarly publications)
- I-LABS is now developing SparkLing Bilingual on an LMS platform that can be scaled for teachers in 0-3 and 3-5 year-olds in Spanish-English dual-language classrooms
- We plan to engage dual-language teachers from First 5 CA, Oregon, and (hopefully) WA State in the fall of 2023

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Learning to Read: Success of I-LABS On-Line Reading Camp

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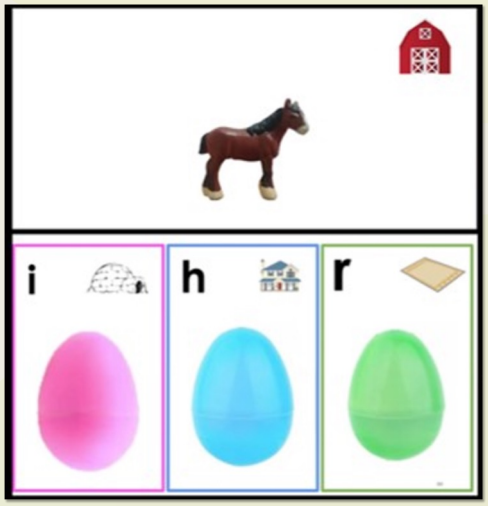
Can an Online Reading Camp Teach 5-year-old Children to Read?



Wiess et al. & Kuhl, *Frontiers in Human Neuroscience*, 2022

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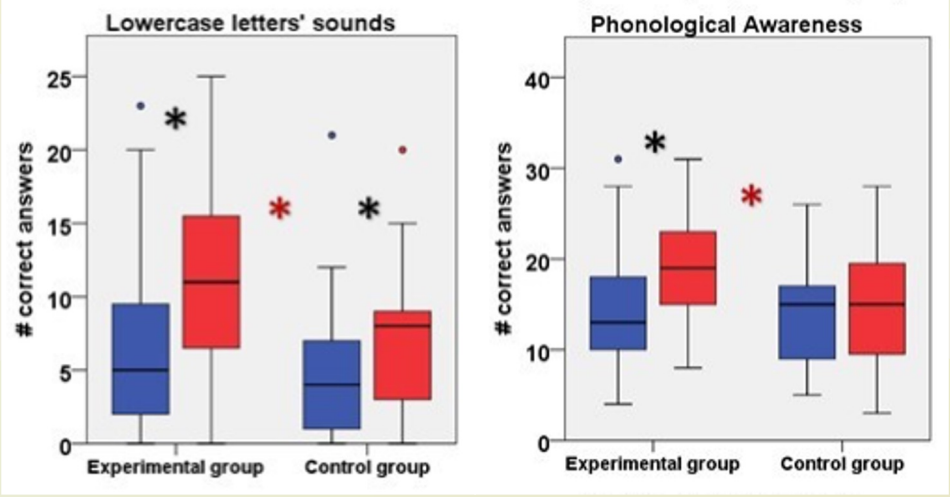
Reading Camp Participants Improved on All Measures Over Controls



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This project has drawn a lot of attention

Can an Online Reading Camp Teach 5-Year-Old Children to Read?

frontiers

Frontiers in Human Neuroscience
Published on 30 Mar 2022

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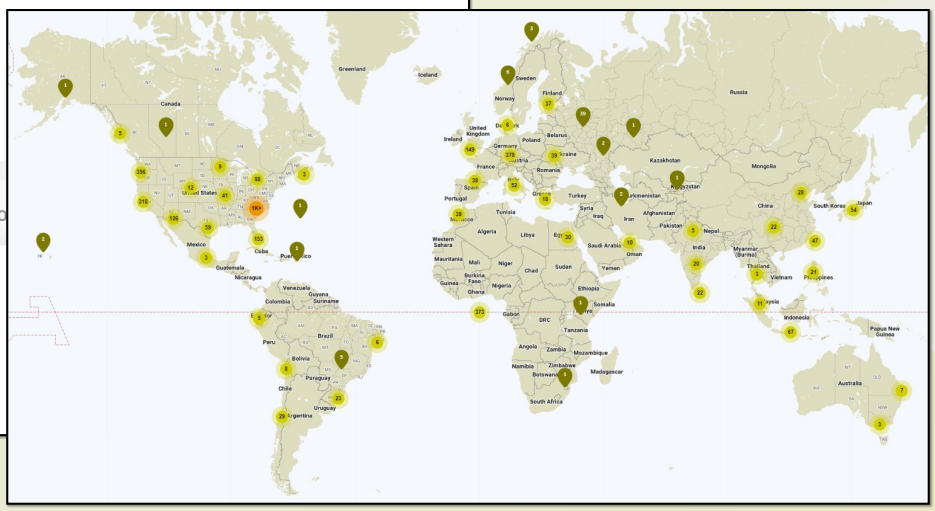

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UW NEWS

NEWS RELEASES

April 11, 2022

Even in a virtual classroom, preschoolers can gain reading skills

Kim Eckart
UW News

A new study by the Institute of Learning & Brain Sciences at the UW focuses on preschoolers' early reading skills. *Rendy Novantino/Unsplash*

frontiers

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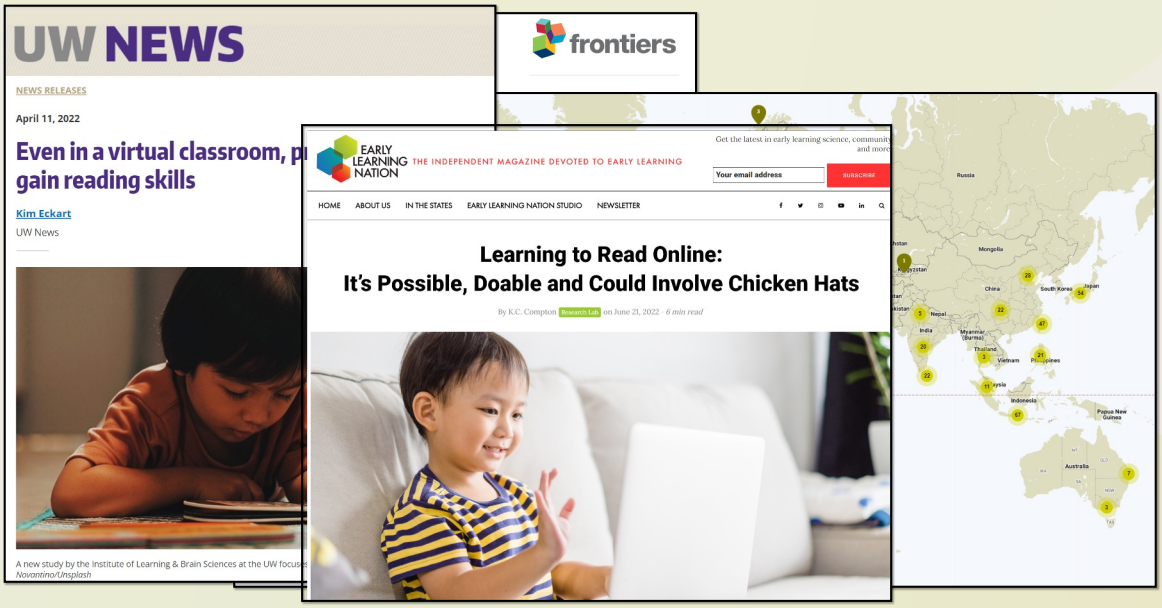
This project has drawn a lot of attention



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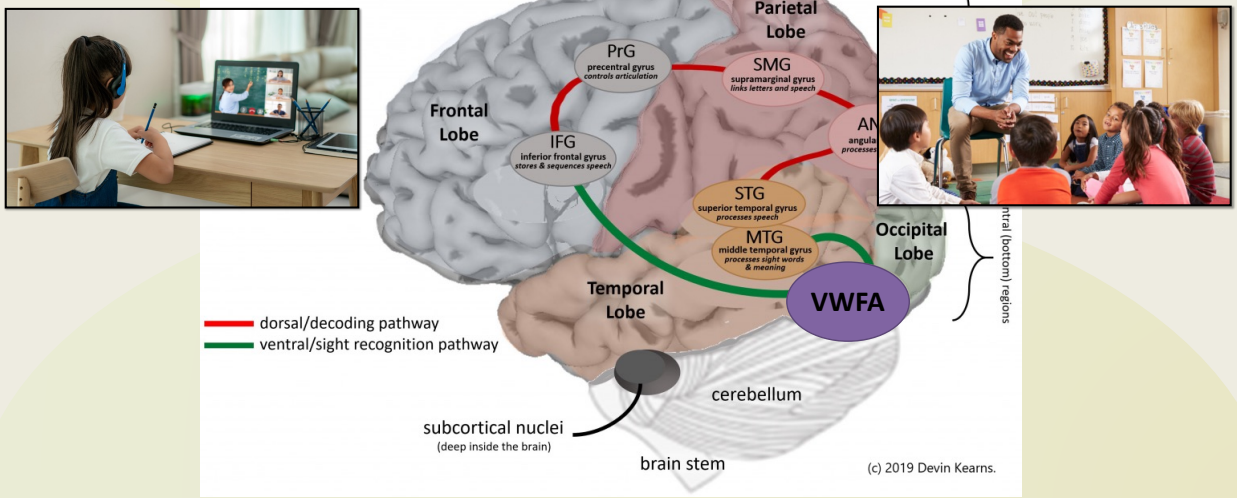
Online vs. In-person?



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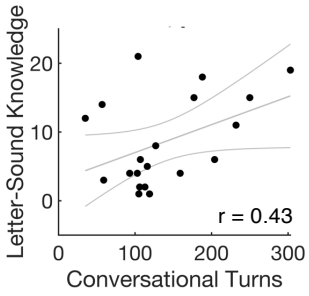
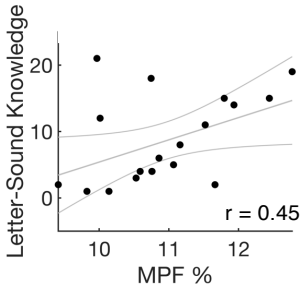
Linking Early Language Input to Brain Connections and Age 5 Reading Readiness Skills

Parent-infant **conversational turns** predict 5-year letter-sound knowledge



Brain Connections at 2 years predict 5-year letter-sound knowledge



Huber et al. & Kuhl, *Journal of Neuroscience*, 2023

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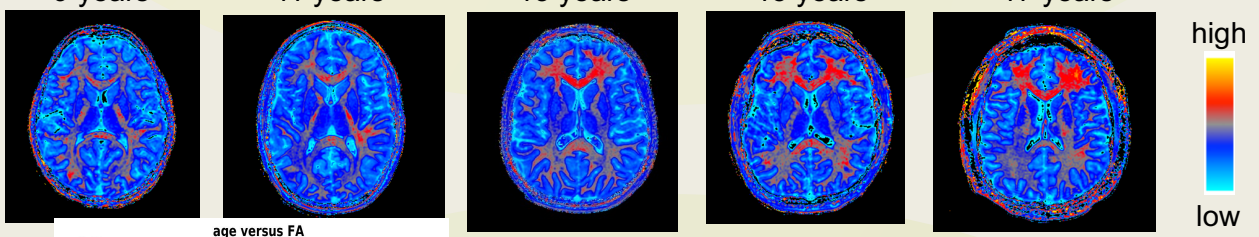
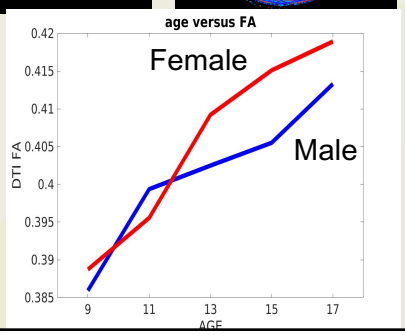
Work in Progress: Teens' Prefrontal Cortex Supports Executive Function and Social Skills





Growth of key fiber tracts important for attention skills as well as processing social information such as eye gaze, facial expressions, tones of voice, and intentions.

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Three Recommendations

Funding recommendations for WA State parents and teachers using I-LABS evidence-based proven methods that enhance language and literacy in 0-5 year old children:

(1) Community-based **Parent 'Coaching'** for language development

(2) Teacher-training on **SparkLing™ Bilingual**, a program that ignites dual-language learning in both home and school languages in 0-5 year-olds

(3) **Reading Camp** for 5-year-olds that improves reading readiness measures and prepares children's brains for reading instruction.

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Kuhl Laboratory Supporters

- The Bezos Family Foundation
- The Gates Foundation
- NSF Science of Learning Center grant
- The National Institutes of Health
- The Simms-Mann Foundation
- The Kaiser Foundation
- The Overdeck Foundation
- Bernard van Lear Foundation
- WA State Life Sciences Fund

Thank You!

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Thank You!

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