Science of Language and Learning in the Early Childhood Classroom

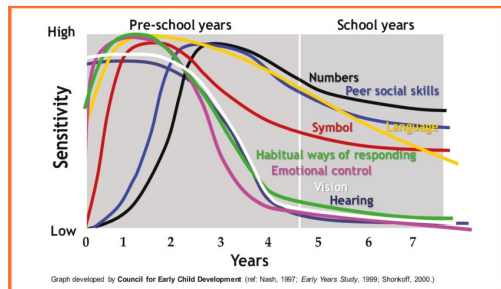

Ohio Literacy Academy
June 8, 2023
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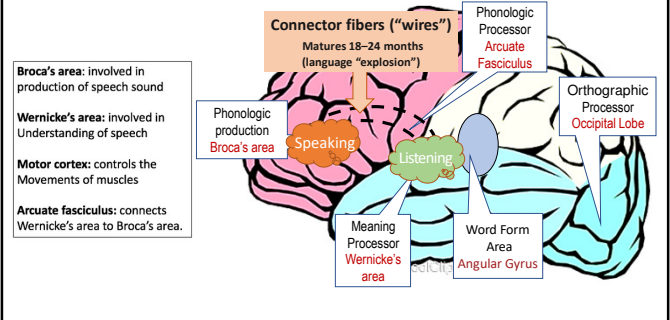## Science of Language and Learning Topics

- Brain development
- Language and learning science
- Instructional research in early childhood classrooms

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Sensitive Time Periods in Early Brain Development

Graph developed by **Council for Early Child Development** (ref: Nash, 1997; *Early Years Study*, 1999; Shonkoff, 2000.)

Listening, Speaking, and Literacy Learning in the Brain

Broca's area: involved in production of speech sound

Wernicke's area: involved in Understanding of speech

Motor cortex: controls the Movements of muscles

Arcuate fasciculus: connects Wernicke's area to Broca's area.

Connector fibers ("wires")
Matures 18–24 months (language "explosion")

Phonologic Processor
Arcuate Fasciculus

Phonologic production
Broca's area

Speaking

Listening

Orthographic Processor
Occipital Lobe

Meaning Processor
Wernicke's area

Word Form Area
Angular Gyrus

Language Environment & Early Brain Development

The relationship between language exposure and cognitive development is fully mediated by brain maturation. (Deoni, 2022)

Language Exposure → Brain Maturation and Myelination → Language & Cognitive Functioning

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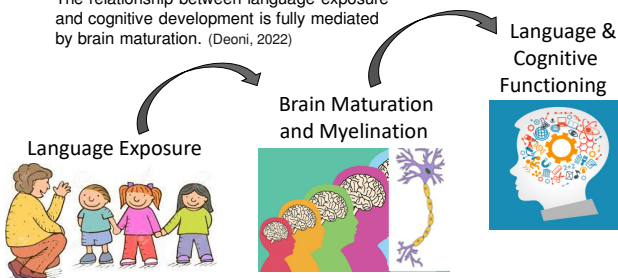
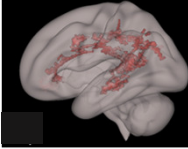## Brain Structure Changes with Learning

- **Activity-dependent**: neural circuits need to be consistently activated over time to be strengthened.
- Those that are rarely excited may be pruned away.
- Brains do not develop passively, but only in an environment of **social responsiveness** and **social interaction**.
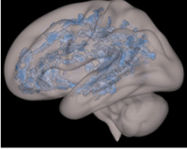
Reading vs Screen Time in Preschoolers

Source: Dr. John S. Hutton, Cincinnati Children's Reading and Literacy Discovery Center, 2021.

More Reading

Left Hemisphere Tracts

More Screen Time

Language and Literacy Skills
- More developed with higher skills
  - Encourages talk
- Less developed with lower skills
  - Replaces talk

Horowitz-Kraus, T., & Hutton, J. S. (2018)

Prevailing Philosophies on Learning

- Children "construct" their own knowledge.

- Education should be "child-centered" and driven by the interests of the individual child – with the teacher acting as a facilitator.

BUT...

Prevailing Philosophies

These theories have long been discredited.

There is a wealth of evidence showing that it is far more effective to impart information to children directly rather than having them attempt to figure it out for themselves, especially when they don't already know much about a topic.

Willingham, 2016

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4 Pillars of Learning (Dehaene, 2020)

1. Focused attention

2. Active engagement

3. Feedback

4. Cycle of rehearsal and consolidation

Effective Learning Strategies

Production Effect

- A memory advantage for items studied/rehearsed **aloud** over items studied/rehearsed silently.
(Icht, Mama, & Algom, 2014)

  - Practice retrieving new learning from memory
  - Space out retrieval practice

Effective Learning Strategies

- **Interleave** learning of different items and problem types.
  - Opposite of massed practice
  - Mixing up problem types and items improves your ability to discriminate between them, identify the unifying characteristics, and improves learning.

  (McDaniel, Brown, & Roediger III, 2014)

- Turn and talk to a partner and list the four pillars of learning.

Interleaving in Alphabet Instruction

Teaching more than one letter at a time with component parts results in better learning outcomes for young children.

(Sunde, Furnes, & Lundetræ, 2020; Vadasy, & Sanders, 2021)

Statistical Learning

I goed to the park.

- Brain networks pick up on **statistical patterns** across words.
- Most of this learning is implicit, subconscious and goes on in the background while engaged in primary tasks.
- **Timely** and **targeted instruction** provides a bigger boost**.**

Seidenberg et al., 2020

Accelerate
Graduate

Statistical Learning and Instruction

Explicit instruction (the visible tip of the iceberg)

I DO

leads to

WE DO

Implicit learning (the submerged part of the iceberg)

YOU DO

"Semi-supervised within an implicit experience." (Seidenburg, 2017)

What about Play?

Philosophical and Evidence-based Practice

- There is strong agreement among early childhood educators and researchers, independent of philosophical orientation, that **play** is a necessary component of early childhood curriculum for helping young children develop in optimal ways.
- Balancing perspectives of the need for sustained uninterrupted child-initiated play opportunities with adult-initiated activities to address academic learning becomes an issue in determining best practice.

Research on Play

What the Empirical Research Says about Play

- Empirical research basis is still in the early phases for the contribution of play in the development of other skills.
- "The existing evidence does not support strong causal claims about the *unique* importance of pretend play for development."

(Lillard, Lerner, Hopkins, Dore, Smith, & Palmquist, 2013)

Instructional Impacts on Learning

- Learning occurs in an interconnected and recursive manner integrating skills across the developmental domains.
- Educational approaches that promote children's developing language and social-emotional skills while integrating cognitive and executive function skills facilitate school readiness and academic abilities in the early grades. (Zelazo et al., 2016)

Playful Learning : Purposeful Play

- "Playful learning" helps children make important connections deepening their background knowledge better than providing opportunities for pretend, open or free-play
- Real learning happens with language-based interactions.
- The key point is that adult **intentionality** and **interaction** makes an important difference in young children's learning.

"Playful instruction and purposeful play"

(Thunder, Almarode, & Hattie, 2022
Visible Learning in Early Childhood)

What about Following a Child's Lead?

"There is a profound limit to the role that first-hand experience can play in cognitive development. In many domains, children cannot gather the relevant data for themselves. Children have to depend on what other people tell them."

(Paul Harris, 2012, *Trusting What You're Told: How Young Children Learn From Others,*)

"When we guide children's learning, they will lead themselves where they need to be."

Language Interactions

Tune In
Talk More
Take Turns

Interactive and **child-directed** conversations from caregivers who are **responsive** to children's comments, queries, and understandings are important and vital to children's language development and learning.

(From the Thirty Million Words Initiative; Suskind, 2015)

Child-Directed Language

- Helps young brains learn language.
- Has a lot of expression with a positive tone.
- Does **_not_** use incorrect pronunciation or grammar.
- Helps draw attention to what is being said and who is saying it, encouraging the child to be attentive, be engaged, and interact.

Tuning In

- Teachers, caregivers, and parents consciously **"tune-in"** and notice what a child is focused on, what a child's behavior is expressing, what a child is needing – next – following the child's lead, then **talk** about it.

  ▸ When we guide children's learning, they will **lead** themselves where they need to be or where they need to go.

Talking More

- **Narrate** what is happening by using **Self-Talk** to describe what you are doing or how to do something.
  .
- Use **Parallel Talk** to describe what the child is doing or should be doing.

▸ When we guide children's learning, they will **lead** themselves where they need to be or where they need to go.

Talking More

Self-Talk:
the cooking show host

➢ Modeling a new and deeper learning

Parallel Talk:
the sports announcer

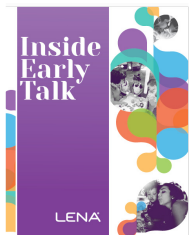➢ Guiding a new and deeper learning

I DO   WE DO

Take Turns

- "Taking turns" in conversation is the most valuable of the three **Ts** for brain development.
  - "serve-and-return"
  - "strive for 5"

How Many Conversational Turns?

LENA: Language **EN**vironmental **A**nalysis

Young children need:
- 40 conversational turns every hour at home
- 5 or more at school

(Gilkerson et al., 2018; Inside Early Talk, LENA Foundation, 2020.

A 30-Second Conversation

- **Taking conversational turns:**
  - Engage in conversation with your partner.
  - Count the number of turns you have in 30 seconds.

  - **Use this simple activity to:**
    - Actively engage in conversation.
    - Nurture oral language.
    - Encourage sharing and deepening of relationships.
  - Take time each day to engage in authentic conversations.

Language Interactions

Tune In
Talk More
Take Turns

Fourth T: Turn it Off

Effective Questioning Routines

- Use a questioning routine that guides children's learning.
  - First, ask more specific or closed-ended questions to check for understanding.
  - Next, ask higher-level or more open-ended questions to extend their learning.
- Only use higher-level questions when children are able to correctly respond to lower-level questions. Children might remember inaccurate responses or wild guesses they hear.

(Neuman & Wright, 2013)

Lower-Level and Higher-Level Questioning

Lower-level semantic skills seem to be a stronger predictive indicator of listening comprehension than inferential skills in preschool children.

(Blank et al., 1978; Florit et al., 2013; Kendeou et al., 2008; Scarborough, 2005)

Why?   The abstract nature of language is still developing in the preschool years.

Early Childhood Instruction Impacts

What instructional context BEST facilitates young children's early literacy learning?

a. Teacher-child modulated learning
b. Child-child modulated learning
c. Child modulated learning

Research on Learning: Evidence-Based Practice

- Teacher-child modulated learning is more effective than child- or child-child modulated learning.
  Connor, Morrison, & Slominski, 2006

- Valuable learning experiences occur when adults provide children with the "tools" they need to then make child-guided learning experiences valuable.
  Shanahan & Lonigan, 2013

Interleaving in Alphabet Instruction

Teaching more than one letter at a time with component parts results in better learning outcomes for young children.

(Sunde, Furnes, & Lundetræ, 2020; Vadasy & Sanders, 2021)

Aa /ă/ apple
Bb /b/ bus

Letter Instruction Components
- Name
- Shape (uppercase/lowercase)
- Sound
- Target word
- Mouth shape
- Writing it

Research Findings on Alphabet Learning in Preschool

Optimal Learning Processes:
- Paired associate learning (powerful for memory learning)
  - repetition and practice associating the letter label and letter form
- Articulation-referencing learning
  - speech part of the speech—print connection
  - mouth movements and mirrors
- Orthographic learning
  - letter writing
    (Roberts et al., 2019)

Take Away Thoughts

Key points:
- Active, social engagement is vital for brain development.
- Learning is interconnected across developmental domains.
- Intentional interactions are important for language and learning.
- Following a child's lead is really "tuning into the child" through knowledge of the child's abilities and needs.
- **YOU** are really important in young children's lives!