Putting the Pieces Together

A Cognitive Processing Model for Speech, Language, Literacy & Executive Functioning

Tera Sumpter, M.A., CCC-SLP

Who am I?

SLP & BUSINESS OWNER

14 years experience in speech-language pathology

Growing Cleveland area private practice--Seeds of Learning LLC--with two locations

AUTHOR & COMMUNITY ADVOCATE

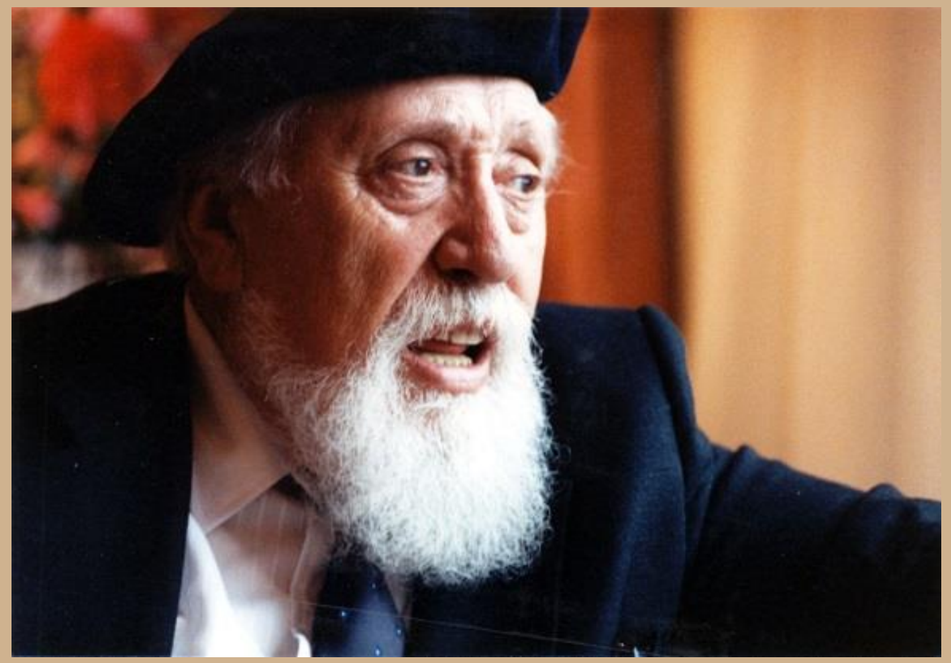
Author of: *Seeds of Learning: A Cognitive Processing Model for Speech, Language, Literacy, and Executive Functioning*

Host and instructor for Seeds of Learning Mighty Networks Community

TERA SUMPTER

Neuroplasticity & Metaplasticity

Cognitive Modifiability

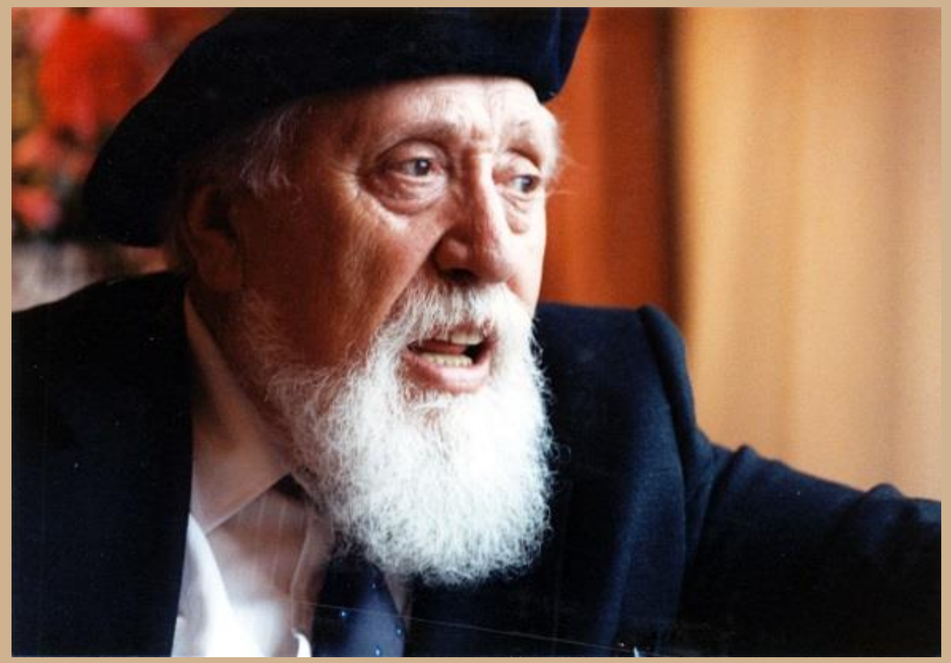


“Structural changes refer not to isolated events but to the organism's manner of interacting with, i.e., acting on and responding to, sources of information. ”

-Reuven Feuerstein

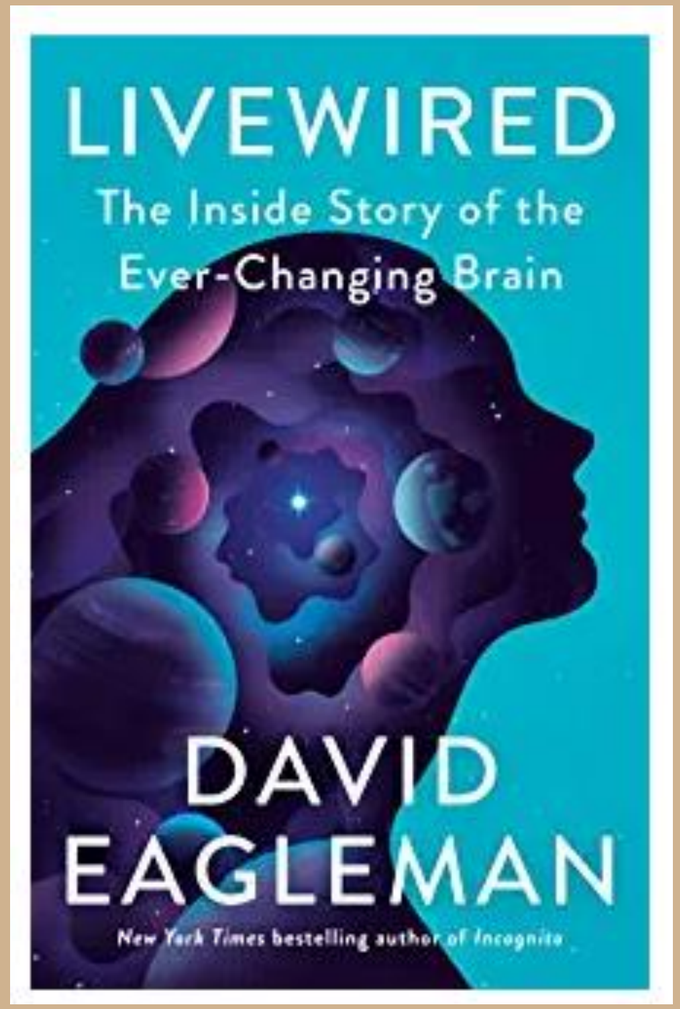
(Feuerstein, Falik, and Rand (2006), *Creating and Enhancing Cognitive Modifiability: The Feuerstein Instrumental Enrichment Program*, ICELP Publications, page 16.)

Cognitive Modifiability



“Thus, a *structural change*, once set in motion, will determine the future course of an individual's development. ”
-Reuven Feuerstein

(Feuerstein, Falik, and Rand (2006), *Creating and Enhancing Cognitive Modifiability: The Feuerstein Instrumental Enrichment Program*, ICELP Publications, page 16.)



"The brain's ability to rewire gives it tremendous flexibility: it dynamically reconfigures itself to absorb and interact with data."

-David Eagleman

My Goal for Today...

Keys to Academic Success

1. Comprehension

1.

2. Expression

1.

3. Reading

1.

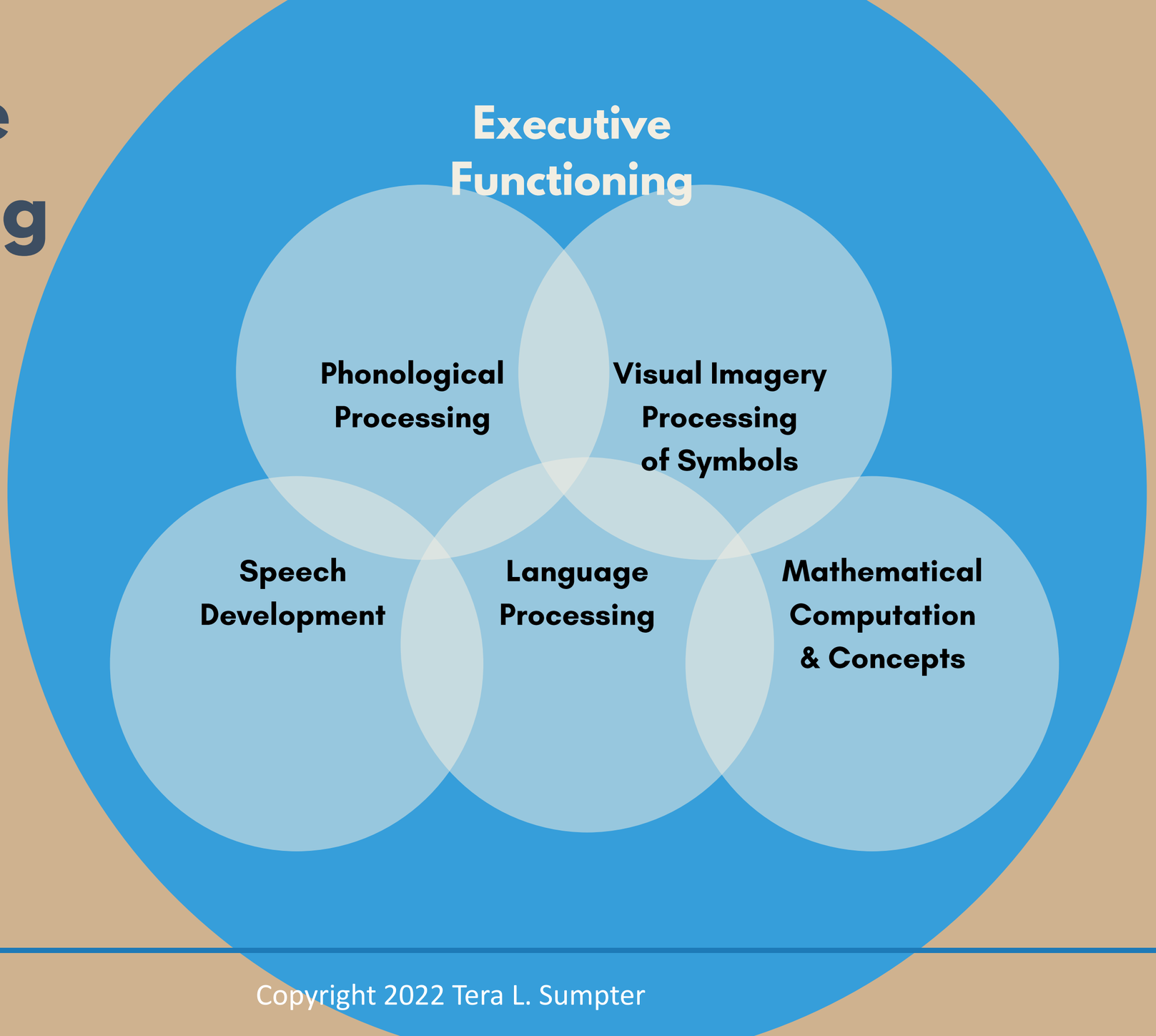
4. Writing

1.

5. Self-Regulation

1.

Cognitive Processing Model



Cognitive Processing Model

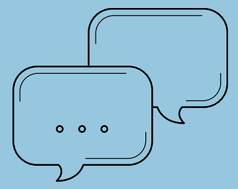
Executive Functioning

Phonological Processing

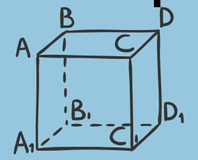
Visual Imagery Processing of Symbols

Speech Development

Language Processing



Mathematical Computation & Concepts



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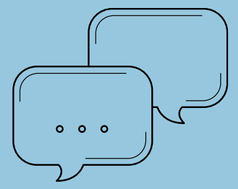

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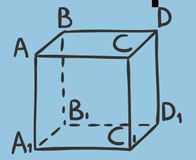

Speech Development

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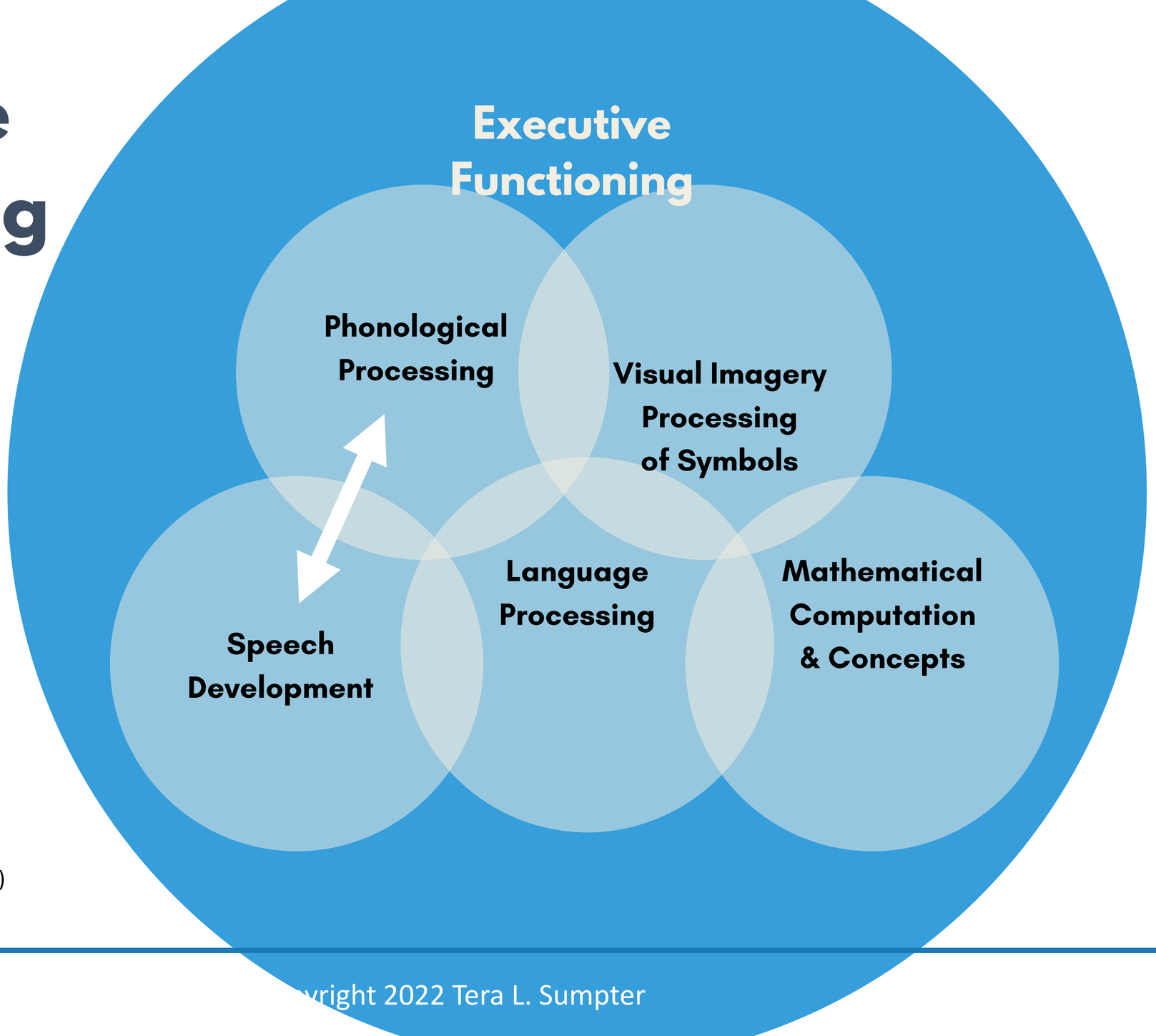

(Barbara, A.L., et al, 2015)
(McNeill, B.C., et al., 2009)
(Rvachew & Grawburg, 2006)
(Gillon, 2000)

“Children with CAS are particularly susceptible to phonological awareness and reading delay. “

(McNeill, B.C., et al., 2009)

“Research indicates that phonological awareness intervention holds promise for children with speech impairment.”

(Gillon, 2000)

More than half the children with speech disorders experience trouble reading

(Bishop & Adams, 1990; Catts, Adlof, Hogan, & Weismer, 2004;
Catts, 1986; Catts, 1991; Catts, Fey, Tomblin, & Zhang, 2002; McCardle, Scarborough, & Catts, 2001;
Nathan, Stackhouse, Goulandris, & Snowling, 2004; Tomblin, Zhang, Buckwalter, & Catts, 2000).

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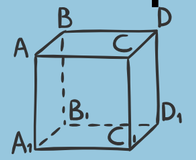
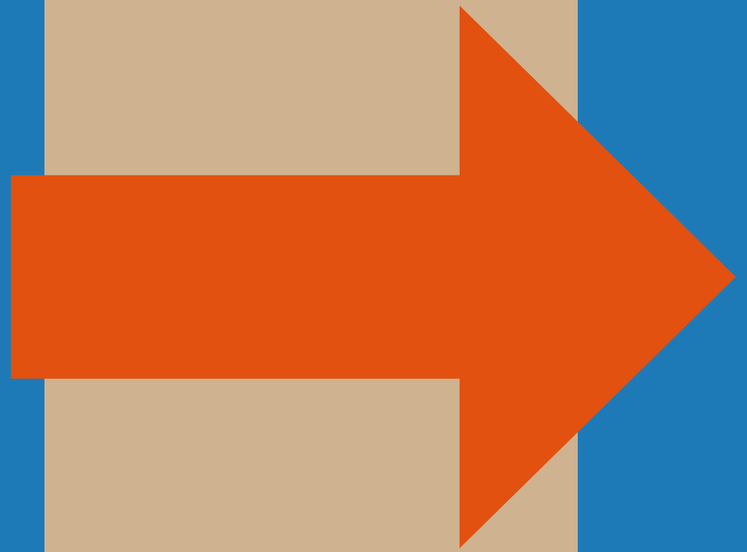


Language



EX

“Language isn’t all encompassing; it’s only a way to tag things that we already share. It’s a system of agreement about communal experiences.”

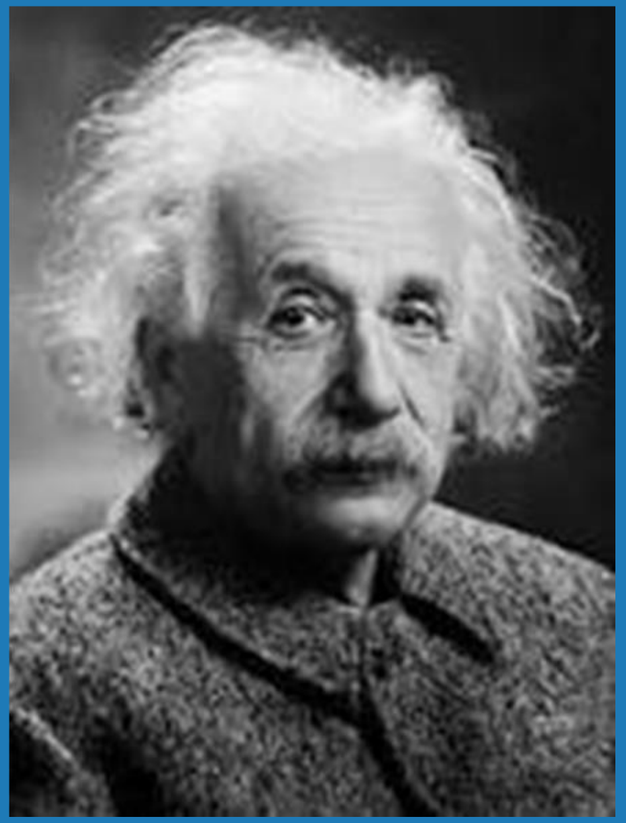
-David Eagleman, neuroscientist

“I don't think that we think in language, or think in words. I think we think in visual images, we think in auditory images, we think in abstract propositions about what is true about what.”

-Steven Pinker, experimental psychologist at Harvard University

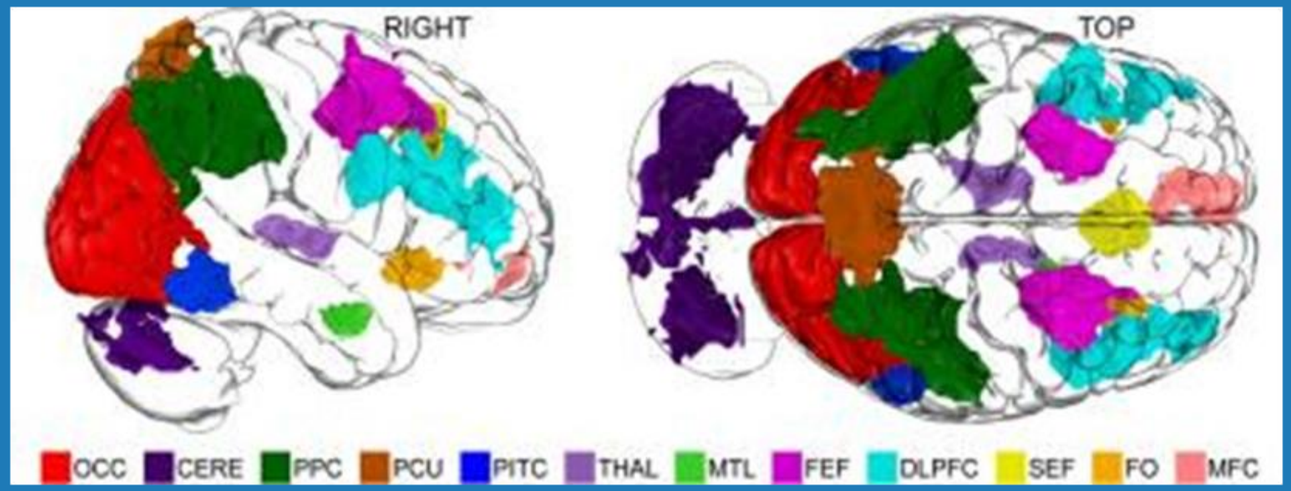
“If I can’t picture it,
I can’t understand it.”

-Albert Einstein



EX

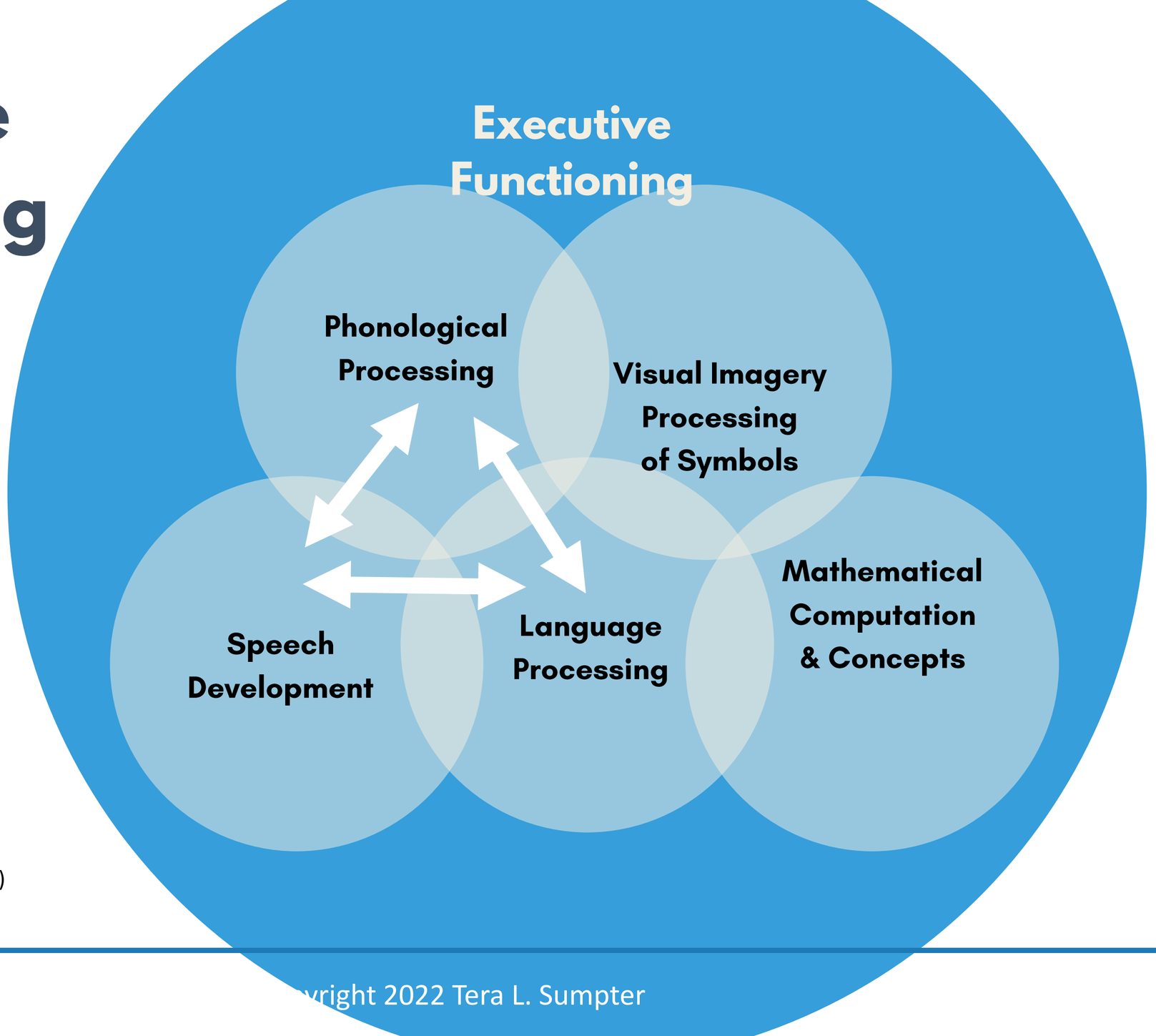
MENTAL WORKSPACE



Eleven areas of the brain are showing differential activity levels in a Dartmouth study using functional MRI to measure how humans manipulate mental imagery.

(Schlegel, A. et al, 2013)

Cognitive Processing Model



(Barbara, A.L., et al, 2015)
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(Rvachew & Grawburg, 2006)
(Gillon, 2000)

“Children with SSD are at greatest risk of delayed PA skills if they have poor speech perception abilities and/or relatively poor receptive vocabulary skills.”

(Rvachew & Grawburg, 2006)

“Performance on phonological encoding tasks was more strongly affected by the size of a child’s receptive & expressive language lexicons rather than speech production accuracy.”

(Munson, B. & Krause, M.O.P., 2017)

“Adolescents with persistent SSD had higher rates of comorbid LI and reading disability than the no SSD and resolved SSD groups.”

(Barbara, A.L., et al, 2015)

It’s all connected!

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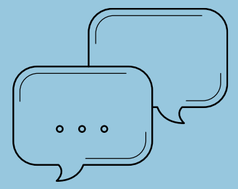
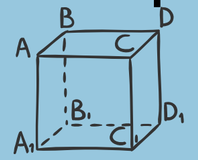


Mathematical Computation & Concepts

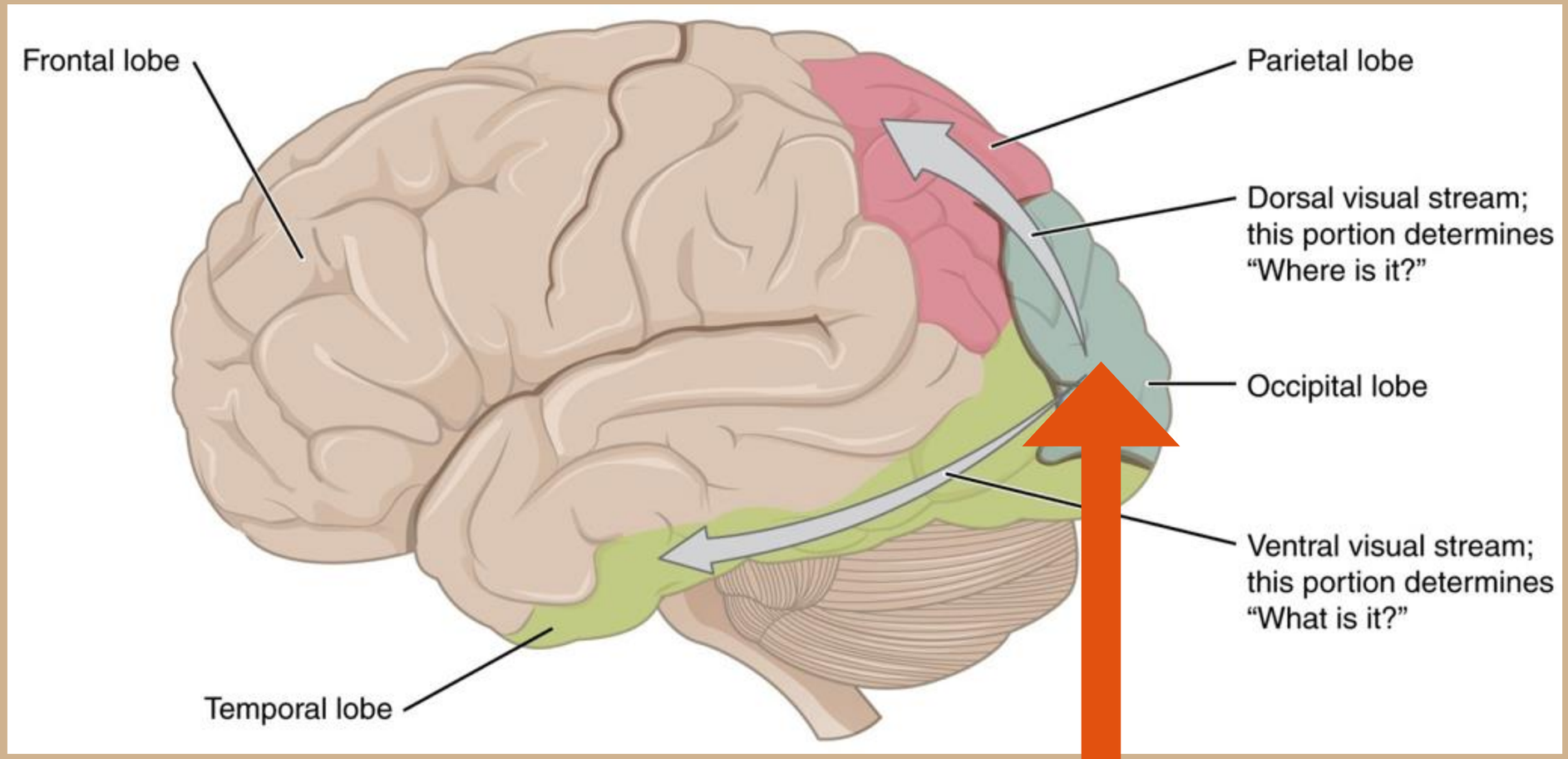


EX

VISUAL IMAGERY PROCESSING

Symbols

VISUAL IMAGERY PROCESSING

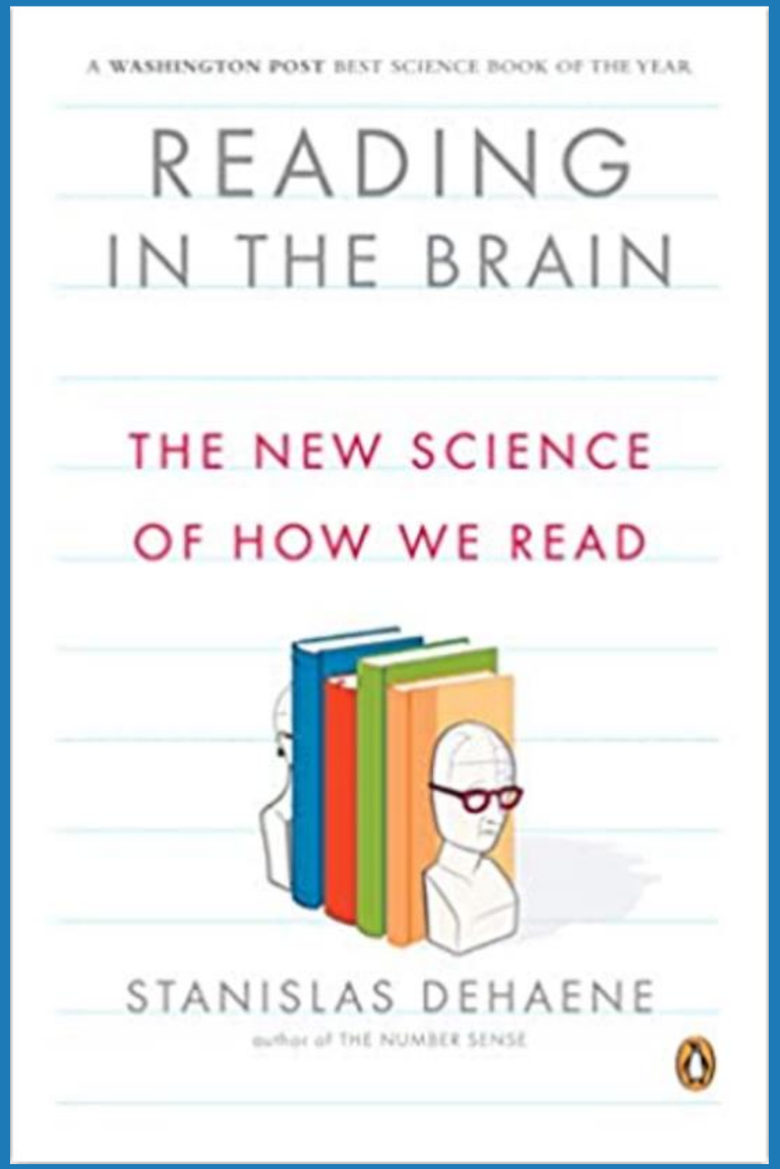


Left Ventro-Occipital Cortex:
Visual Word Form Area

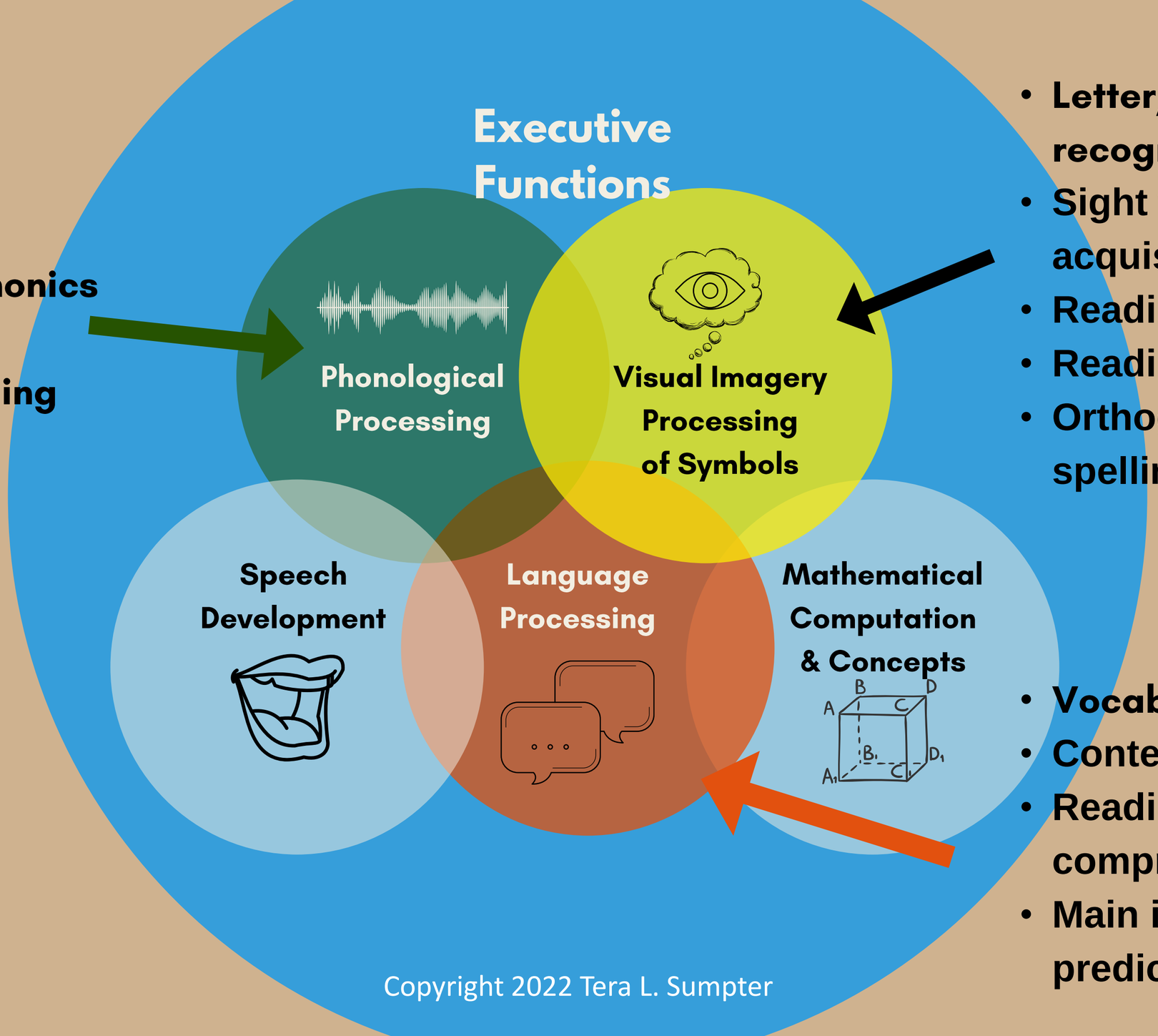
(Dehaene, S. et al, 2010)

VISUAL IMAGERY PROCESSING

I highly recommend...



- Sound to symbol/phonics
- Sounding out/decoding
- Reading accuracy
- Phonetic spelling



- Letter/word recognition
- Sight word acquisition
- Reading rate
- Reading fluency
- Orthographic spelling

- Vocabulary
- Context cues
- Reading comprehension
- Main idea, inferences, predictions

The Literacy "SHIFT"

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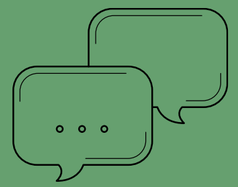

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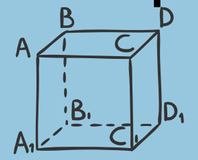
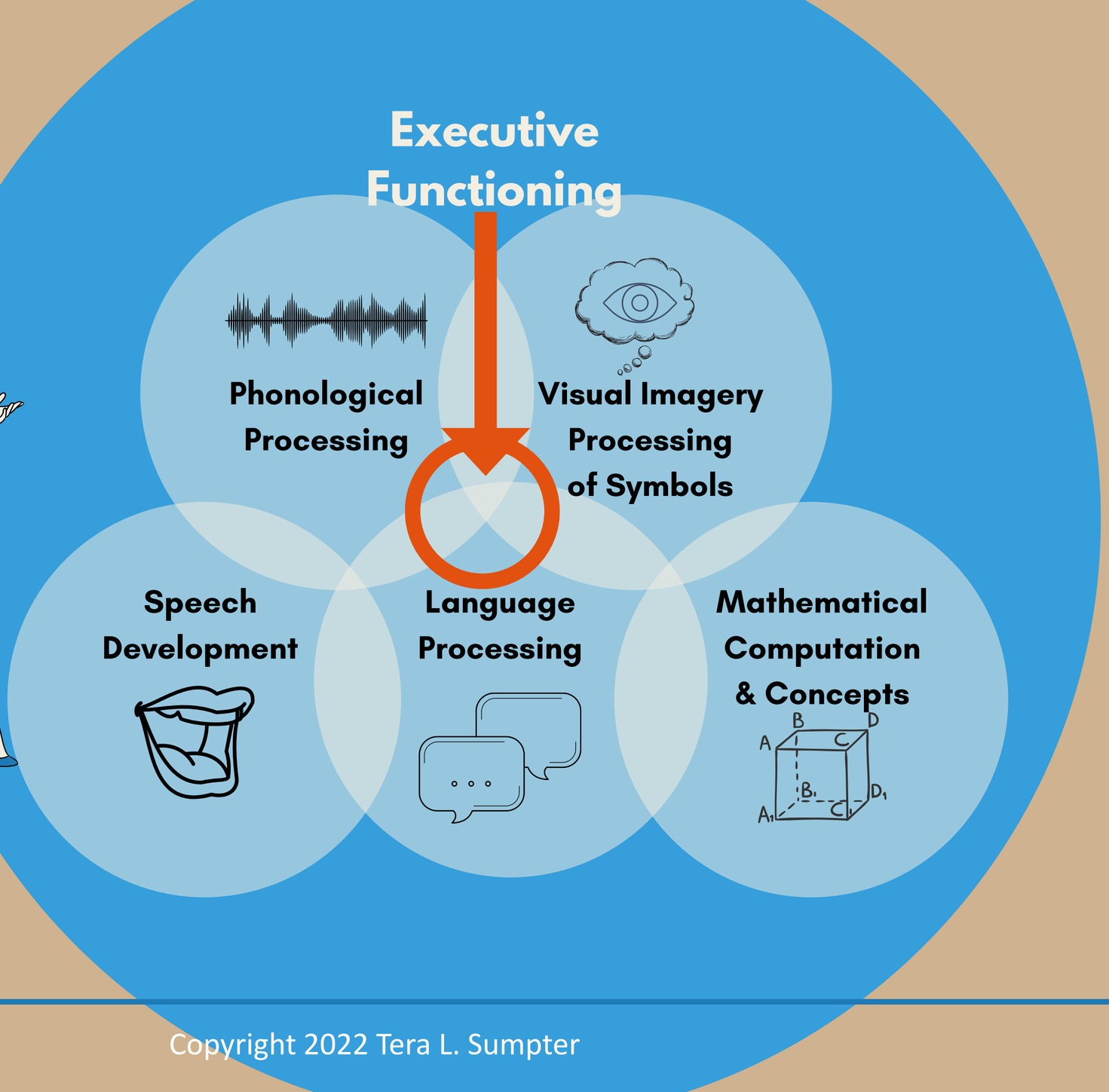
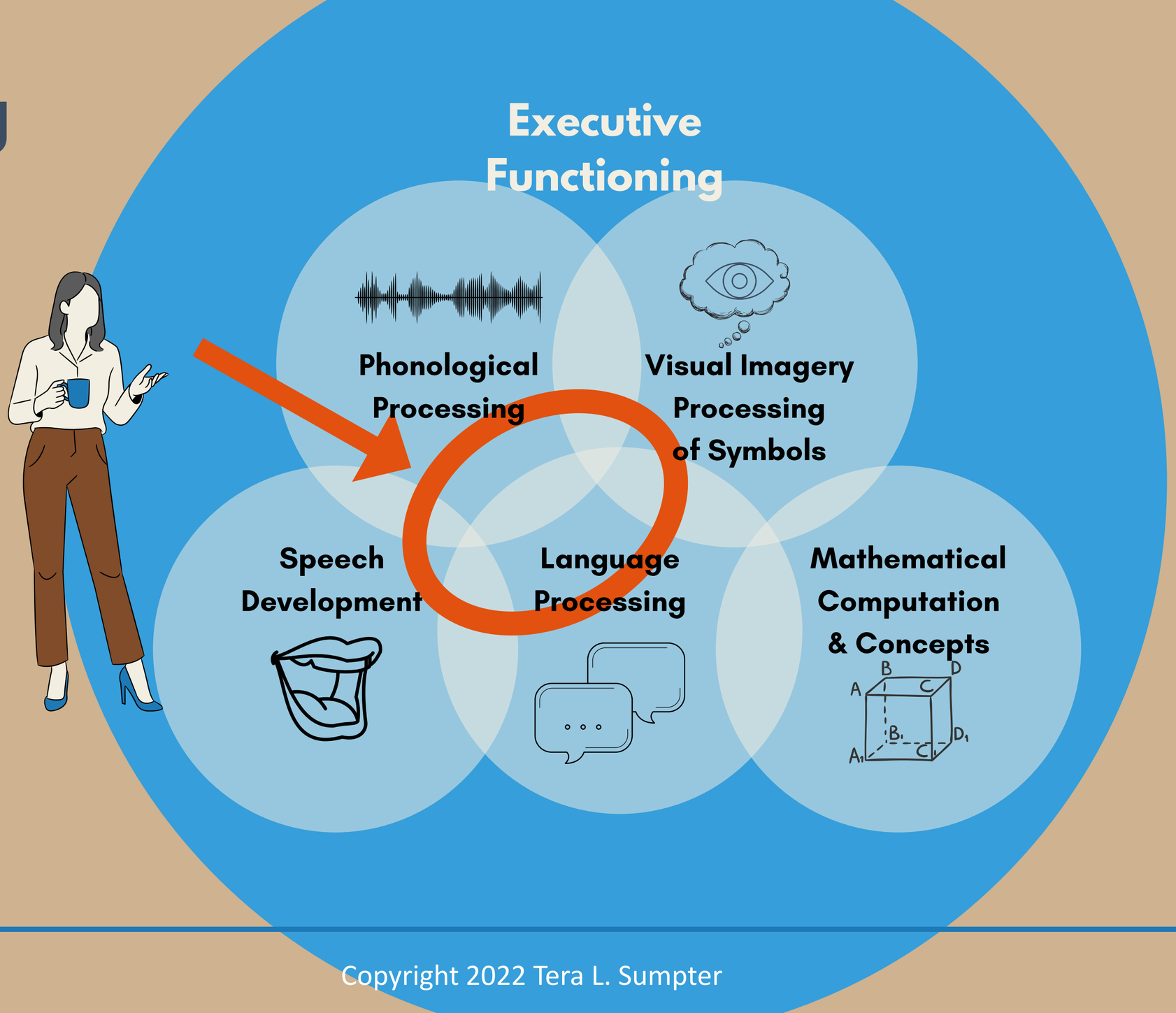


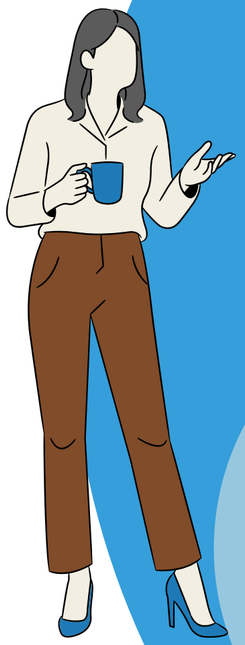
Quiet Paragraph Reading

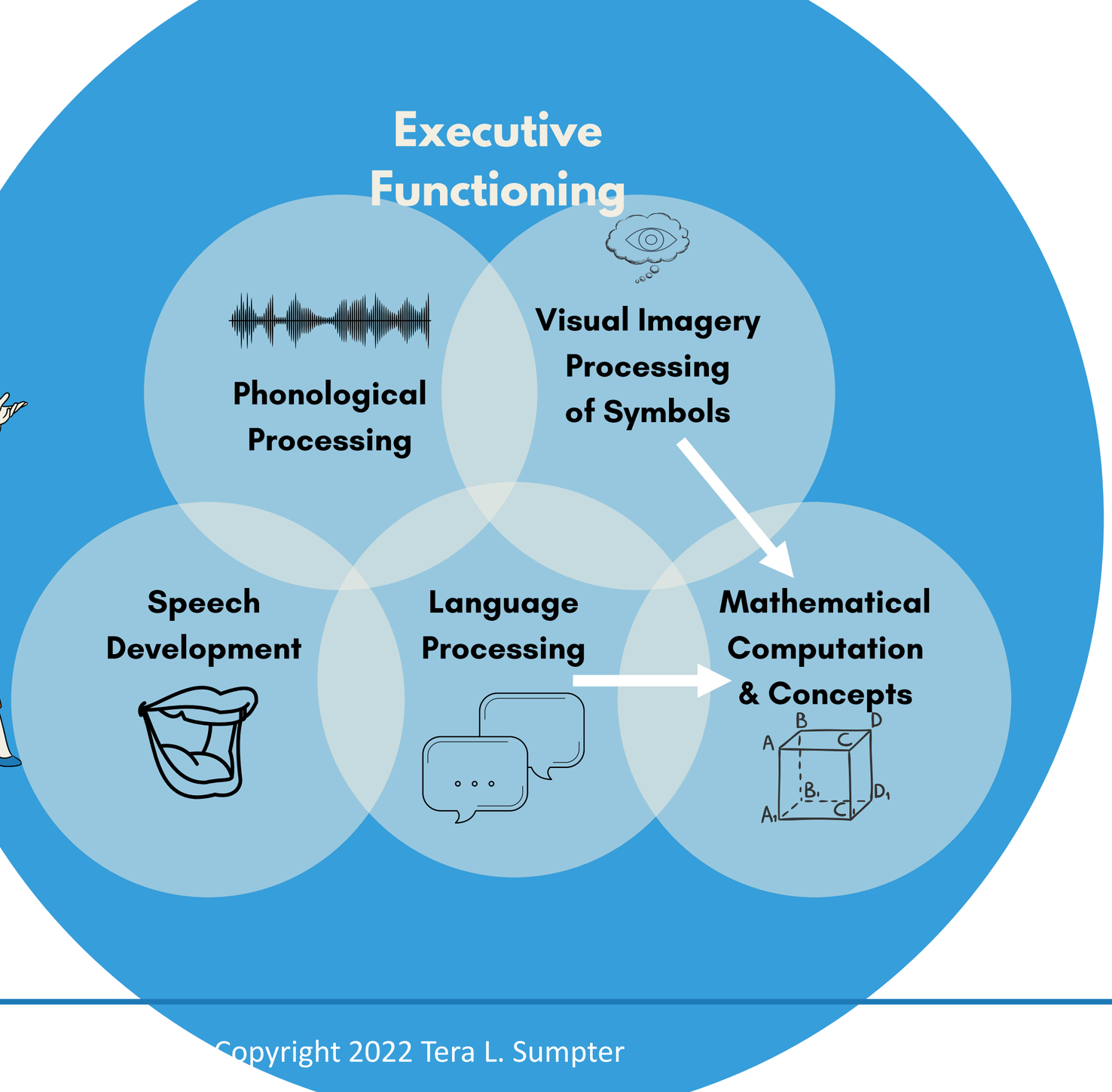


Reading Aloud



Math





Math

Executive

Students with a math disability are just over two times more likely to also have a reading disability than those without a math disability.

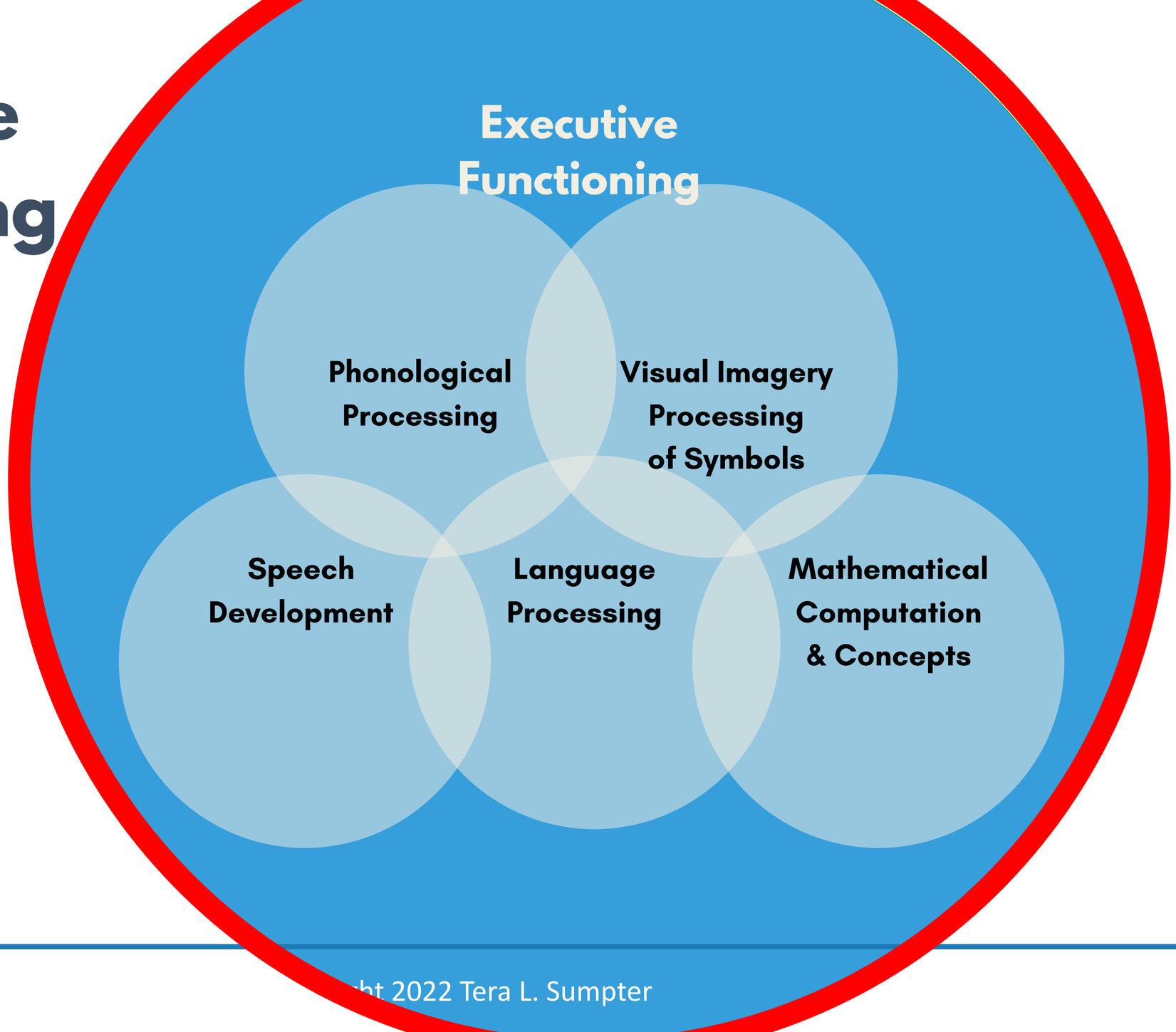
(Joyner & Wagner, 2020)

Ma

Research suggests that reading disorders and math disorders are distinct but related disorders that co-occur due to shared neuropsychological weaknesses in working memory, processing speed, and verbal comprehension.

(Willcutt, E.G. et al, 2013)

Cognitive Processing Model



Executive Functions

Sumpter

Executive Function Skill Clusters (McCloskey 2015)

ATTENTION

Perceive
Focus
Sustain

OPTIMIZATION

Monitor
Modulate
Balance
Correct

INQUIRY

Anticipate
Guage
Analyze
Estimate time
Compare

ENGAGEMENT

Energize
Initiate
Inhibit
Stop
Pause
Flexible
Shift

EFFICIENCY

Sense time
Pace
Sequence
Execute

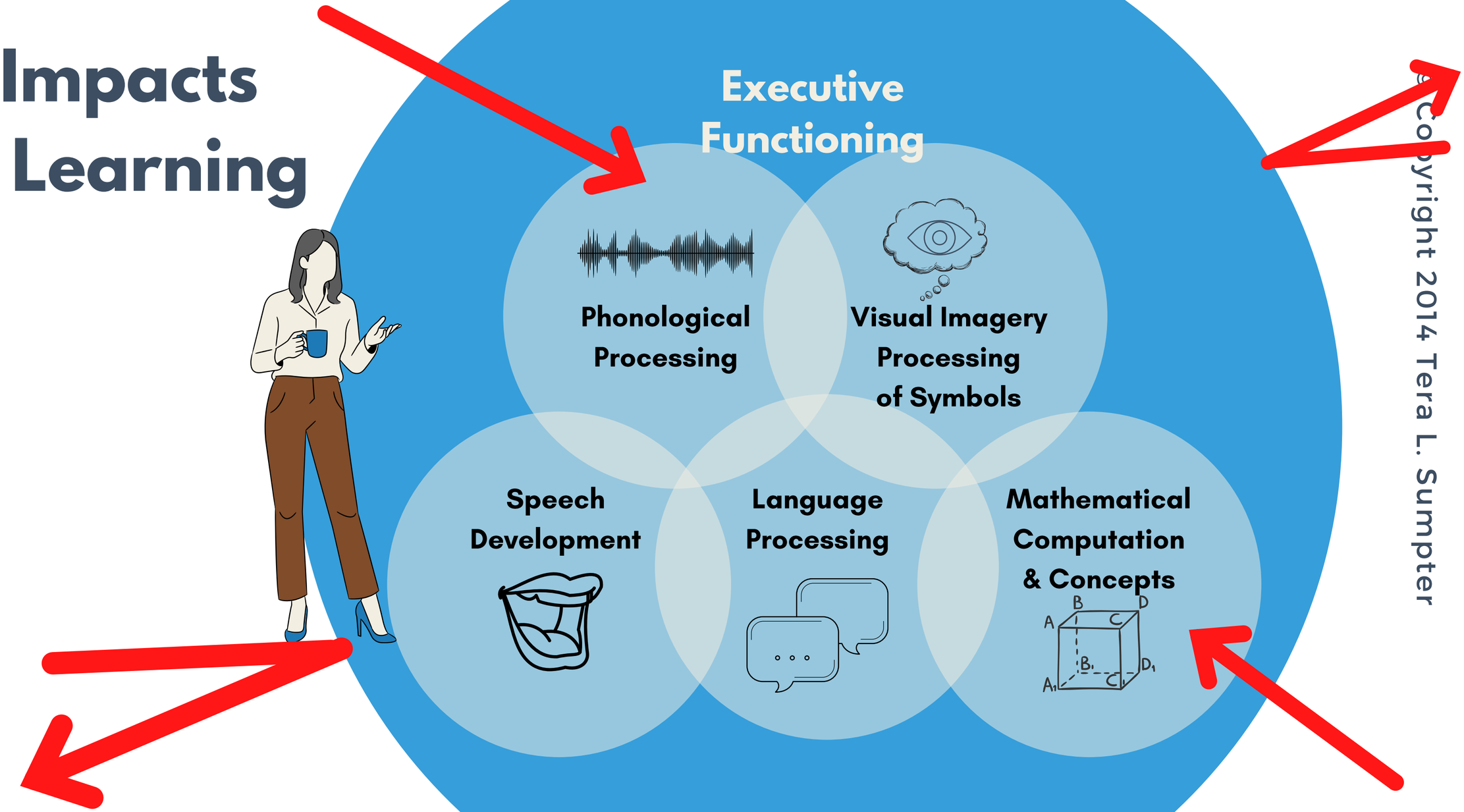
MEMORY

Hold
Manipulate
Store
Retrieve

SOLUTION

Generate
Associate
Prioritize
Plan
Organize
Decide

EF Impacts on Learning



Assessment

Specific Language Impairment

Dysgraphia

Dyslexia

Dyscalcula

Specific Language Disability

Speech or Language Impairment

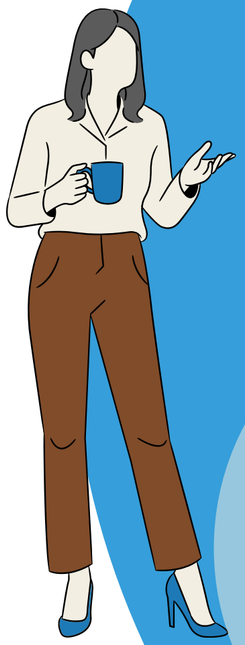
Learning Disability

Traumatic Brain Injury

Intellectual Disability

P. O. P.

Patterns Of Processing



Executive Functioning

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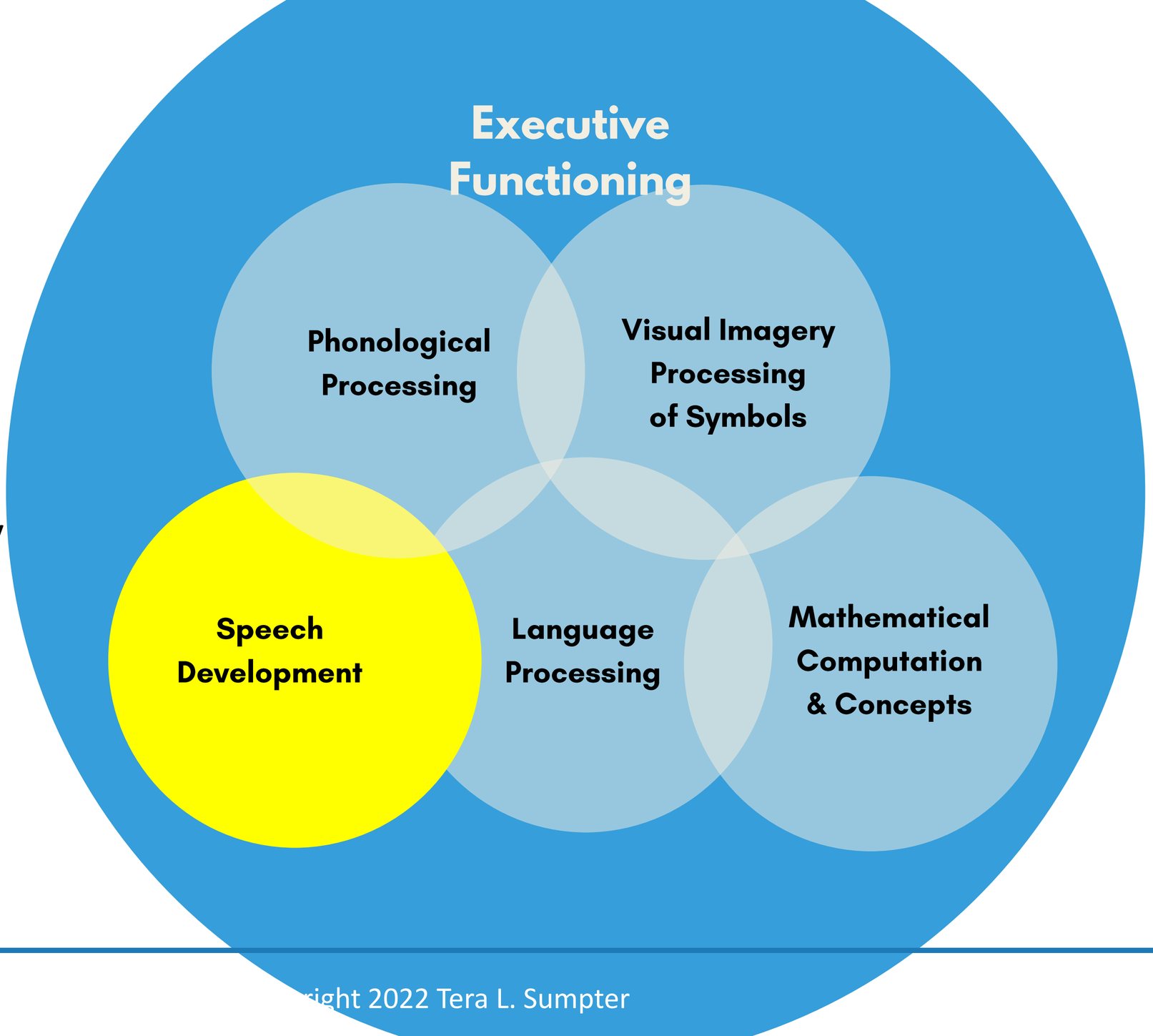
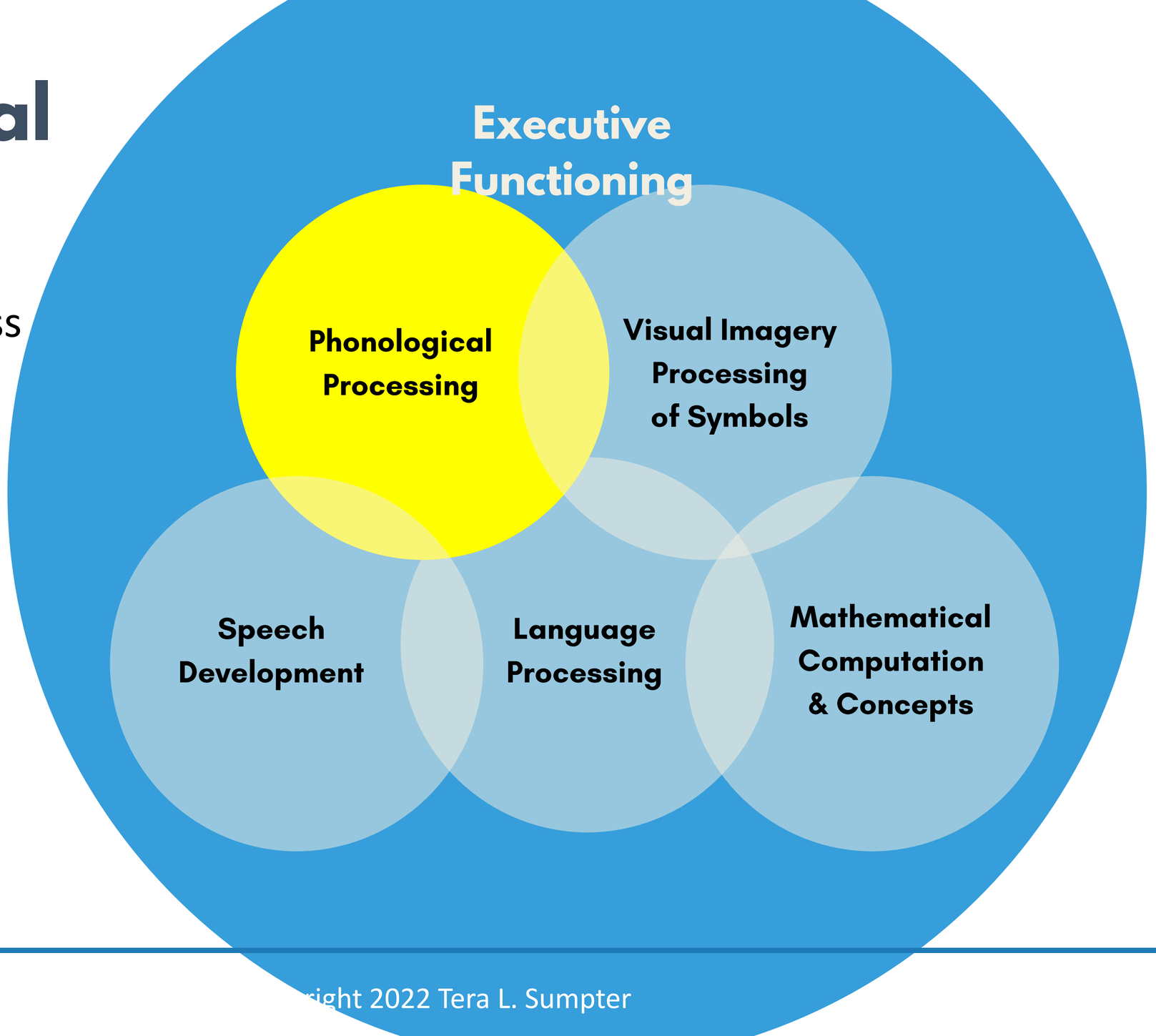
Speech

- Speech inventory (GFTA-3, Moving Across Syllables)
- DDK
- Natural speech sample/conversation/ play
- Recordings from home



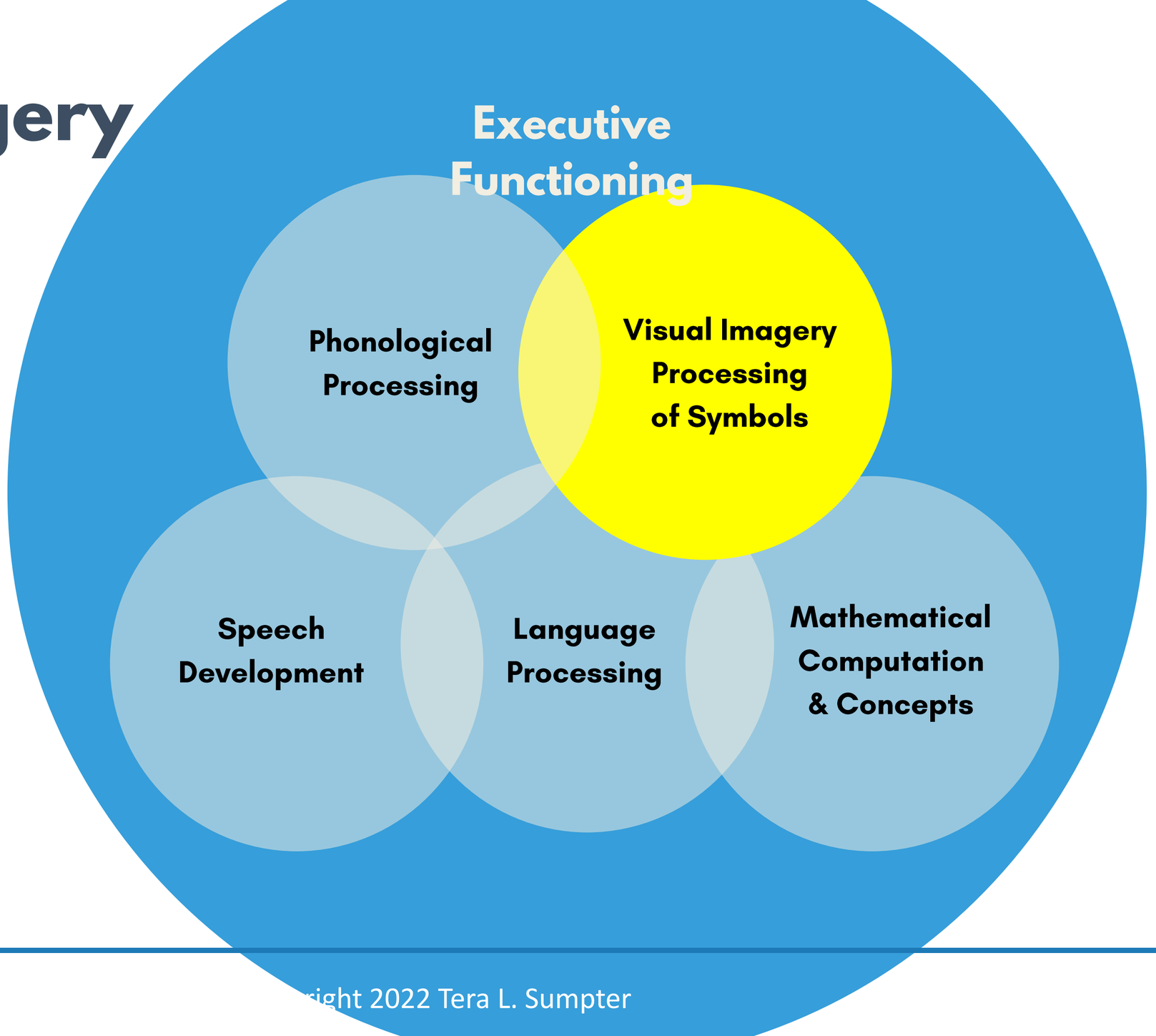
Phonological Processing

- Phonemic Awareness (Lindamood Auditory Conceptualization test)
- Phonics
- Nonsense word decoding (Word Attack: Woodcock Johnson)
- Nonsense word spelling



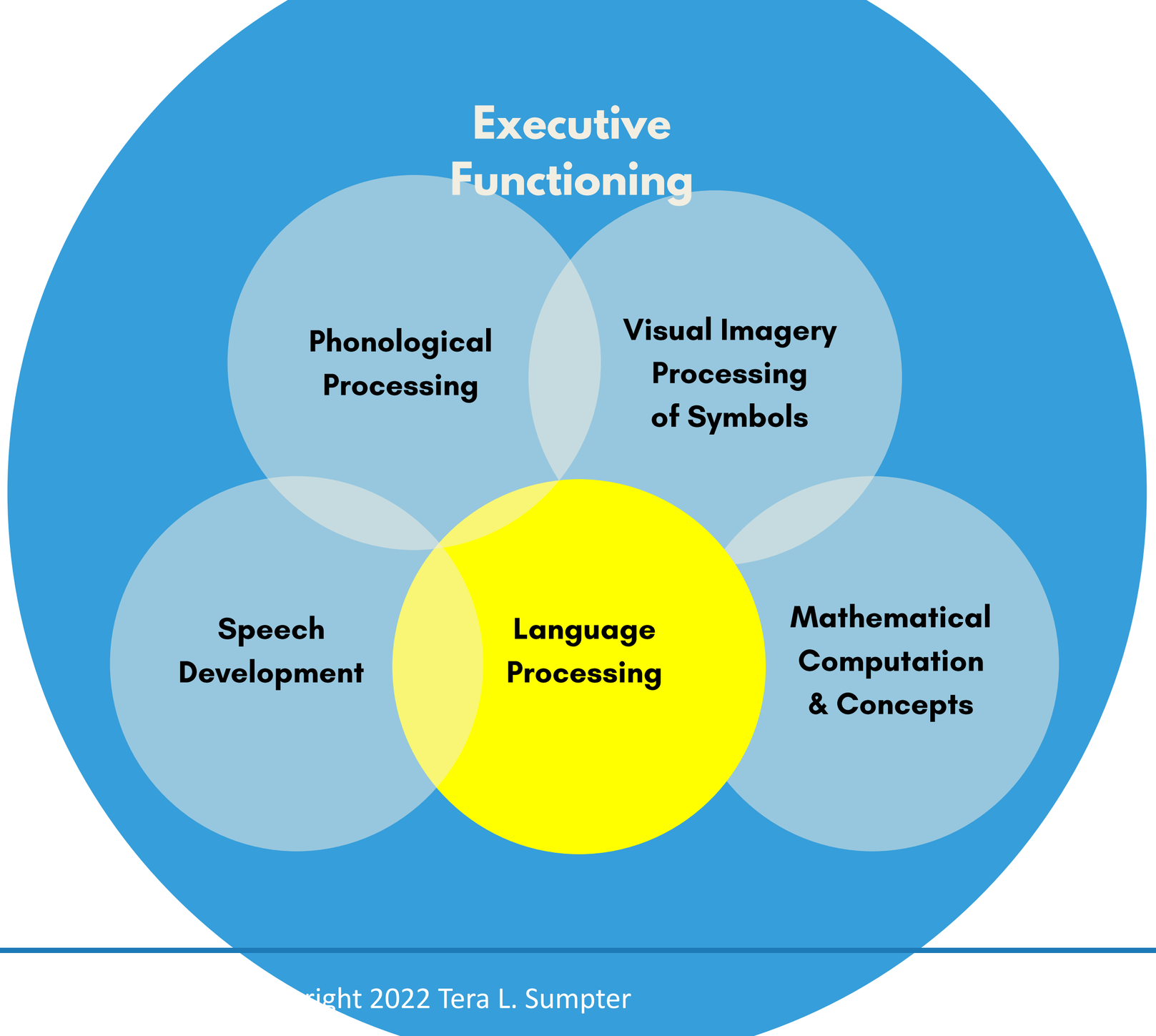
Visual Imagery Of Symbols

- Symbol Imagery Test
- Sight word inventory (SORT-R3)
- Orthographic spelling (WRAT-4 Spelling)



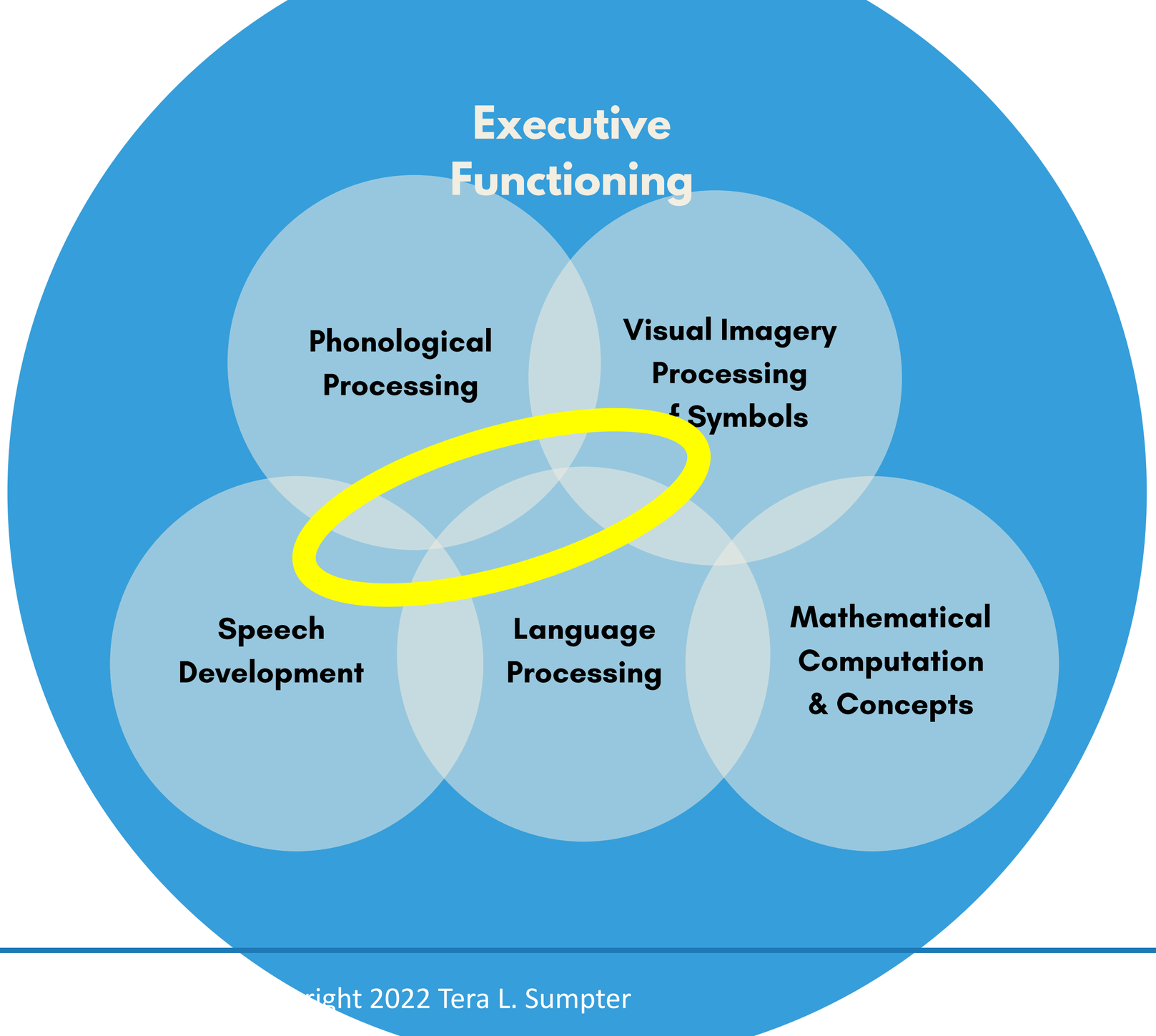
Language

- Language assessments of different lengths and complexities (PLS-5, CELF-5)
- Written language measure
- Conversational language sample



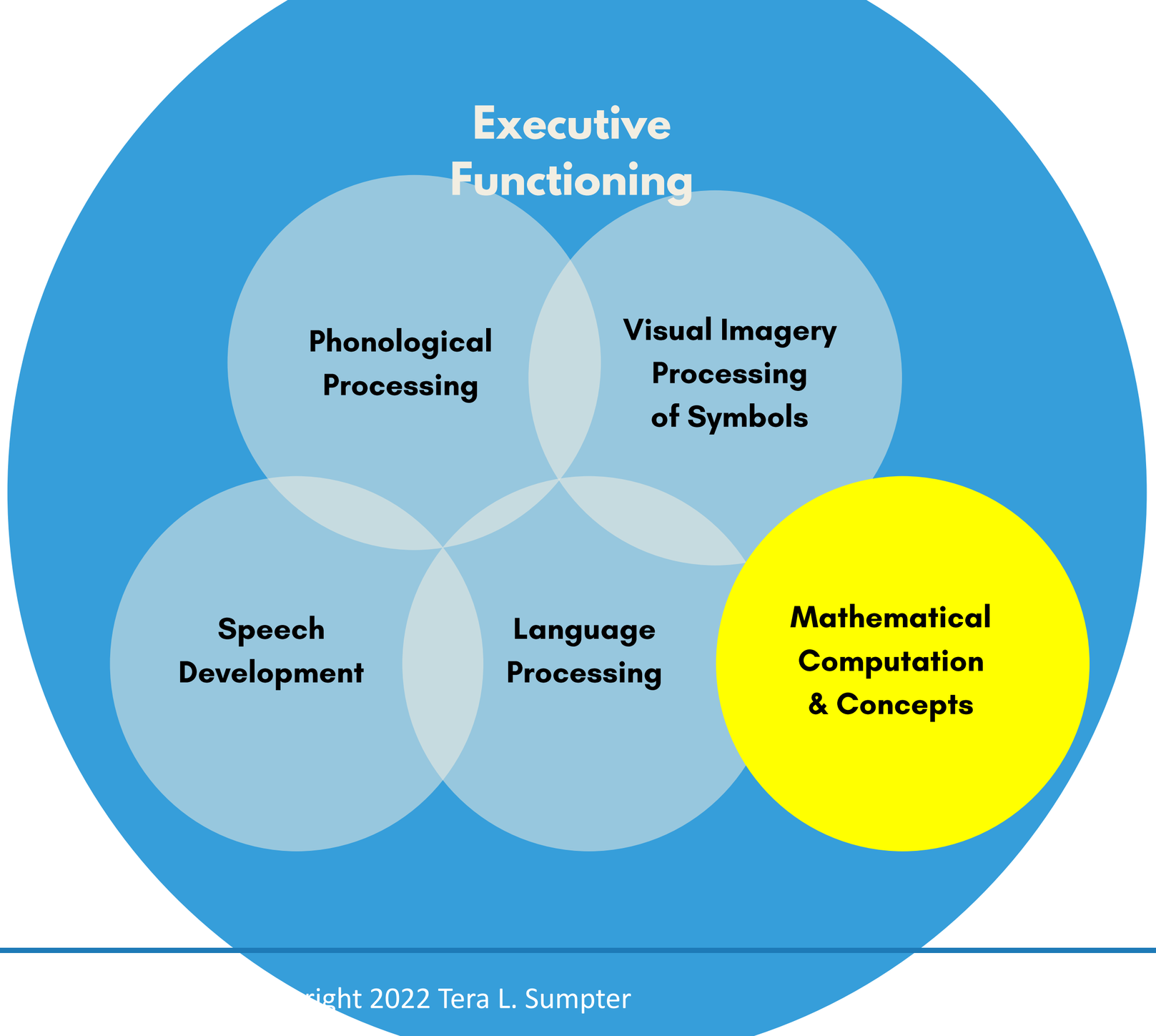
Reading in Context

- Integrated literacy measure (GORT-5)



Math

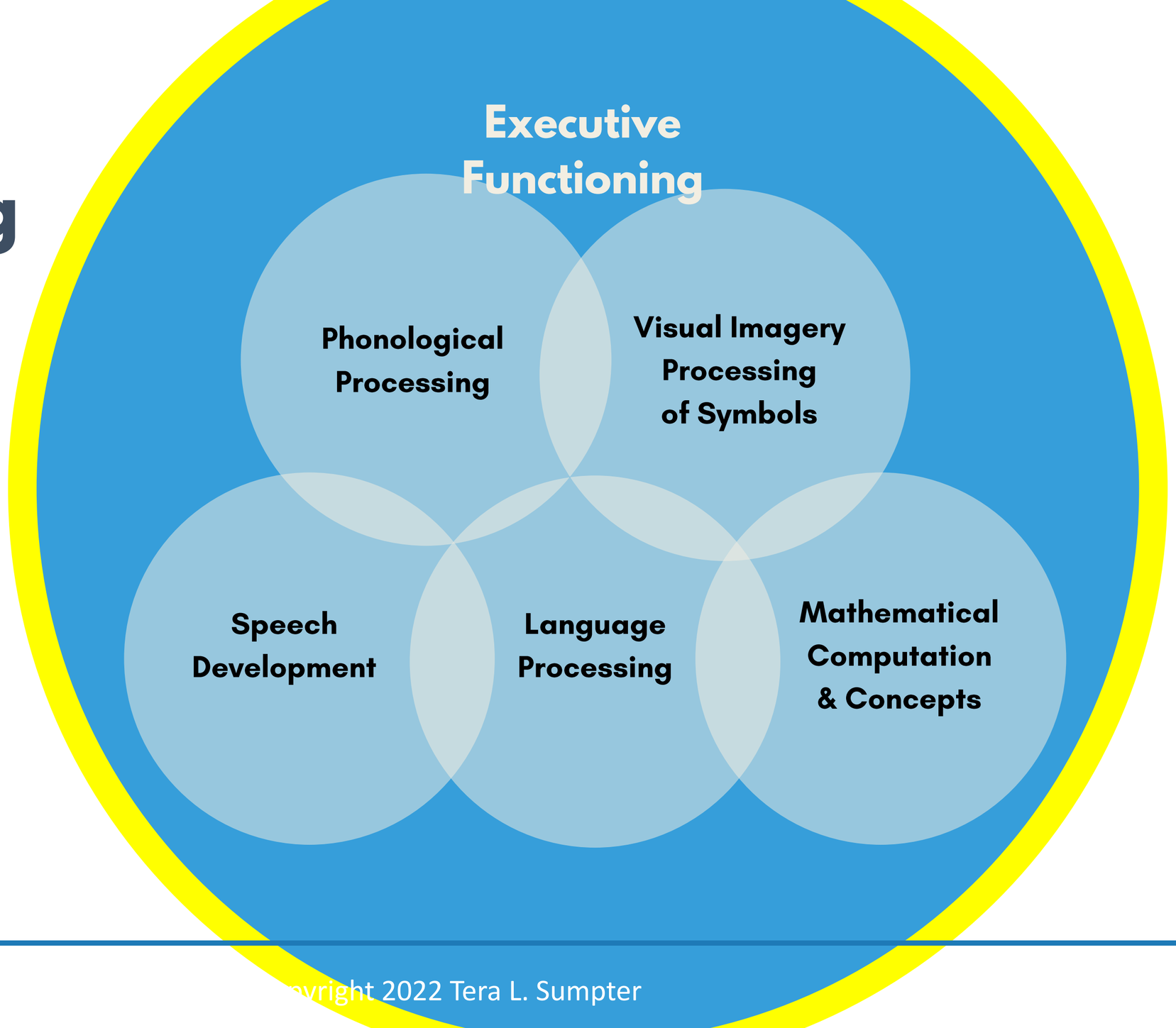
- Math academic test (WRAT-5)
- Classroom work samples



Executive Functioning

Dynamic assessment

- Observation
- Parent/teacher rating scales
- Self-report
- Work samples
- Questionnaires

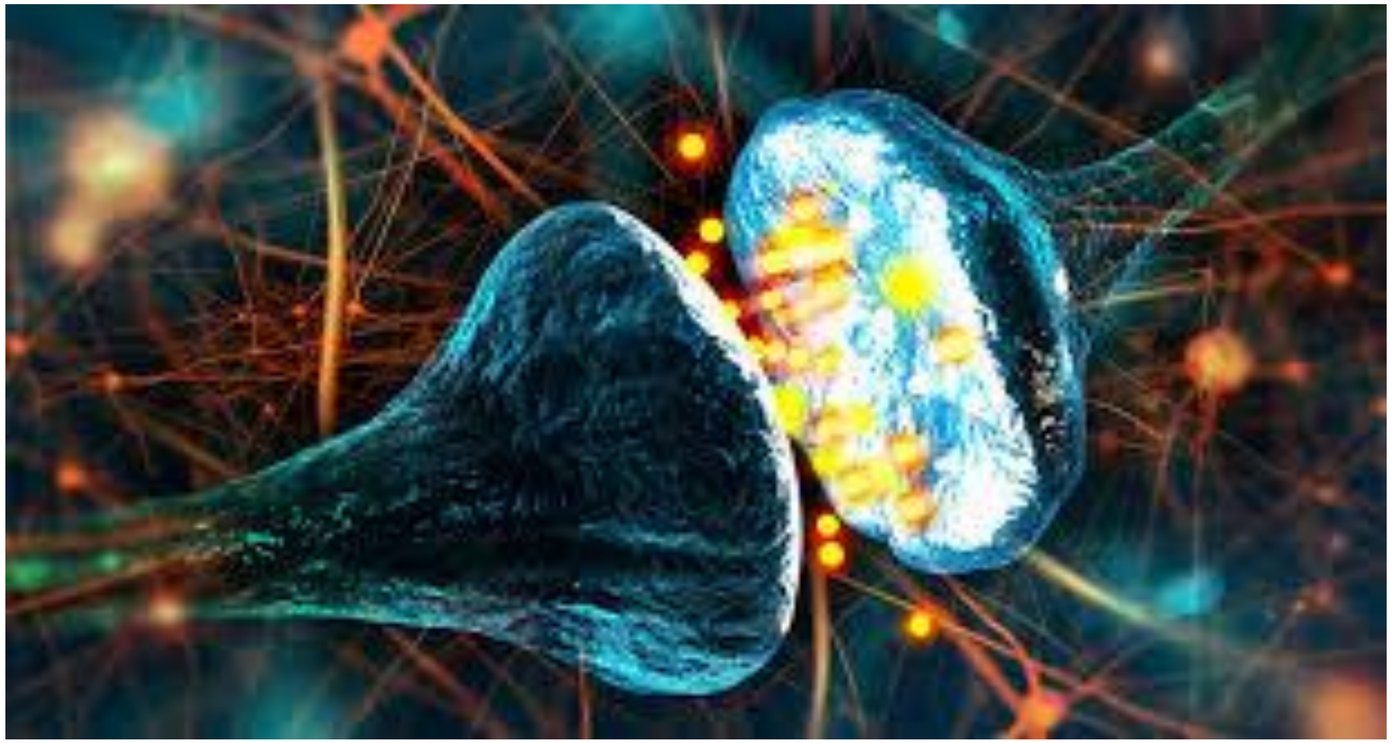


Assessment Notes:

- Does your assessment tool require more than one type of cognitive processing? (ex. Phonological processing assessed using verbal expression.)
- Are you examining receptive & expressive pathways?
- if assessing reading comprehension, always compare to oral comp!

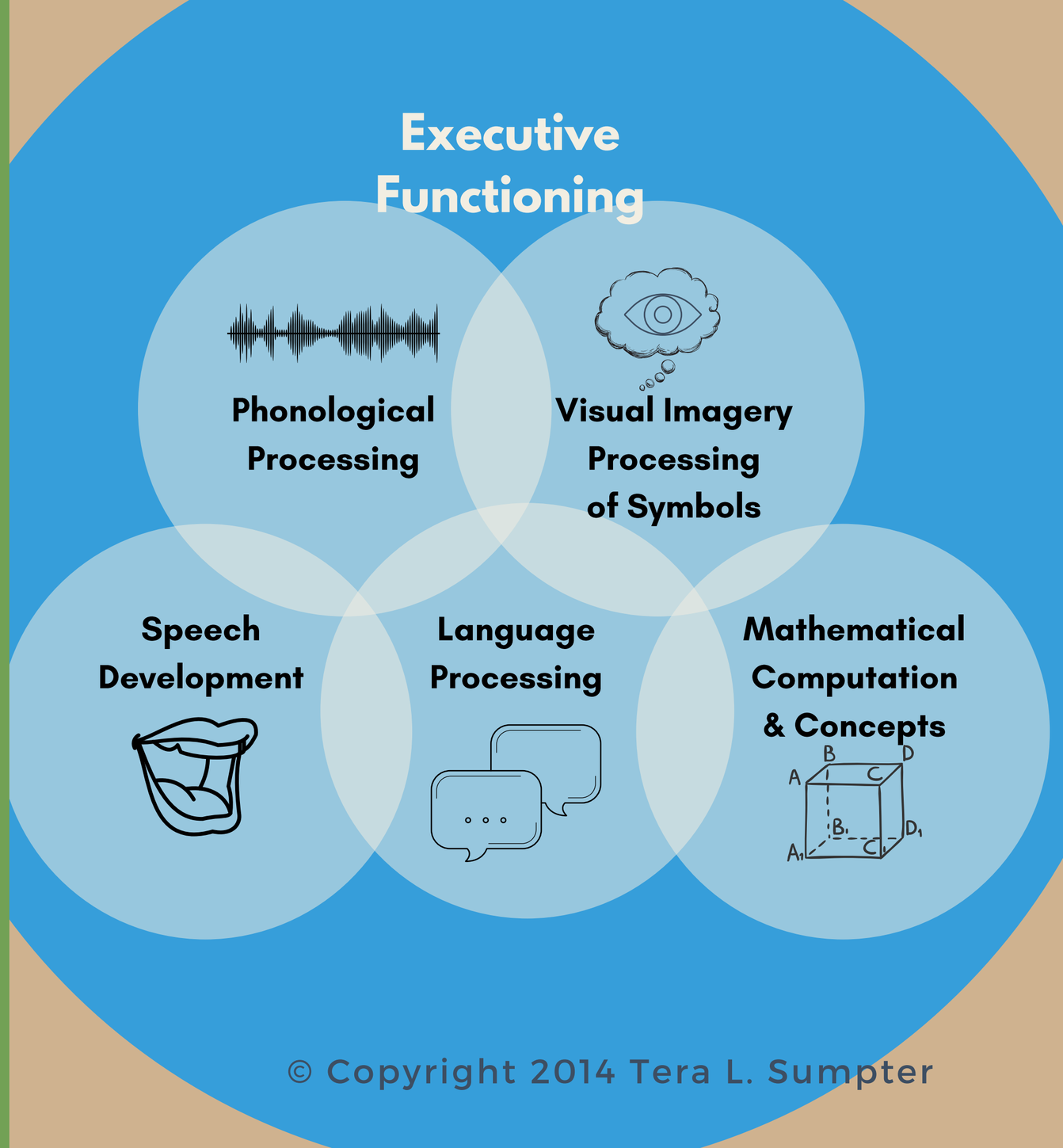
Intervention

What is learning?

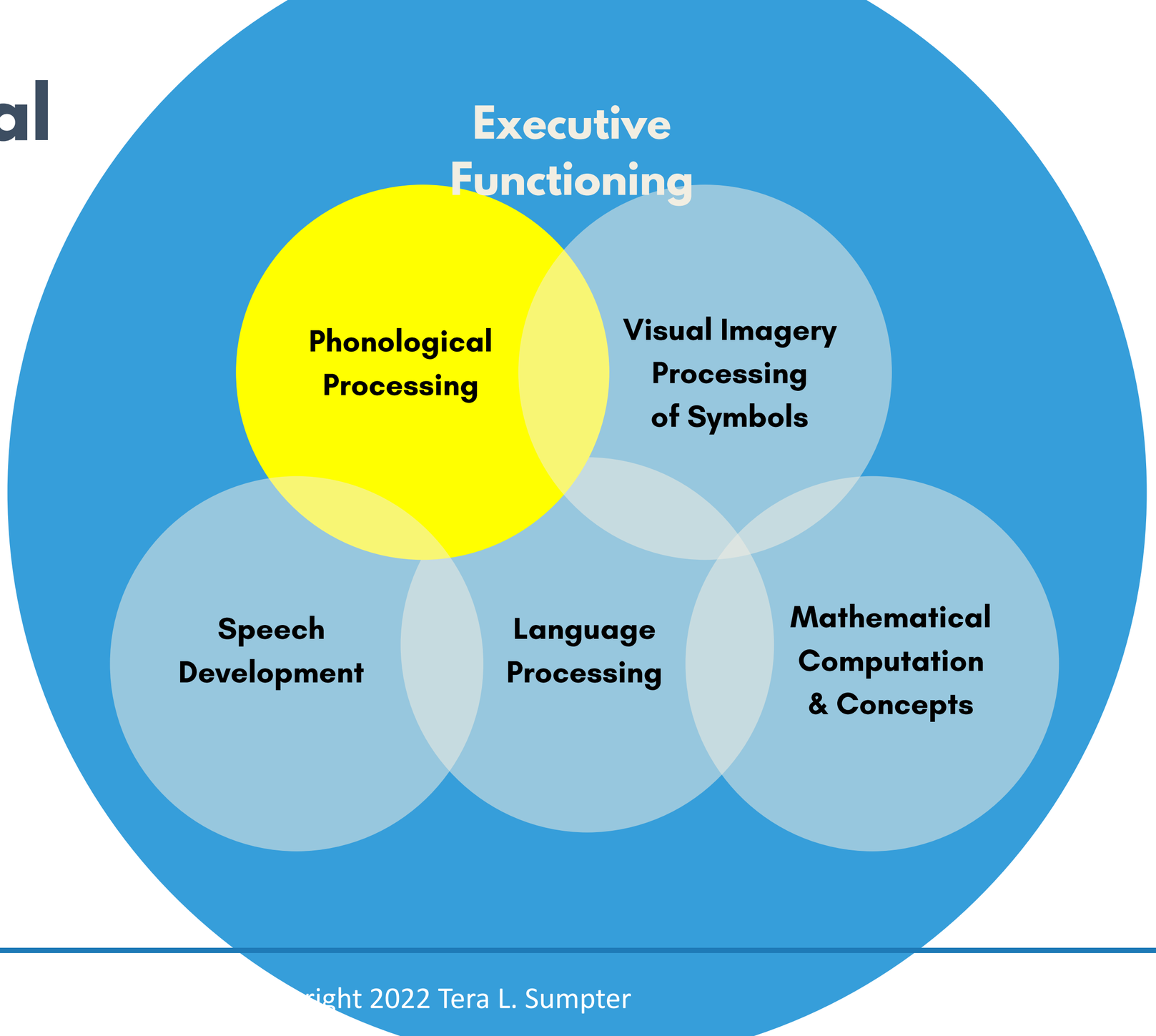


Student A

- Does well in math and science
- Comprehends everything presented orally
- Struggles in language arts
- Has had speech therapy since 4-years old
- Traditional speech therapy has not been very successful
- Has residual articulation errors of /r/, /s/ and /l/. Speech is "slushy"
- Reading scores are below average
- Doesn't attempt to sound out when reading
- Guesses a lot when reading
- Spelling is not phonetic
- Reading comprehension is below average.
- Very hard working



Phonological Processing



Sample Chains

CV/VC	CVC	CCVC	2-syllable
eep	pib	flad	aption
ep	pab	flid	iption
et	pad	frid	ipture
it	lad	grid	mipture
ti	lud	grib	miply
too	lug	groob	moply
to		gloob	mogly

Sample Goals

- Dx: phonological impairment with breakdown at CVC syllable structure or literacy impairment characterized by phonological breakdowns at the CVC level

Goal 1: Student will label the number of sounds in a CVC+ word with 90% accuracy to improve phonological processing skills.

Goal 2: Student will label the order and identity of sounds in a CVC+ word with 90% accuracy to improve phonological processing skills.

Goal 3: Student will manipulate (initial, medial, final, blends) sounds in a CVC+ word with 90% accuracy to improve phonological processing skills.

Sample Therapy Activities

1. Orally repeating chains at CVC level
2. Manipulating syllables with mouth pictures
3. Block chains at CVC level
4. Phonics
5. Decoding at CVC level
6. Contextual reading at CVC level

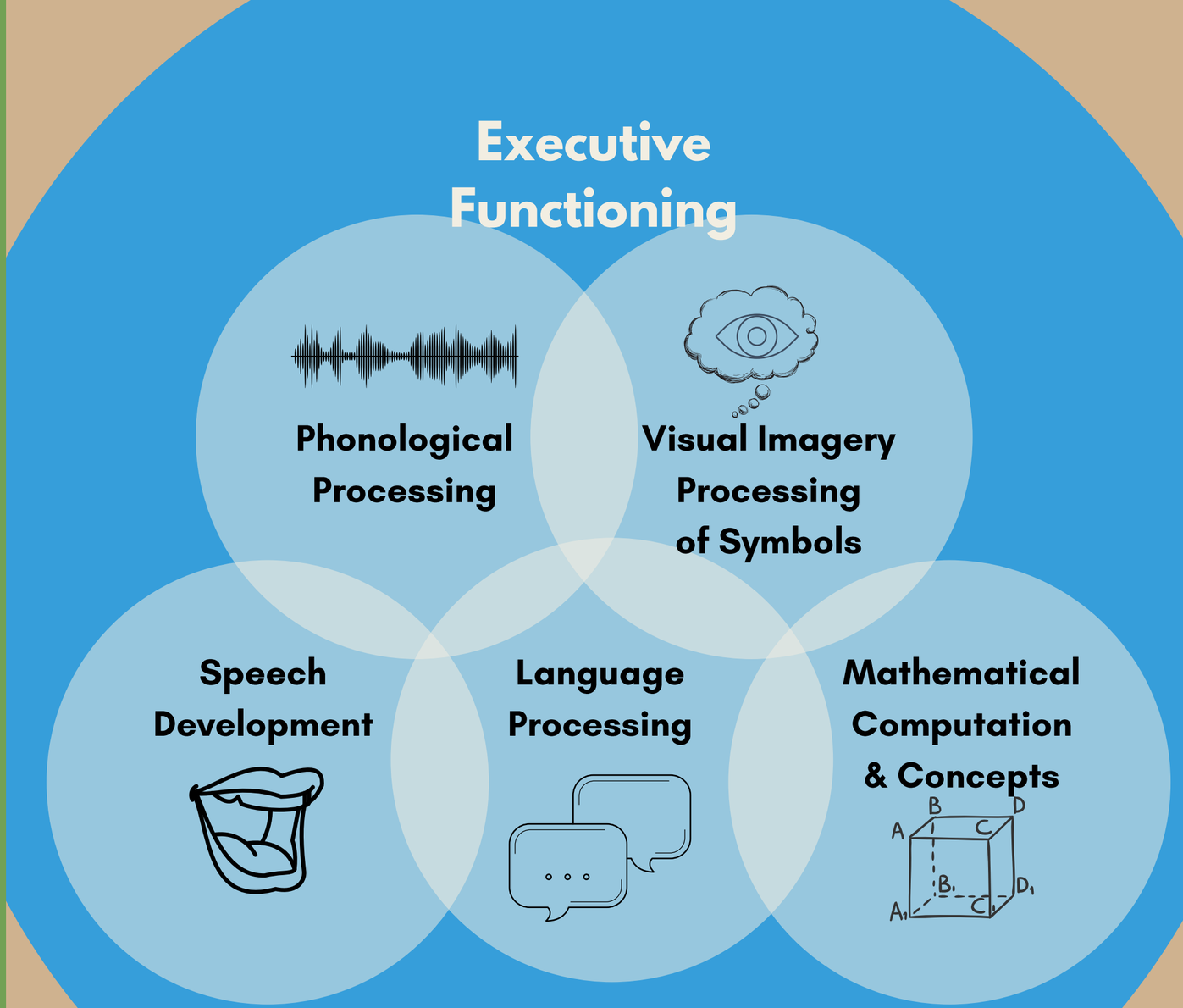
Favorite program: LiPS by Pat Lindamood

Phonological Processing Task: from the LiPS program

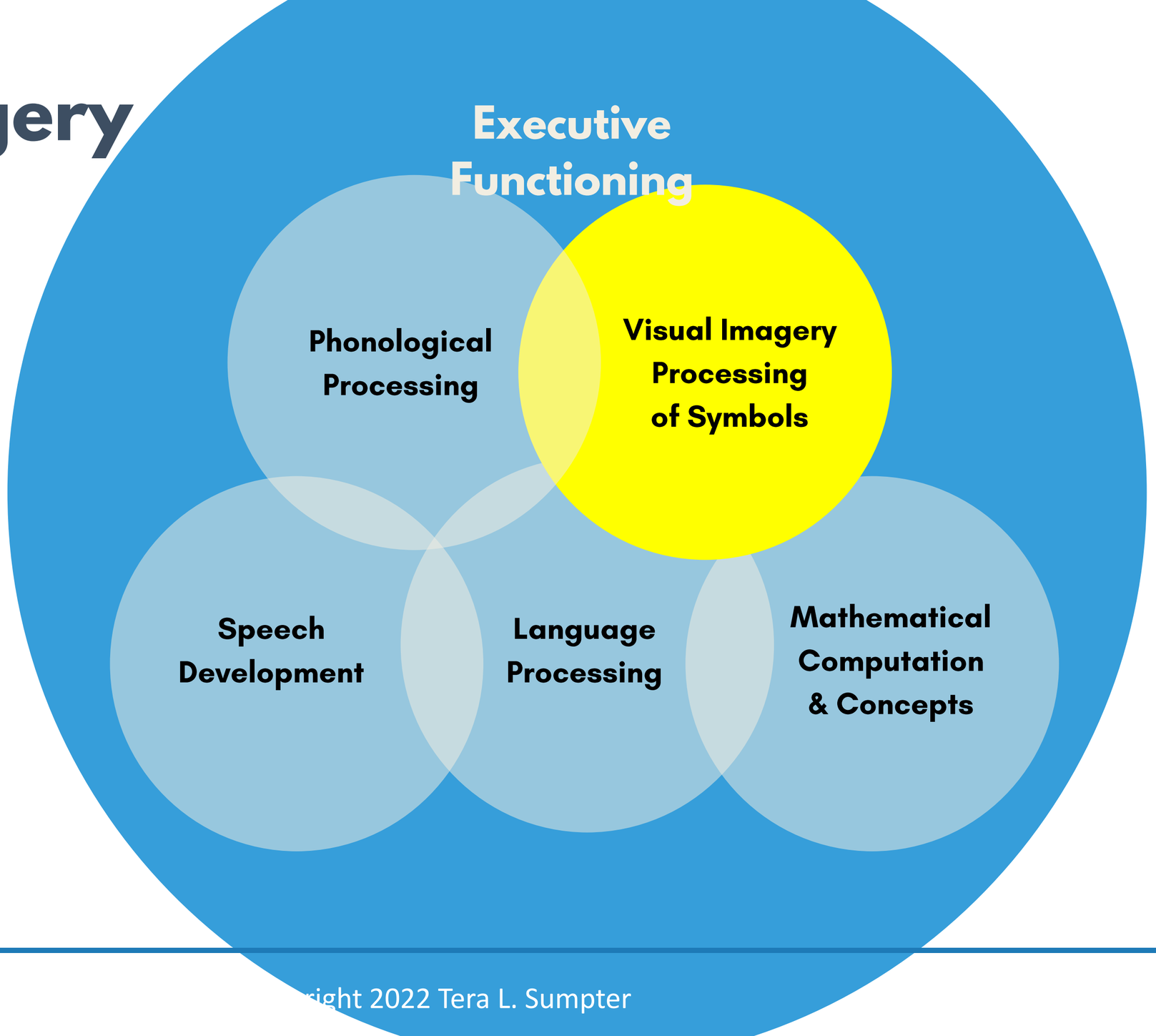
Phonological Processing Task: from the LiPS program

Student B

- Struggling in reading
- Sounds out most words
- Reading is slow and choppy
- Writing is phonetic
- Lots of letter reversals
- Reading comprehension is poor
- If information is presented orally, he does well
- Math is difficult- see number reversals and uses incorrect operations and has trouble keeping columns straight



Visual Imagery Of Symbols



Sample Goals

- Dx: visual imagery impairment of symbols with breakdown at CV/VC syllable structure or literacy impairment characterized by visual processing of symbols deficits at the CV/VC level

Goal 1: Student will retain and recall the letters in a CV/VC+ word with 90% accuracy to improve visual imagery processing skills for symbols.

Goal 2: Student will label the order and identity of letters in a CV/VC+ word from their visual memory with 90% accuracy to improve visual imagery processing skills for symbols.

Goal 3: Student will manipulate letters in a CV/VC+ word from their visual memory with 90% accuracy to improve visual imagery processing skills for symbols.

Sample Therapy Activities

1.Finger write CCVC/CVCC words

Always follow with questions about word

2.Finger write chains at CCVC/CVCC level

3. Sight Words

4. Orthographic Spelling

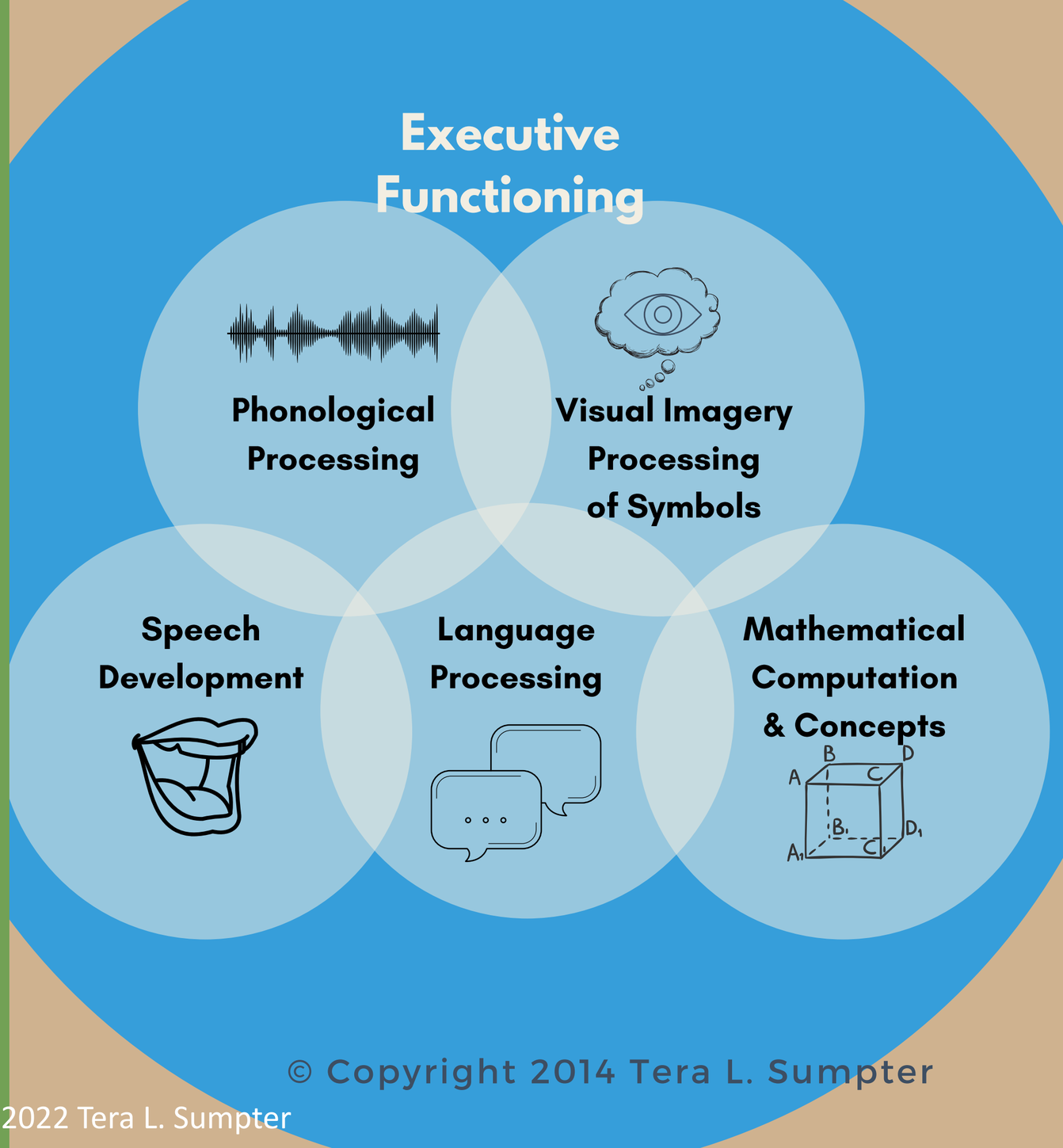
Favorite program: Seeing Stars by Nancy Bell

Visual Processing for Symbols Task

Visual Processing for Symbols Task

Student C

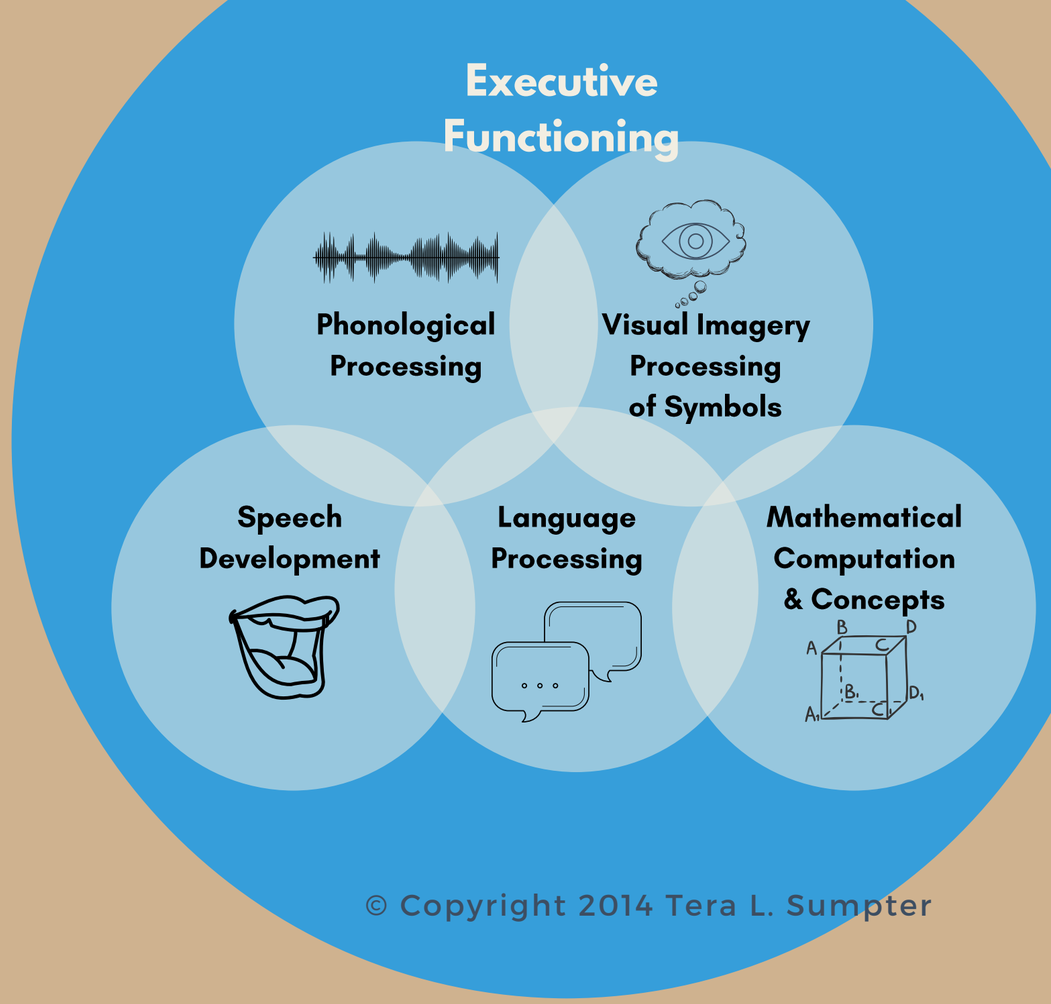
- Reading fluency and accuracy are good
- Reading comprehension is poor
- Zones out during class lectures
- Has trouble explaining her responses to questions orally and in writing
- Has trouble following and participating in class discussions
- Has trouble following classroom instructions
- Doesn't understand classroom material
- Verbal and written expression is hard to follow-very disorganized and jumps from idea to idea
- Doing poorly in math
- Teachers say she's simply lost
- Homework takes a long time



All 3 kids are having trouble with reading comprehension

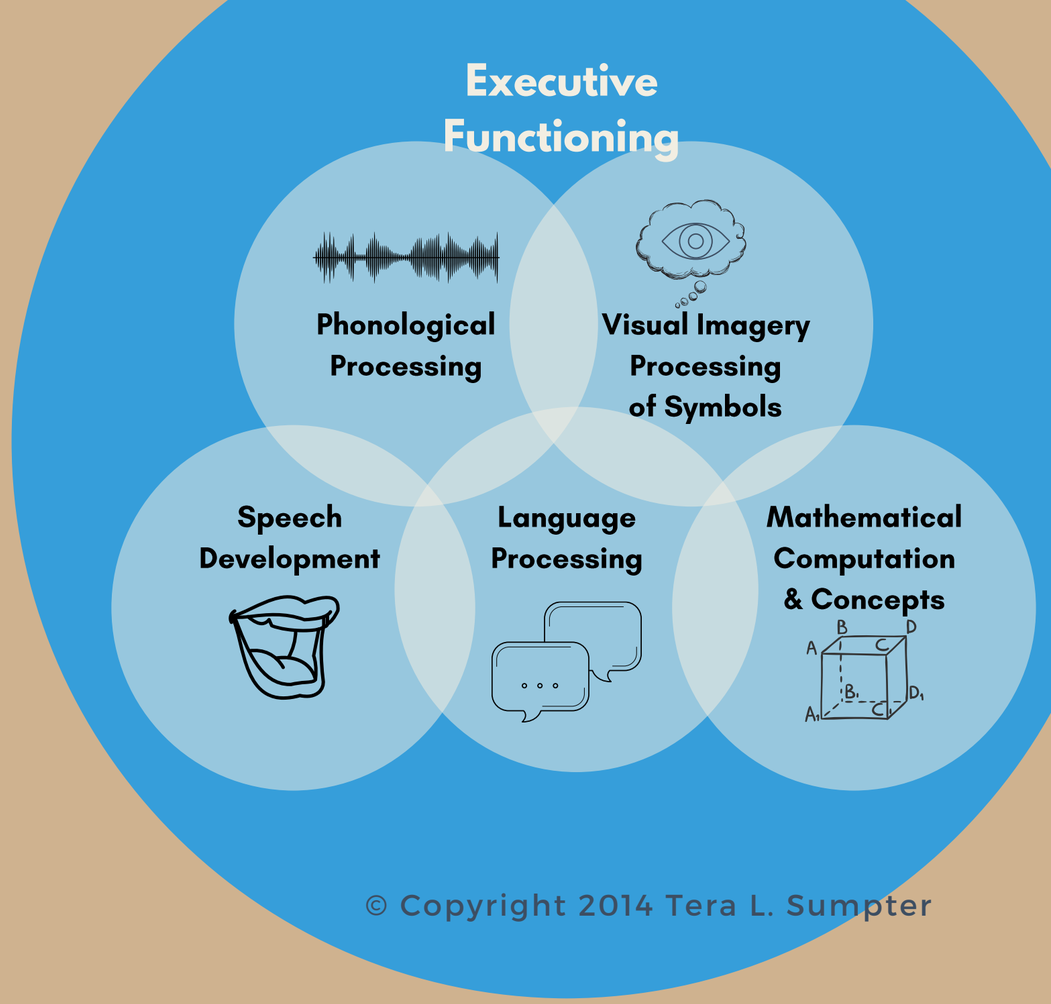
But Why?

- Residual artic issues
- Reading rate: 50th percentile
- Reading accuracy: 13th percentile
- Phonological Processing: 1st percentile
- Nonsense word decoding: 5th percentile
- Sight words: 37th percentile
- Oral language comprehension: 75th percentile

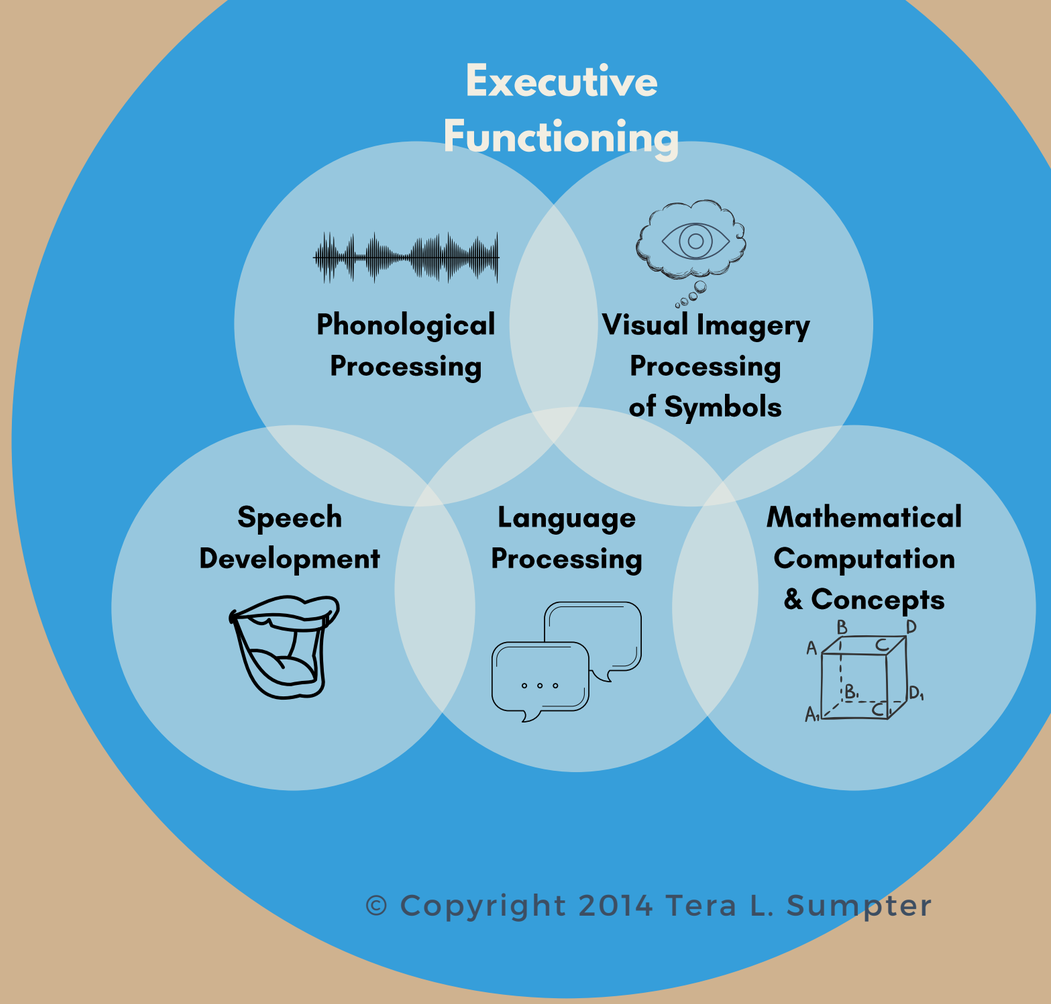


Why is he having trouble with reading comprehension?

- Reading rate: 90th percentile
- Reading accuracy: 75th percentile
- Phonological Processing: 84th percentile
- Nonsense word decoding: 50th percentile
- Sight words: 40th percentile
- Oral language comprehension: 10th percentile



Why is she having trouble with reading comprehension?

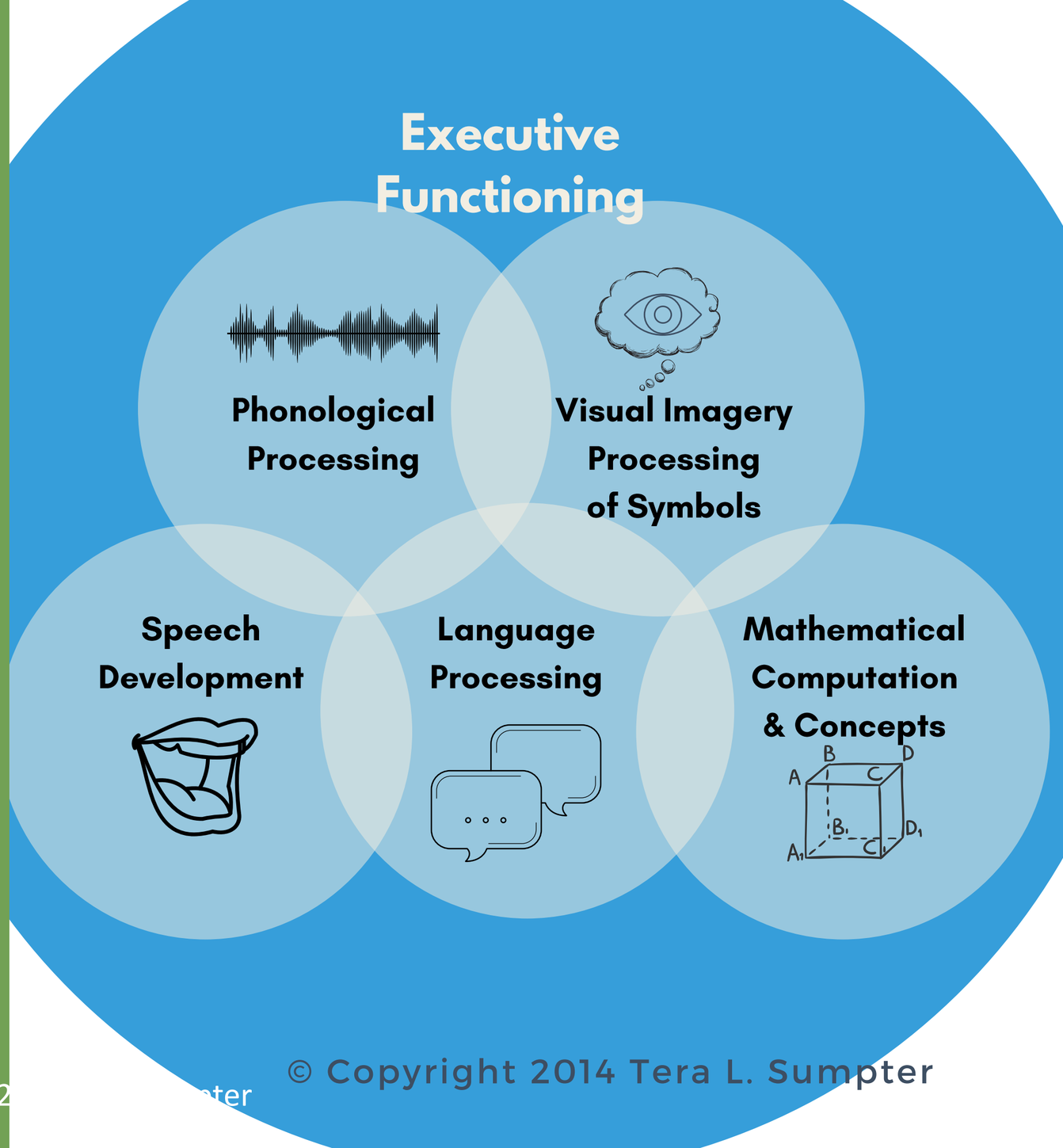


- Reading rate: 5th percentile
- Reading accuracy: 37th percentile
- Phonological Processing: 50th percentile
- Nonsense word decoding: 75th percentile
- Sight words: 2nd percentile
- Oral language comprehension: 90th percentile

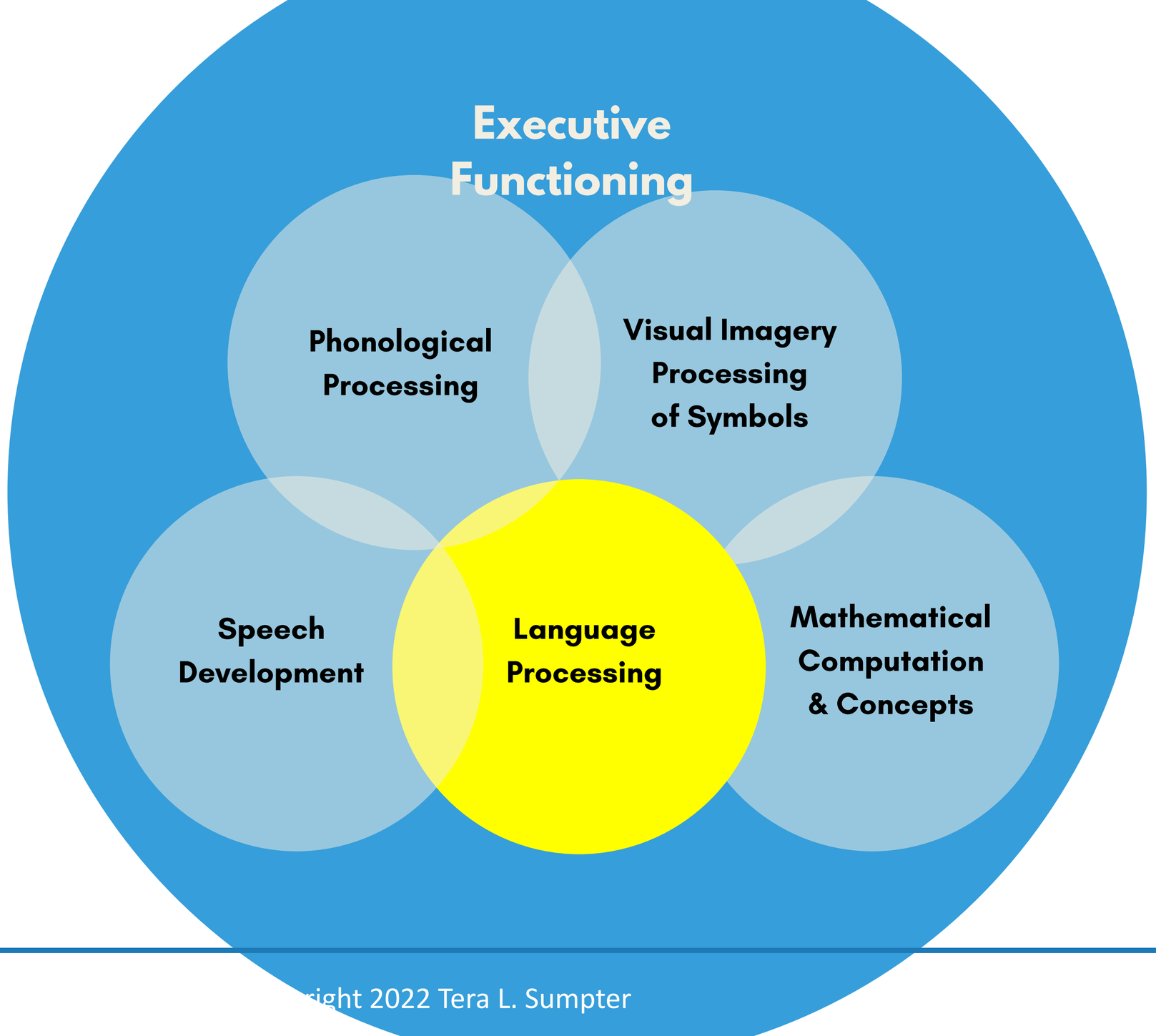
Why is he having trouble with reading comprehension?

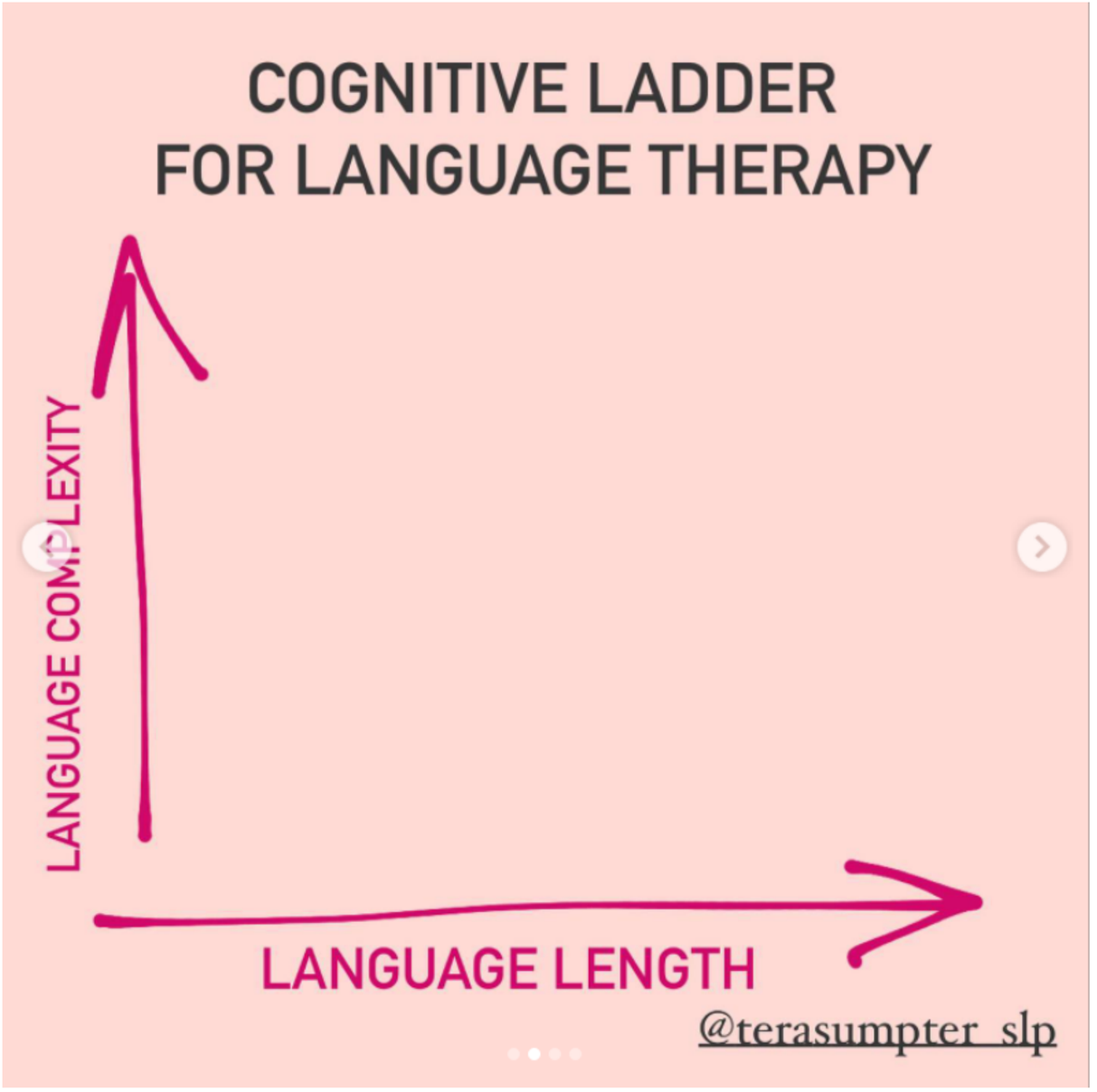
Student D

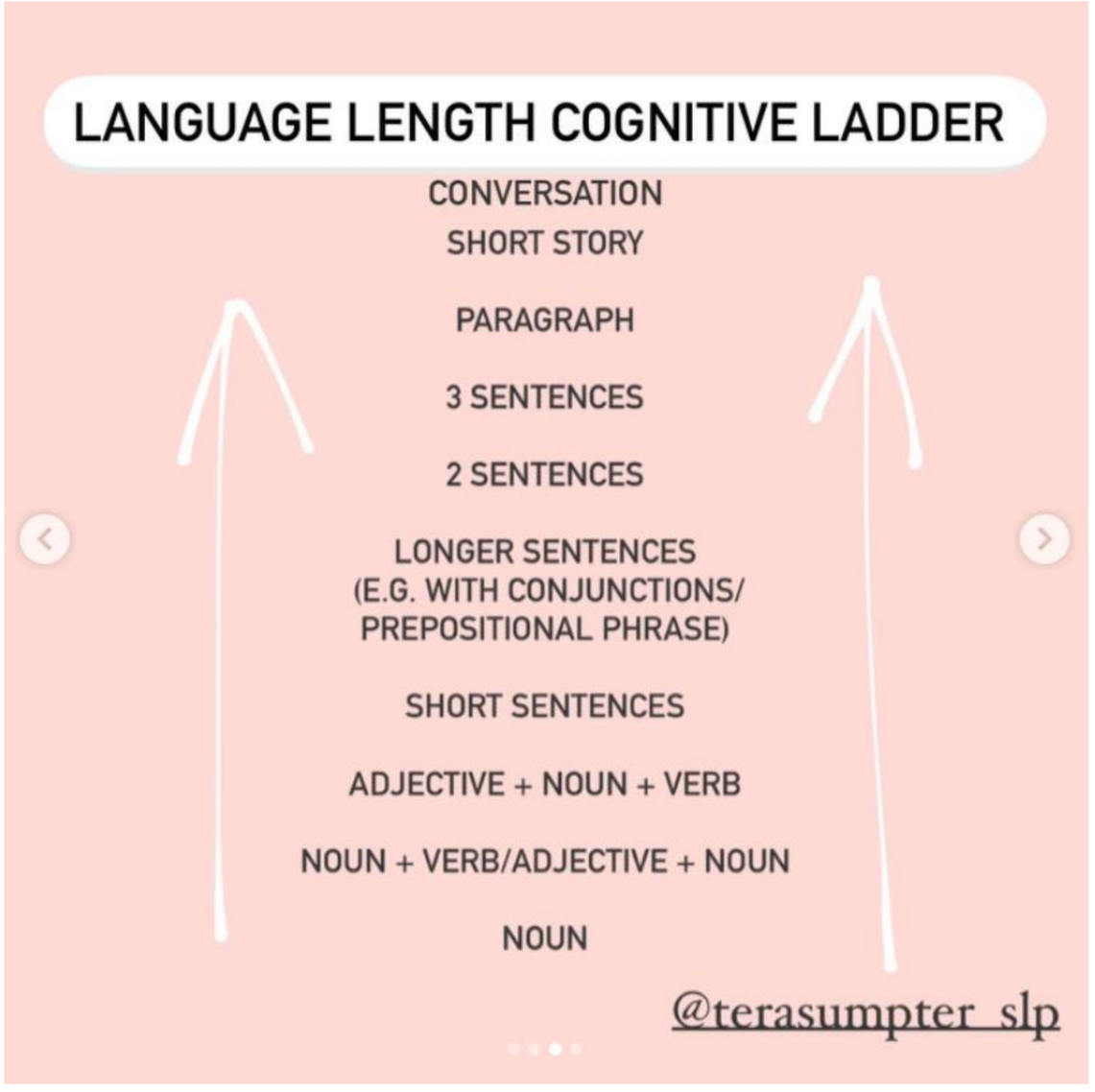
- Difficulty following oral and written directions
- Needs lots of repetition of new concepts
- Poor comprehension
- Difficulty expressing themselves verbally and in writing
- Poor generation of novel ideas
- Difficulty getting started on tasks

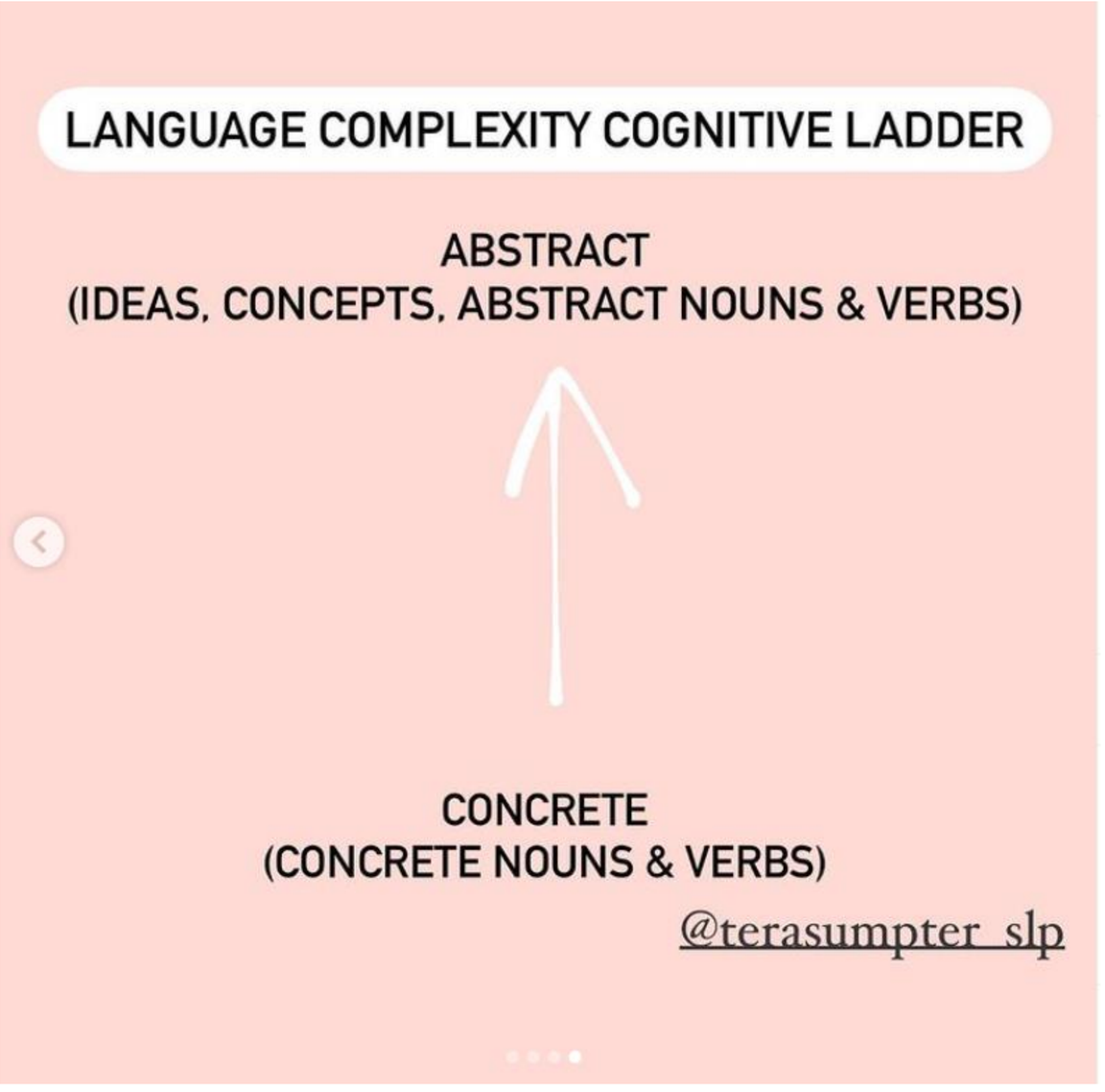


Language




COGNITIVE LADDER
FOR LANGUAGE THERAPY
LANGUAGE COMPLEXITY
LANGUAGE LENGTH
@terasumpter_slp


LANGUAGE LENGTH COGNITIVE LADDER
CONVERSATION
SHORT STORY
PARAGRAPH
3 SENTENCES
2 SENTENCES
LONGER SENTENCES
(E.G. WITH CONJUNCTIONS/
PREPOSITIONAL PHRASE)
SHORT SENTENCES
ADJECTIVE + NOUN + VERB
NOUN + VERB/ADJECTIVE + NOUN
NOUN
@terasumpter_slp


LANGUAGE COMPLEXITY COGNITIVE LADDER
ABSTRACT
(IDEAS, CONCEPTS, ABSTRACT NOUNS & VERBS)
CONCRETE
(CONCRETE NOUNS & VERBS)
@terasumpter_slp

1 activity, 4 steps

Use the same steps for each level of your scaffold

1) child examines & describes object. EET can be incorporated to organize expressive language.

2) tell child to use their imagination to "take a picture" of the object.

3) remove & hide object, and have child describe from the picture in their mind.

4) bring object back out and compare to child's mental image description. "How did we do? Did I picture in our imagination match?"

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1) **Start concrete**

This can be an actual object or picture

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2) **Scaffold Length & Complexity of object**

And therefore language and amount visualized

3) **Scaffold Length & Complexity of object**

And therefore language and amount visualized

@te

4) **Scaffold Length & Complexity of object**

And therefore language and amount visualized

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5) **Scaffold Length & Complexity of object**

And therefore language and amount visualized

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6) One sentence: *The girl eats the cereal.*
7) Two sentences: *The girl eats the cereal. She drinks the milk left in the bowl.*
8) Three sentences: *The girl eats the cereal. She drinks the milk left in the bowl. She puts the empty bowl in the sink.*

Process (see *Visualizing and Verbalizing* program for more details)

1. Child hears or reads sentence(s)
2. Child describes visualized image that matches the sentence(s).
3. Lay place holder (colored square)
4. Review pictures from visual memory
5. Child retells story
6. Identify main idea
7. If appropriate, ask abstract questions: inferences, predictions, etc.

1.

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2.

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3.

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Gestalt Formation:
Main idea versus details

1)

Main Idea: unicorn
Details: body, 4 legs, head, horn, 2 ears, tail

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2)

Main Idea: fish
Details: body, fins, scales, gills, eyes

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3)

Picture from Spotlight Speech & Language on TPT

Main Idea: Raking. Raking the leaves. The kids are raking the leaves. (3 levels of language length depending on child.)
Details: 3 kids, 1 rake, 4 piles of leaves, dog, etc

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4)

Picture from Learning to Sequence

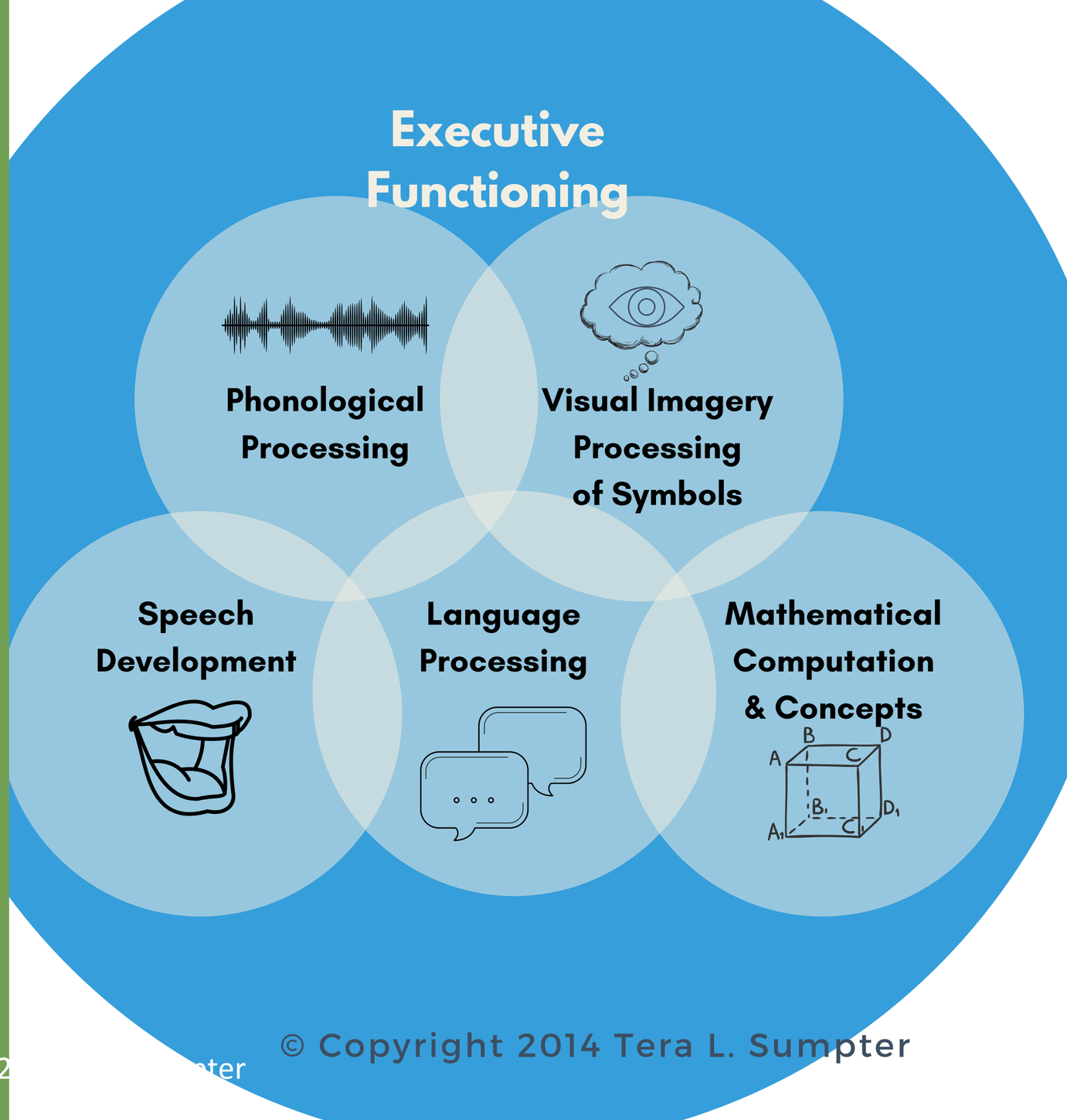
Main Idea: The girl is making a peanut butter and jelly sandwich.

Details: First she gets the bread. Next she spreads peanut butter on a piece of bread. Then she spreads jelly on the other slice of bread. Last she puts the slices together.

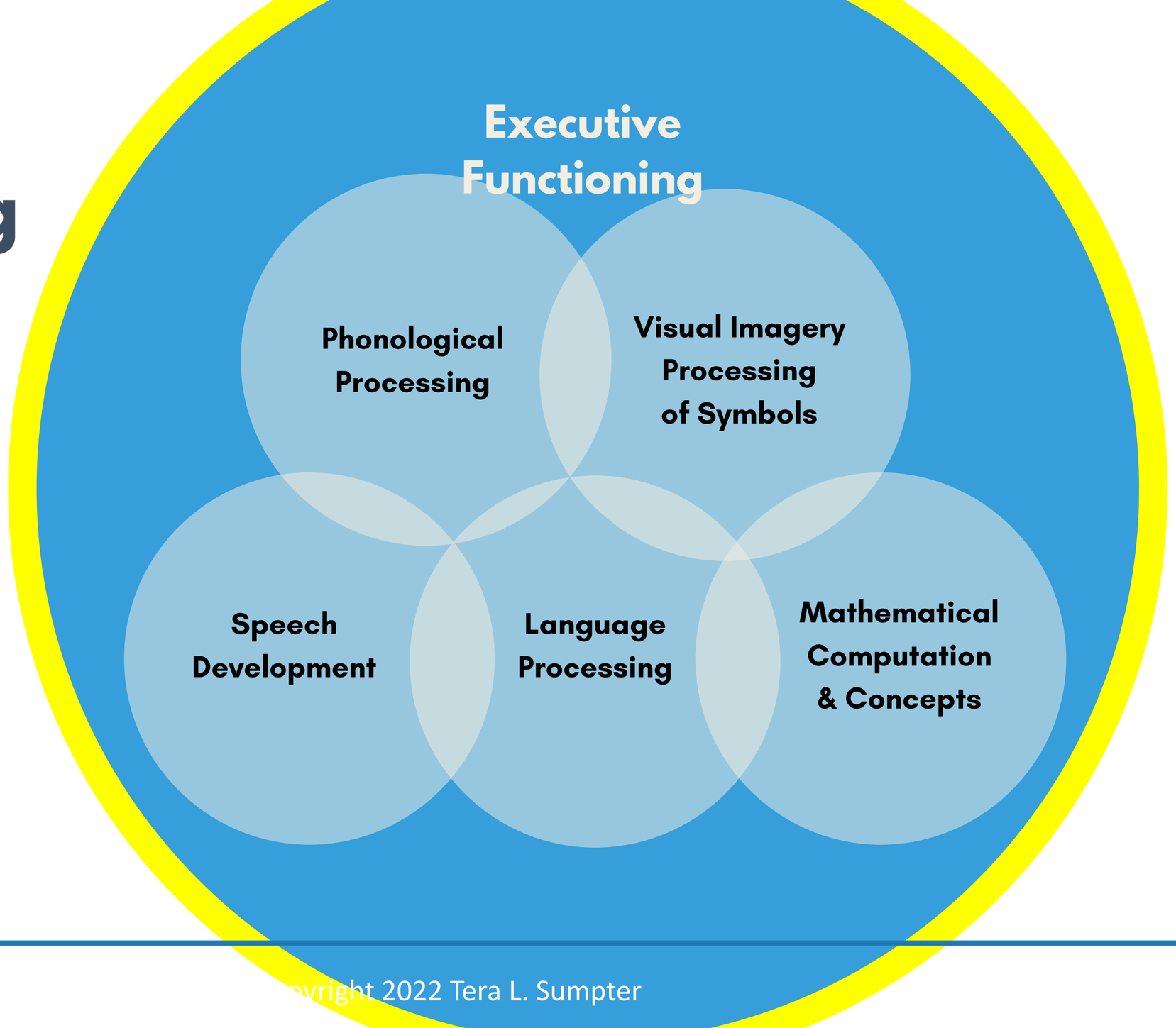
_slp

Student E

- Rarely turns in homework
- Extremely disorganized
- Misplaces personal items
- Makes careless mistakes on work
- Makes lots of mistakes when reading
- Doesn't notice mistakes when reading
- Doing poorly in all subjects
- Difficulty initiating assignments
- Difficulty with time management skills



Executive Functioning

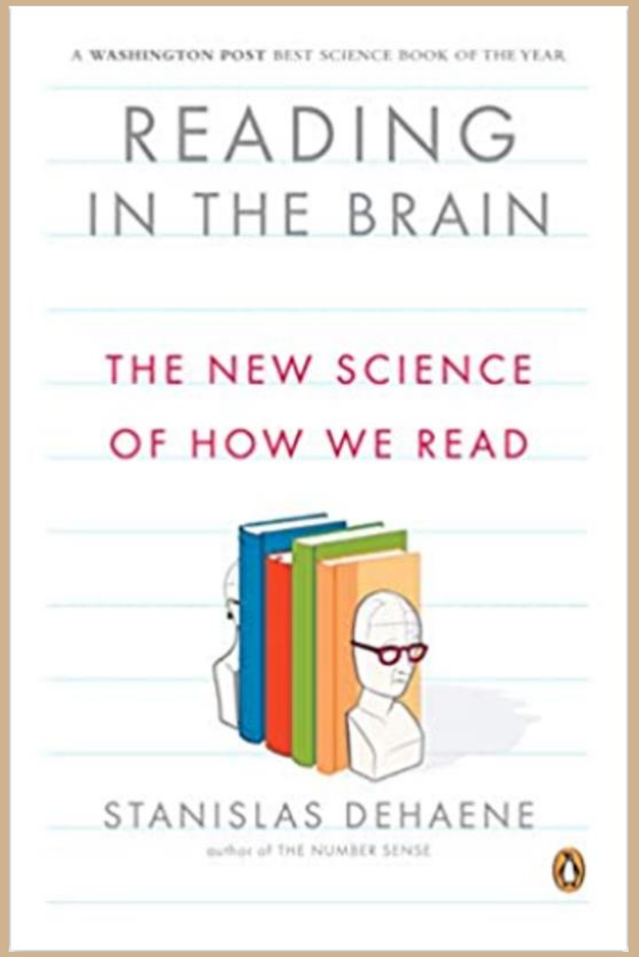


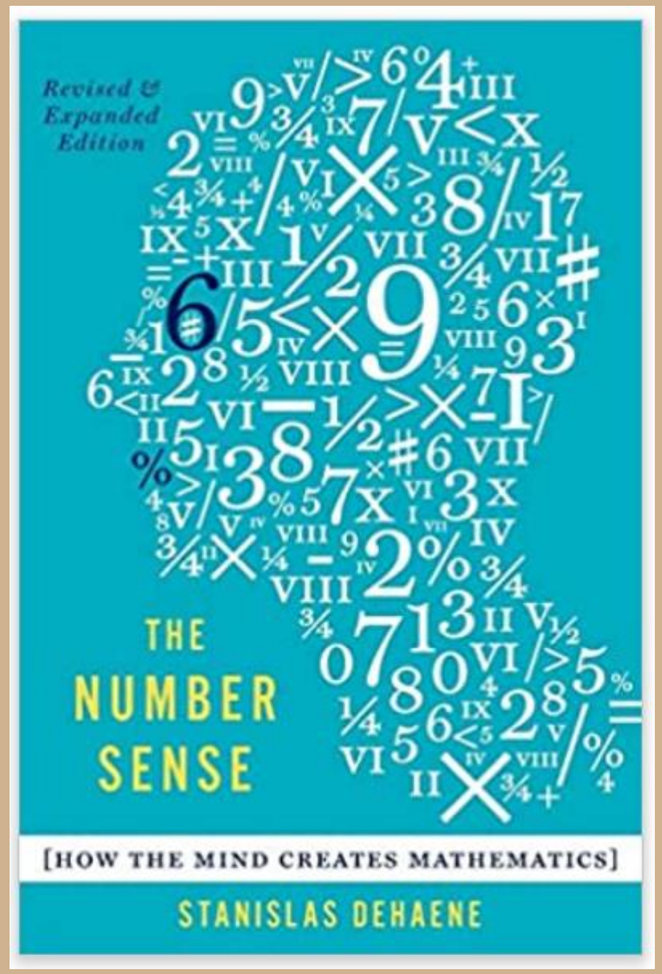
WHAT CAN WE DO?

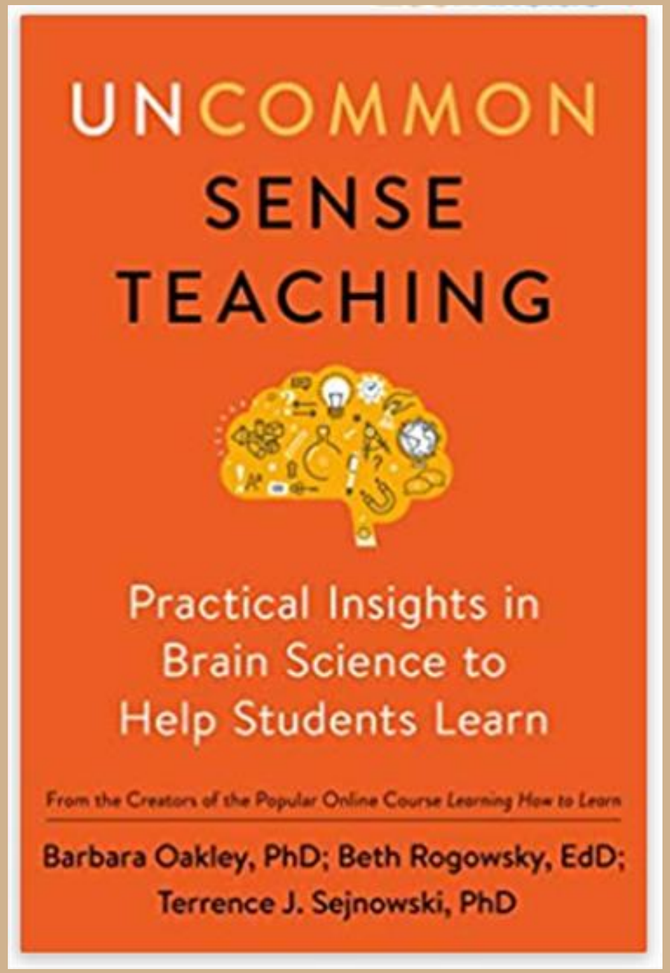
- INCREASE AWARENESS
- VISUALIZE
- PLAN
- SELF-EVALUATE

Female, 8-yo: narrating Buddy story

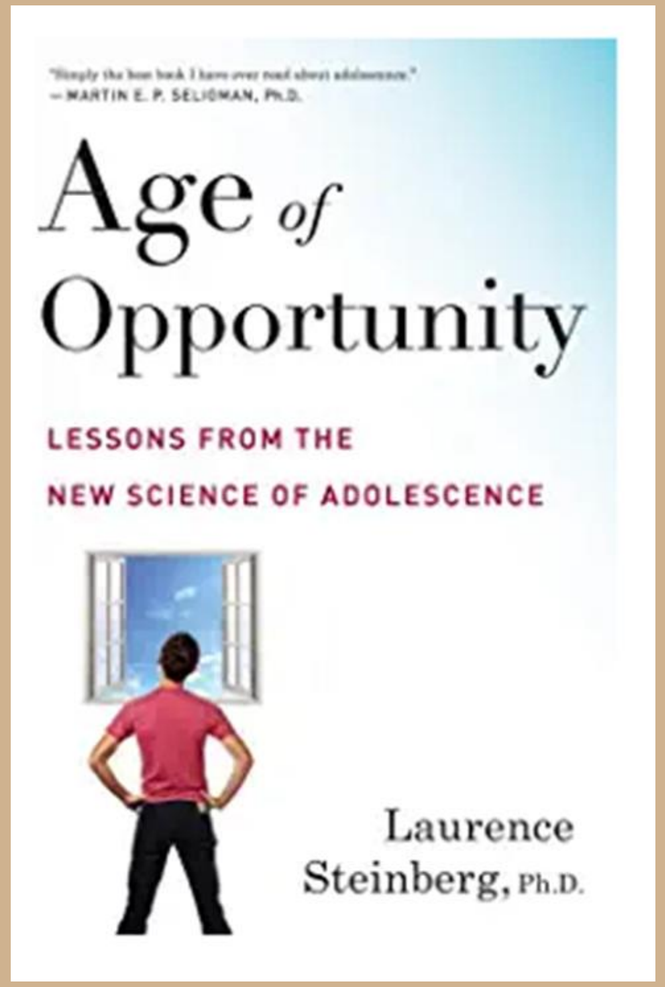
Favorite Books

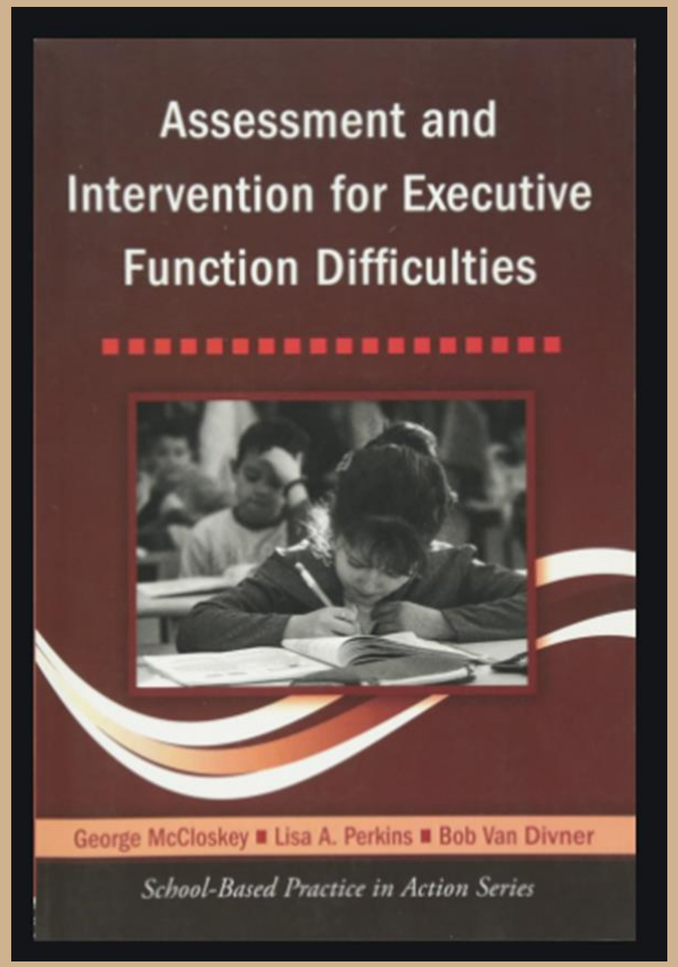


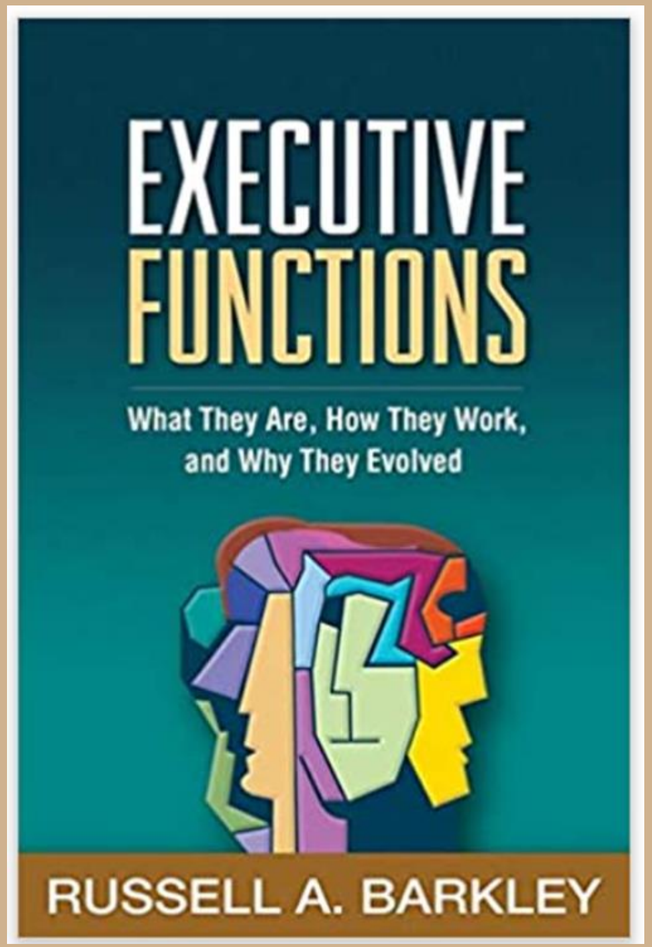




Favorite Books







The Seeds of Learning:

A Cognitive Processing Model for Speech, Language, Literacy & Executive Functioning

By Tera Sumpter, M.A. CCC-SLP

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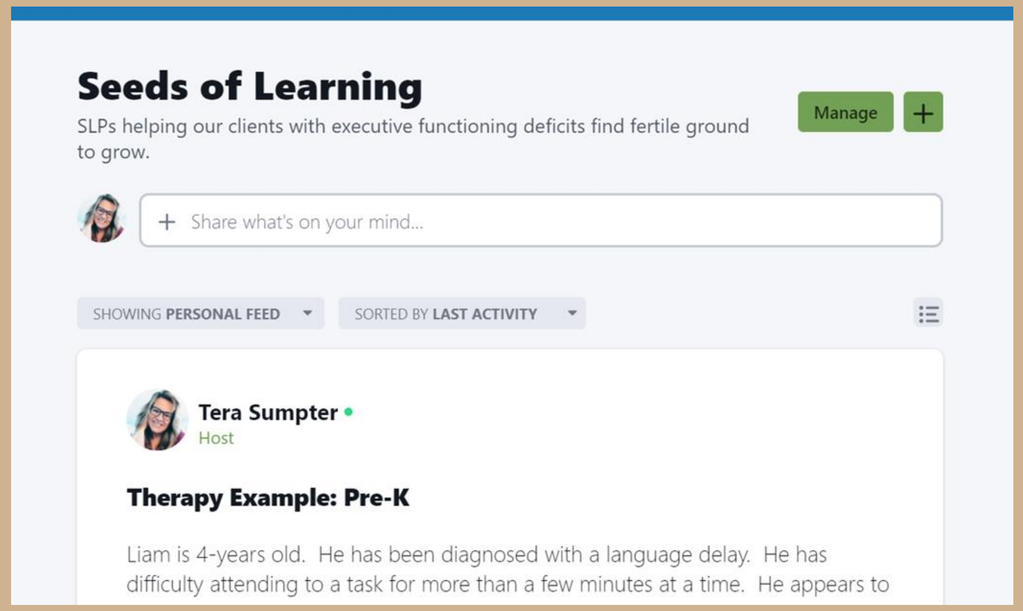
Executive Functioning Educational Community



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References

Alloway, T.P., Tewolde, F., Skipper, D., and Hijar, D. (2017). Can you spell dyslexia without SLI? Comparing the cognitive profiles of dyslexia and specific language impairment and their roles in learning. *Research in Developmental Disabilities* 65:97-102.

Alt, M., Arizmendi, G.D., and Beal, C.R. (2014). The Relationship Between Mathematics and Language: Academic Implications for Children With Specific Language Impairment and English Language Learners. *Language, Speech, and Hearing Services in Schools* 45(3):220-233.

Aron, A.R., Robbins, T.W., and Poldrack, R.A. (2004). Inhibition and the right inferior frontal cortex. *Trends in Cognitive Sciences*. 8(4):170–177.

Baddeley, A.D. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences* 4(11): 417-423.

Barbara, A.L., Freebairn, L., Tag, J., Ciesla, A.A., Iyengar, S.K., Stein, C.M. and Taylor, H.G. (2015). Adolescent Outcomes of Children With Early Speech Sound Disorders With and Without Language Impairment. *American Journal of Speech Language Pathology* 24(2):150-163.

Barkley, R.A. (2012). Executive Functions: What They Are, How They Work, and Why They Evolved. The Guilford Press: New York.

Bell, N. (1997). Seeing Stars: Symbol Imagery for Phonemic Awareness, Sight Words and Spelling. Gander Publishing.

Bell, N. (1986). Visualizing and Verbalizing for Language Comprehension and Thinking. Gander Publishing.

Bull, R. & Scerif, G. (2010). Executive Functioning as a Predictor of Children's Mathematics Ability: Inhibition, Switching, and Working Memory. *Developmental Neuropsychology* 19(3):273-93.

Carlson, H., Sugden, C., Kirton, A. and Brooks, B.L. (2018). Neuroplasticity of Functional Connectivity in Language Networks in Children After Perinatal Stroke. Stroke 49:ATMP103.

Carpenter, P.A., Just, M.A., and Reichle, E.D. (2000). Working Memory and Executive Functions: Evidence from Neuroimaging. *Current Opinion in Neurobiology* 10:195–199.

References

Dehaene, S., Pegado, F., Braga, L.W., Ventura, P., Nunes Filho, G., Jobert, A., Dehaene-Lambertz, G., Kolinsky, R., Morais, J., and Cohen, L. (2010). How Learning to Read Changes the Cortical Networks for Vision and Language. *Science* 330(6009):1359-64.

Dehn, M.J. (2008). Working Memory and Academic Learning: Assessment and Intervention. New Jersey: John Wiley & Sons, Inc.

Dodd, B. & Gillon, G. (2009). Exploring the Relationship Between Phonological Awareness, Speech Impairment, and Literacy. *Advances in Speech Language Pathology* 3(2):139-147.

Drazinski, L.A. (2011). Executive Functions Training: Adolescent. LinguiSystems, Inc.

Eagleman, D. (2020). Livewired: The Inside Story of the Ever-Changing Brain. Pantheon Books: New York.

Fazio, B.B. (1996). Mathematical Abilities of Children With Specific Language Impairment: A 2-Year Follow-Up. *Journal of Speech, Language, and Hearing Research* 39(4):839-849.

Felsenfeld, S., Broen, P.A., and McGue, M. (1994). A 28-year Follow-Up of Adults with a History of Moderate Phonological Disorder: Educational and Occupational Results. *Journal of Speech and Hearing Research* 37(6):1341-53.

Feuerstein, R. (2015). Changing Minds and Brains: The Legacy of Reuven Feuerstein, Higher Thinking and Cognition Through Mediated Learning. Teachers College Press.

Feuerstein, R., & Falik, L. H. (2010). Learning to Think, Thinking to Learn: A Comprehensive Analysis of Three Approaches to Instruction. *Journal of Cognitive Education and Psychology* *9*(1):4-20.

Guarnera, M., Commodari, E. and Peluso, C. (2013). Rotation and Generation of Mental Imagery in Children with Specific Language Impairment. *ACTA PAEDIATRICA: Nurturing The Child* 102(5):539-543.

Guarnera, M., Faraci, P., Commodari, E. and Buccheri, S.L. (2017). Mental Imagery and School Readiness. *Psychological Reports* 120(6):1058-1077.

Hood, M. & Conlon, E. (2004). Visual and Auditory Temporal Processing and Early Reading Development. *Dyslexia* 10(3):234-52.

James, K. H. (2009) Sensori-Motor Experience Leads to Changes in Visual Processing in the Developing Brain. *Developmental Science* 13:279–288.

References

Joyner, R. E. & Wagner, R. K. (2020). Co-occurrence of Reading Disabilities and Math Disabilities: A Meta-Analysis. *Scientific Studies of Reading* 24(1): 14–22.

Kolb, B. & Gibb, R. (2011). Brain Plasticity and Behaviour in the Developing Brain. *Journal of the Canadian Academy of Child and Adolescent Psychiatry* 20(4):265–276.

Kolker, B. & Terwiliger, P.N. (1986). Visual Imagery of Text and Children's Processing. *Reading Psychology* 7(4):267-277.

Lindamood, P.C. & Lindamood, P.D. (1998). The Lindamood Phoneme Sequencing Program for Reading, Spelling and Speech. PR0-ED.

Mazoyer, B., Zago, L., Mellet, E., Bricogne, S., Etard, O., Houde, O., Crivello, F., Joliot, M., Petit, L., and Tzourio-Mazoyer, N. (2001). Cortical Networks for Working Memory and Executive Functions Sustain the Conscious Resting State in Man. *Brain Research Bulletin* 54(3):287-298.

McCabe, D.P., Roediger, III, H.L., McDaniel, M.A., Balota, D.A., and Hambrick, D.Z. (2010). The Relationship Between Working Memory Capacity and Executive Functioning: Evidence for a Common Executive Attention Construct. *Neuropsychology* 24(2):222-243.

McCloskey, G. (2015). Improving Executive Functions. PESI rehab seminar.

McCloskey, G., & Perkins, L.A. (2012). Essentials of Executive Functions Assessment. New York: Wiley.

McCloskey, G., Perkins, L.A., & VanDivner, B. (2009). Assessment and Intervention for Executive Function Difficulties. New York: Routledge Press.

McNeill, B.C., Gillon, G.T., and Dodd, B. (2009). Phonological Awareness and Early Reading Development in Childhood Apraxia of Speech (CAS). *International Journal of Language and Communication Disorders* 44(2):175-92.

Munson, B. & Krause, M.O.P. (2017). Phonological Encoding in Speech Sound Disorder: Evidence from a Cross-Modal Priming Experiment. *International Journal of Language and Communication Disorders* 52(3):285-300.

Nathan, L., Stackhouse, J., Goulandris, N. and Snowling, M.J. (2004). The development of early literacy skills among children with speech difficulties: a test of the "critical age hypothesis". *Journal of Speech Language and Hearing Research* 47(2):377-91.

References

Pauls, L.J. & Archibald, L.M.D. (2016). Executive Functions in Children With Specific Language Impairment: A Meta-Analysis. *Journal of Speech, Language, and Hearing Research* 59(5):1074-1086.

Poeppel, D., Idsardi, W.J., and van Wassenhove, V. (2008). Speech Perception at the Interface of Neurobiology and Linguistics. *Philosophical Transactions of the Royal Society B* 363 (1493):1071–86.

Rey, V., De Martino, S., Espesser, R., and Habib, M. (2002). Temporal Processing and Phonological Impairment in Dyslexia: Effect of Phoneme Lengthening on Order Judgment of Two Consonants. *Brain and Language* 80:576–591.

Rvachew, S. & Grawburg, M. (2006). Correlates of Phonological Awareness in Preschoolers With Speech Sound Disorders. *Journal of Speech, Language, and Hearing Research* 49(1):74-87.

Scarborough, H.S., Neuman, S.B. & Dickinson, D. K. (2001). Handbook of Early Literacy Research. New York: Guilford Press.

Smith, L.B. & Sheya, A. (2010). Is Cognition Enough to Explain Cognitive Development? *Topics in Cognitive Science* 2(4):725-735.

Wagner, R. K., & Torgesen, J. K. (1987). The Nature of Phonological Processing and its Causal Role in the Acquisition of Reading Skills. *Psychological Bulletin 101*:192-212.

Watson, B.U. & Miller, T.K. (1993). Auditory Perception, Phonological Processing, and Reading Ability/Disability. *Journal of Speech, Language, and Hearing Research* 36(4): 850-863.

Willcutt, E. G., Petrill, S. A., Wu, S., Boada, R., DeFries, J. C., Olson, R. K., and Pennington, B. F. (2013). Comorbidity between reading disability and math disability: Concurrent psychopathology, functional impairment, and neuropsychological functioning. *Journal of Learning Disabilities* 46(6): 500–516..

Windsor, J., Kohnert, K., Loxtercamp, A.L., and Kan, P-F. (2008). Performance on Nonlinguistic Visual Tasks by Children with Language Impairment. *Applied Psycholinguistics* 29(2):237-268.