

# Componential Model of Reading: Orthographic and environmental influences

- R. Malatesha Joshi
- Texas A & M University
- [mjoshi@tamu.edu](mailto:mjoshi@tamu.edu)

University of Jyväskylä

September 12, 2018

- P. G. Aaron, Indiana State University, USA
- Bae, Han Suk, Dong-A University, S. Korea
- Breznitz, Zvia, University of Haifa, Israel
- Erbeli, Florina, University of Ljubljana, Slovenia
- Gooden, Regina, Neuhaus Center, USA
- Grigorenko, Elena, Moscow State University & University of Houston
- Hoien, Torleiv, Stanvanger Institute, Norway
- Ji, Xuejun Ryan, University of British Columbia, Canada
- McBride, Cammie, Chinese University of Hong Kong, China
- Nakamura, Pooja, American Institute of Research, USA
- Nishanimath, Surendranath, Samveda Teaching and Research Center, India
- Pittman, Ramona, Texas A & M University, San Antonio, USA
- Quiroz, Blanca, Stanford University, USA
- Tao Sha, Cognitive Neuroscience Lab, Beijing, China
- Singh, Nandini, National Brain Research Centre, India
- Yeon, Sookkyung, Mokpo National University, S. Korea
- Yin, Li, Tsingua University, Beijing, China
- Zhang, S. Texas A & M University, USA
- Zhao, Jing, Sun Yet Sen University, China

- **Annual Meeting of the Association for Reading and Writing in Asia (ARWA)**
  - **Feb. 29-March 1, 2019**
  - **Goa, India**



# Componential Model of Reading: Orthographic and environmental influences

- Introduction:

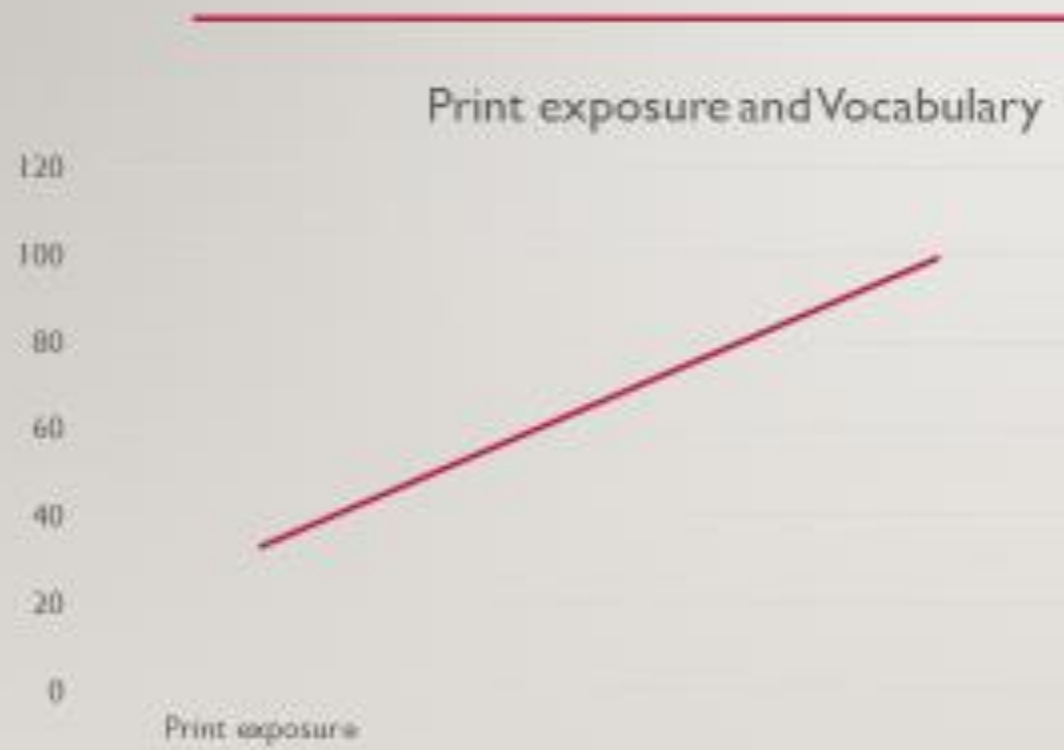
- (2015) About 1 Billion (UNESCO)
- Approximately 25% or 60 million adults and school-age children in the U.S. have difficulty acquiring reading and spelling skills.
- 1/3<sup>rd</sup> of fourth grade students;
- Among minority, inner-city children about 2/3<sup>rd</sup> (67%)
- Illiteracy affects everyone, individual, society, and the nation

- 1. Individual
- >50% of the adolescents with criminal problems and history of substance abuse have reading problems
- 85% in juvenile court system are functionally illiterate.
- > 70% prison inmates cannot read above 4<sup>th</sup> grade level.
- However, provide literacy help, about 16% chance of returning;
- Without help in literacy; 70% chance of returning to prison.
- Costs each taxpayer \$25,000 per year per inmate and nearly double that amount for juvenile offenders.

- 3. At the National Level
- Health care expenses (USA)
- 3<sup>rd</sup> grade and below:
- 10,700 dollars / year
- at least 4th grade:
- 2,900 dollars / year
- More than 3 times (Weiss et al., 2004)
- Illiteracy costs > 1 trillion USD each year (WLF, 2015)
- NIH: 'national public health issue'

# • Advantages of being literate

## PRINT EXPOSURE



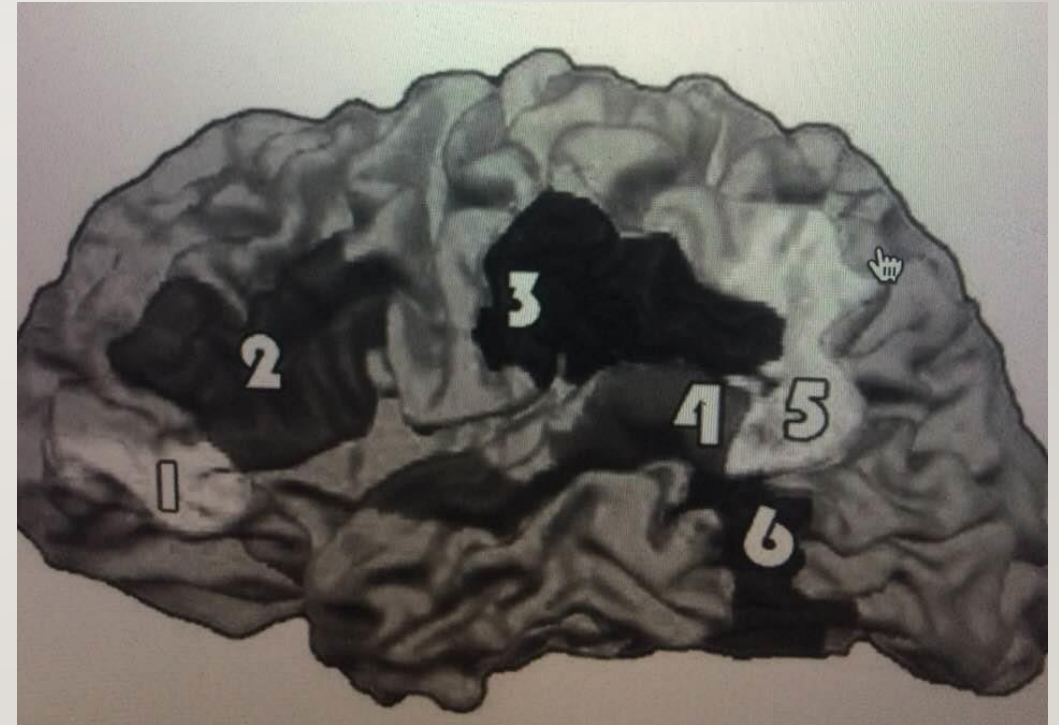
“The observation that individuals who read more have better verbal abilities is among one of the most robust findings in reading research.”  
McCreath et al., 2017, p. 373.

Word Knowledge and World Knowledge

# NEUROLOGICAL

---

- Dementia
- Cortical thickness



Goldman & Manis 2012



Not only reading proficiency but teaching reading also is good

Juel (2002)

Carlson (2016) - Johns Hopkins - Experience Corps Trial

Senior citizens volunteered to teach reading skills to K-3

Brain-imaging studies - beneficial changes in their brains.

- Reasons for illiteracy:
- Instructional and Environmental Reasons (Vellutino & Scanlon, 2003)
- A. Instructional Reasons:
- Ehri (1989): Inadequate instruction spawning limited reading and spelling development and limited phonological awareness is the primary cause of reading disability
- Blachman, Texas group, Florida Group, . .

- Poor instruction resulting in poor reading performance is especially true at the early primary grades.
- Juel (1988): Children who read poorly at the end of first grade were likely to remain poor readers at the end of the fourth grade.
- Landerl & Wimmer (2008): 70% of poor readers in Grade 1 were below average readers in Grade 8
- Lyon et al. (1993): 74% of reading disabled in the third grade continue to exhibit reading and spelling problems even at the ninth grade level.

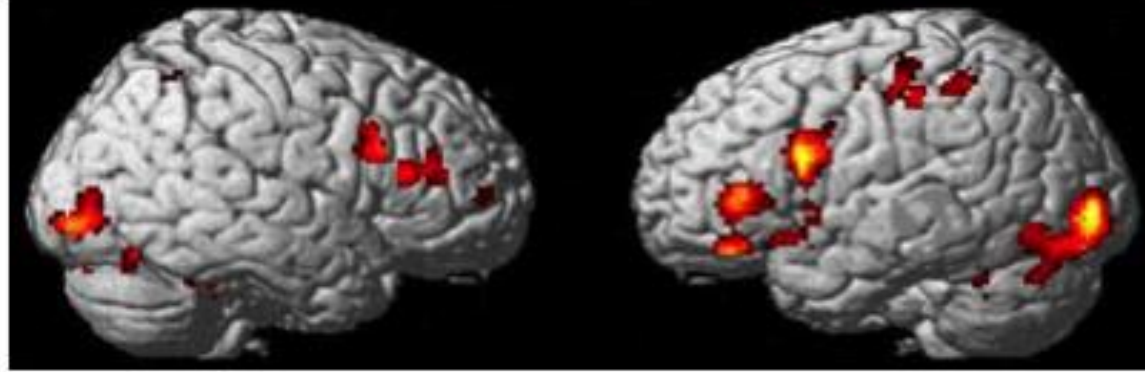
- The reading development of a child is highly dependent upon the quality of early reading instruction...
- “quality classroom instruction in kindergarten and the primary grades is the single best weapon against reading failure” (Snow et al., 1998, p. 343)
- effective instruction can “beat the odds” (Denton, Foorman, & Mathes, 2003)

- Reasons for Illiteracy:
- Environmental and Instructional Reasons:
- Distal Factors (Environment):
- Oral language Development (Hart & Risley, 1995)
- Low language skills: 10 million → 500
- Medium language skills: 20 million → 700
- High language skills: 30 million → 1100
- Juel (1988) end of First grade of schooling: good readers were exposed to 18,681 words; poor readers – 9,975
- Linguistically “poor” first graders knew 5,000 words; linguistically “rich” knew 20,000 words (Moats, 2001).

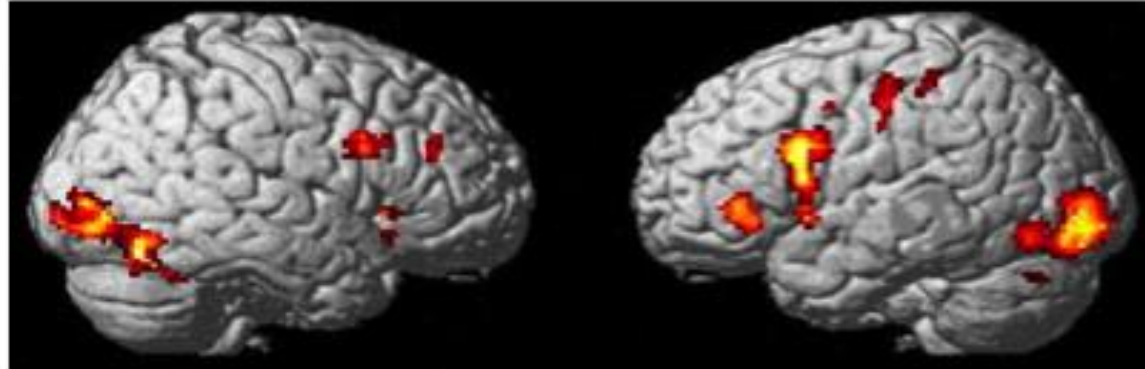
- B. Environmental Reasons:
- Number of books available at home (Chiu & McBride-Chang, 2006);
- Parents reading to children; Enjoyment of reading (Chiu & McBride-Chang, 2006)
- Good readers read 4 nights a week – poor readers read one night a week
- Gender Differences (Chiu & McBride-Chang, 2006)



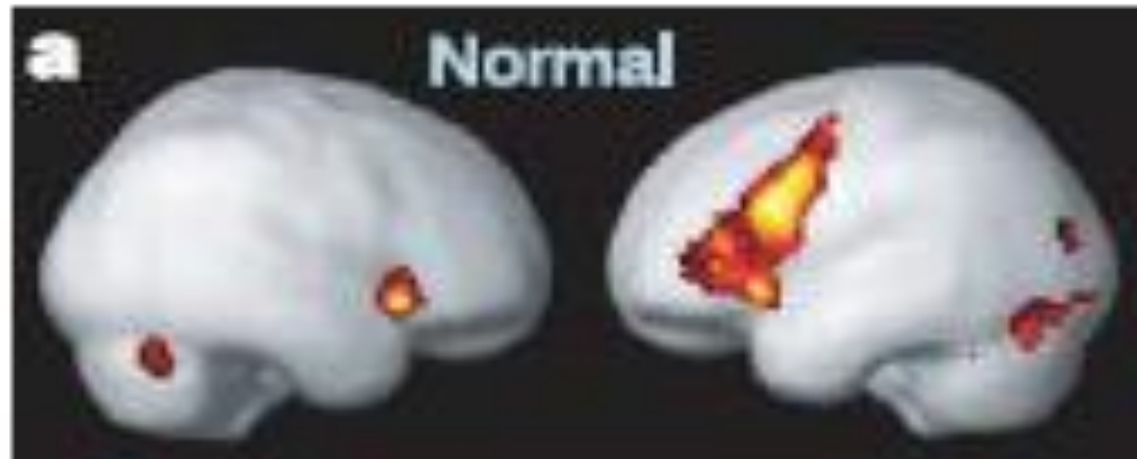
# Brain organization - The universal reading network



Hindi Das, Joshi 2010, 2011

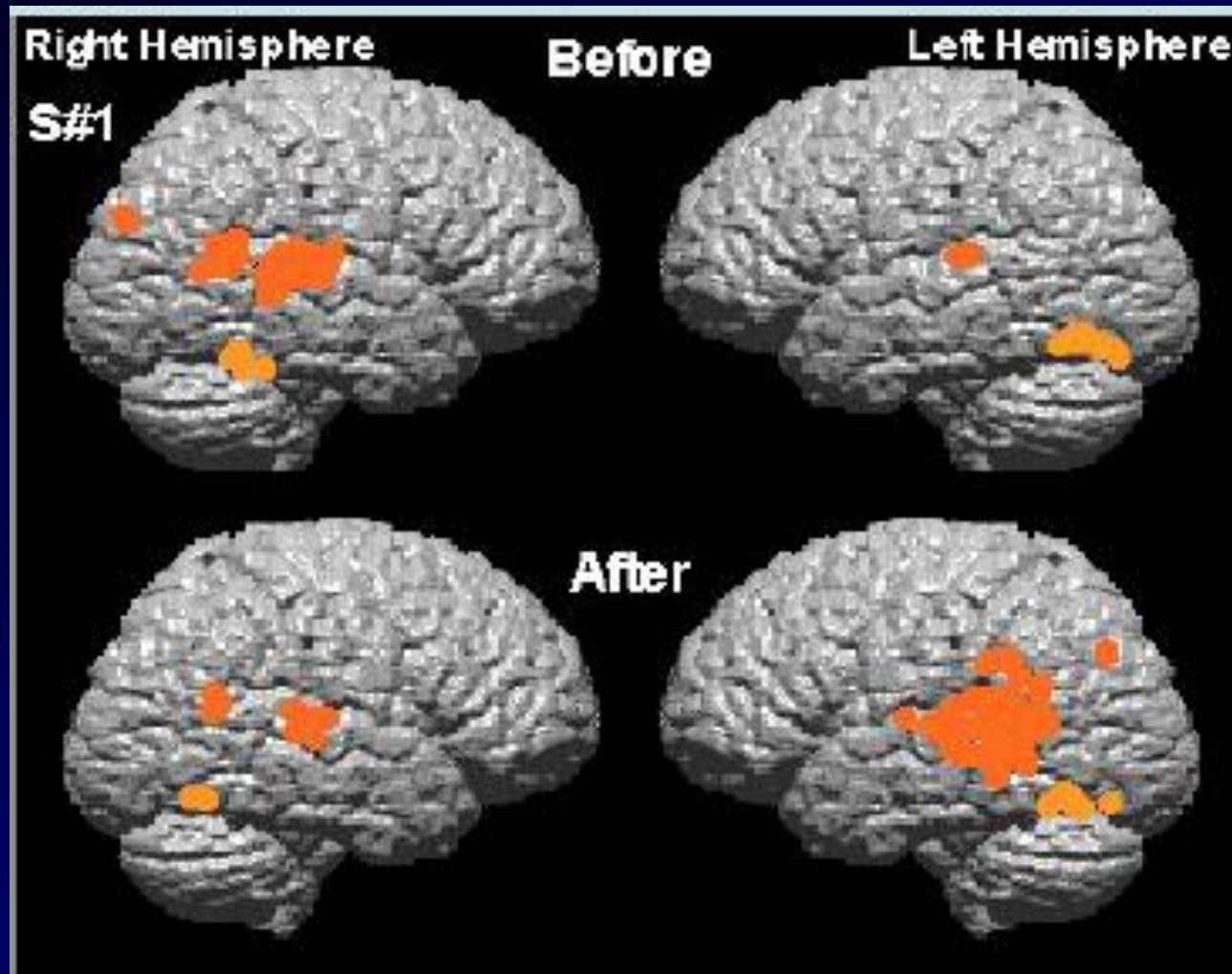


English, Das, Joshi, 2011



Chinese Tan et al., 2004

# Neural Response to Instruction



Appropriate reading instruction can change brain processing

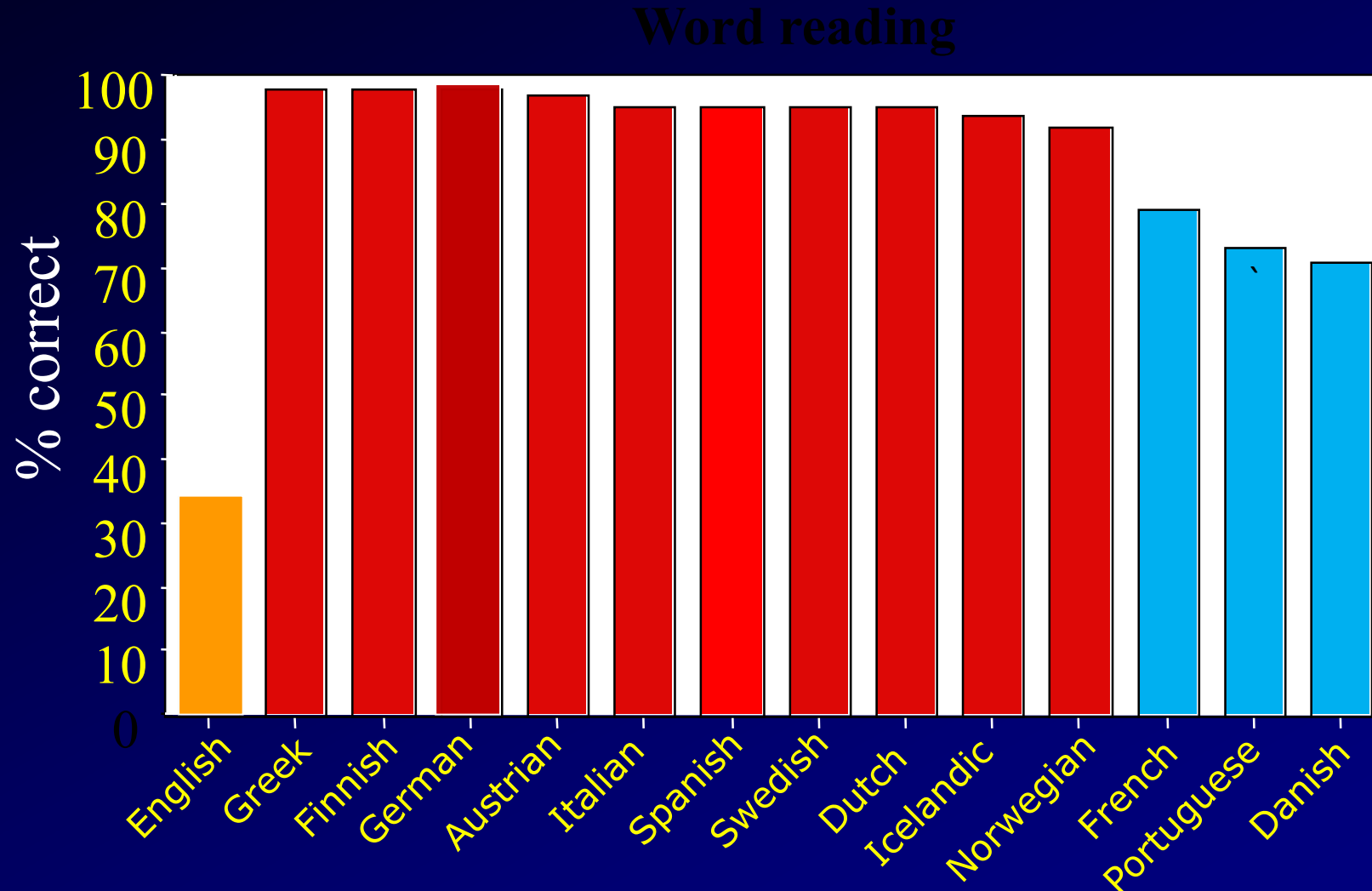


**Brains may be similar from one culture to another but**

**orthographies certainly are not.**

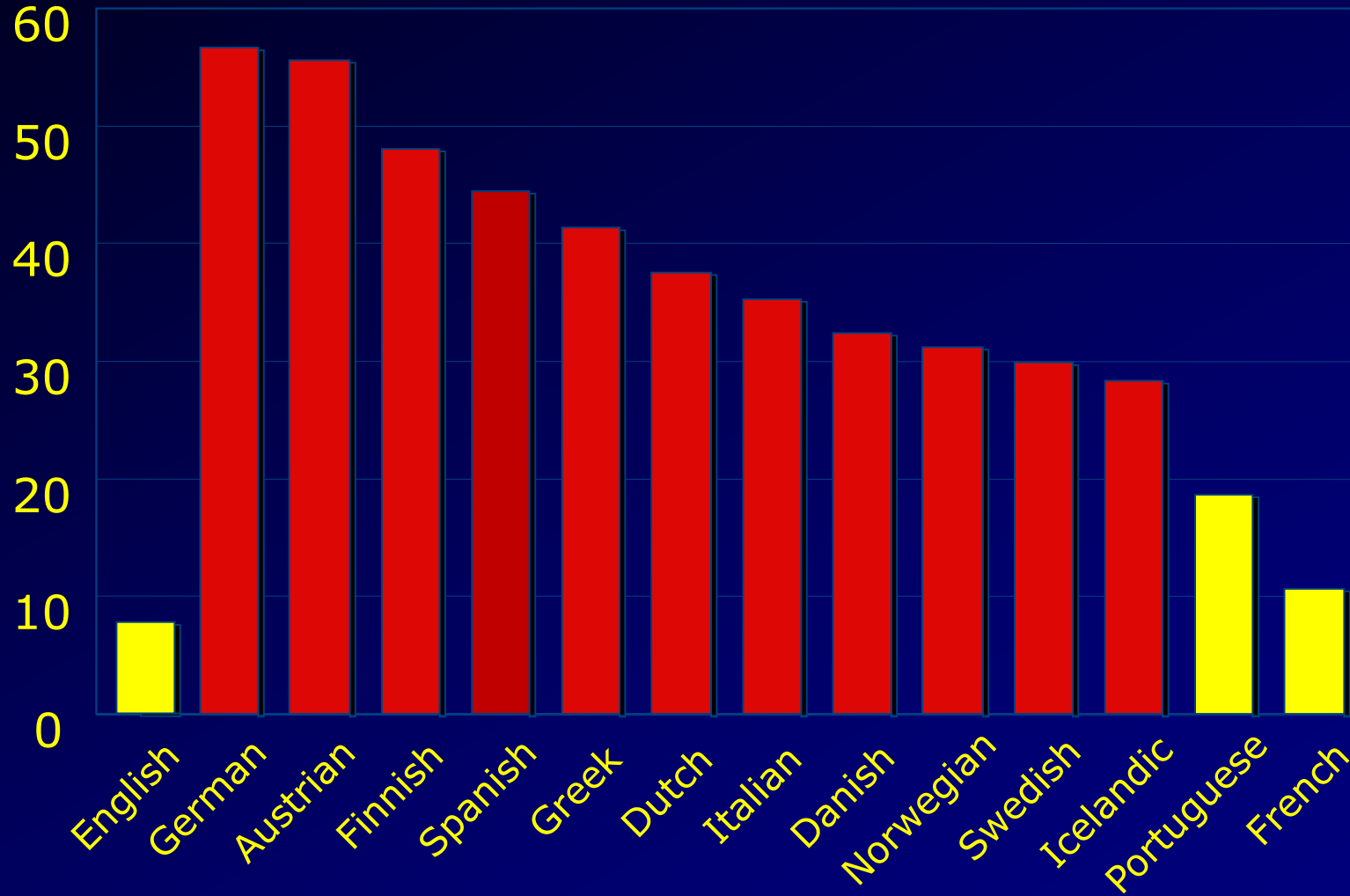
**(Coltheart, Marshall, Newcombe)**

# Reading level after 1 year of instruction



Seymour, Aro, & Erskine et al. (2003), British Journal of Psychology

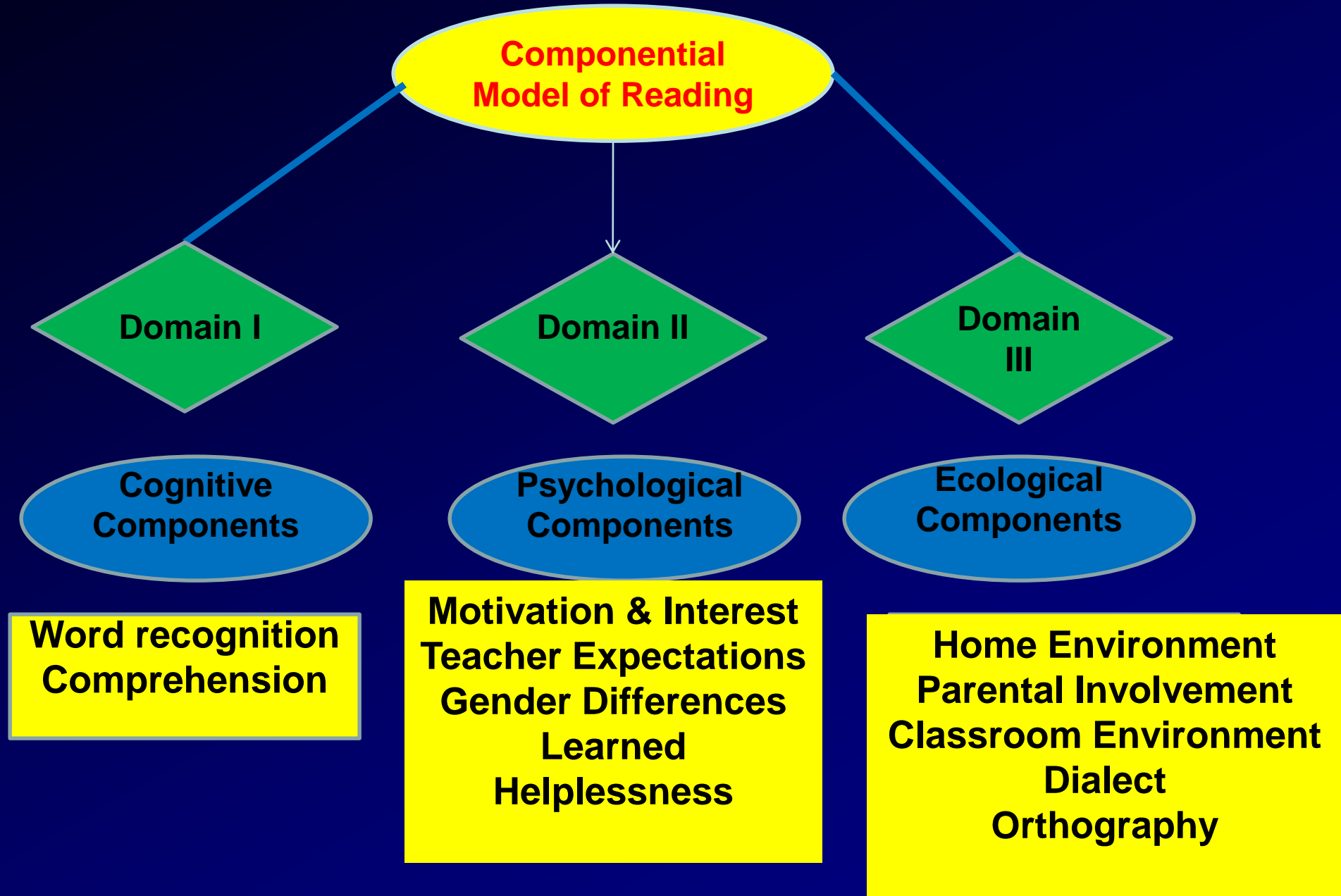
# Items/min

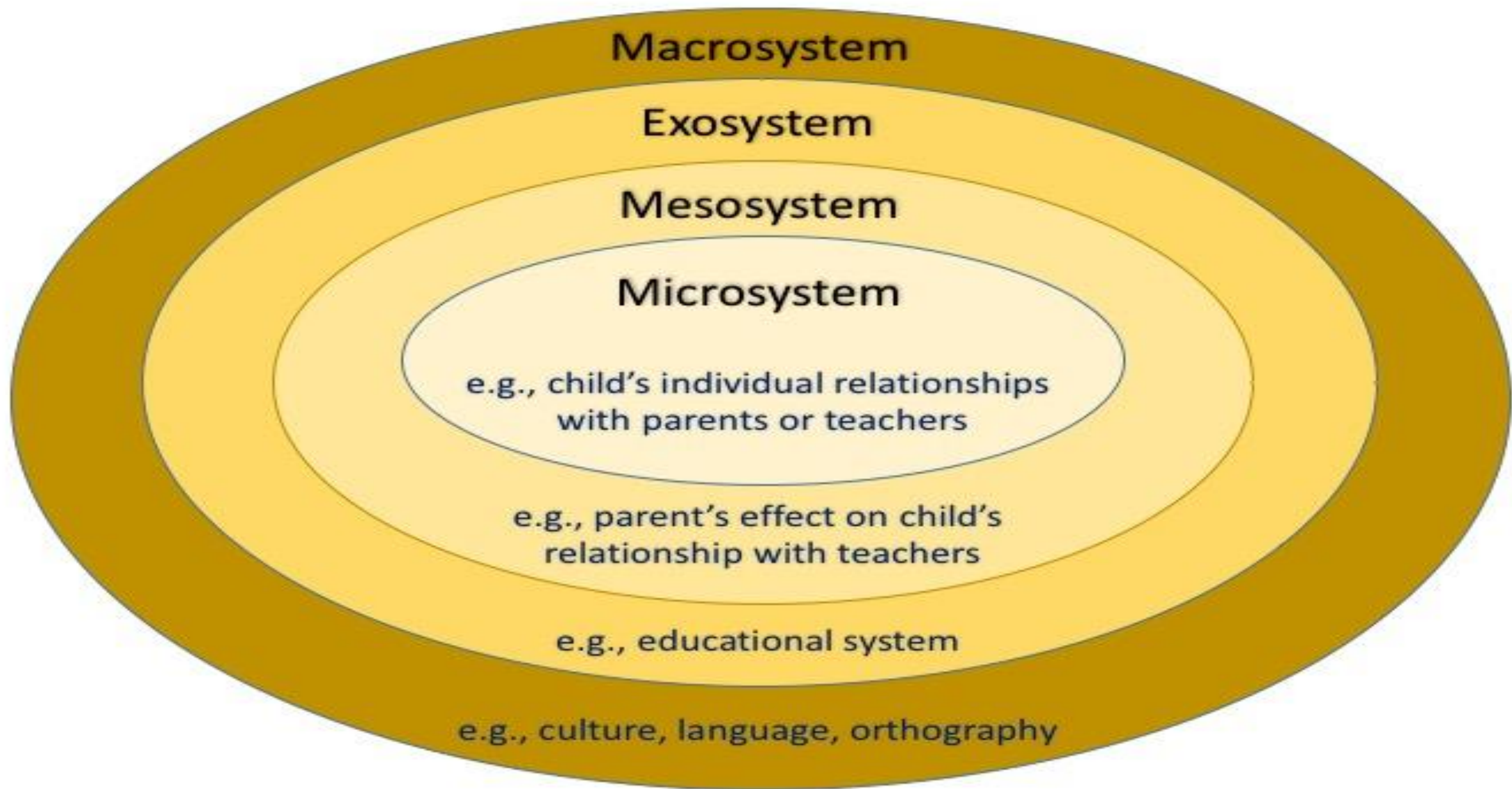


$$r_{\text{accuracy/speed}} = .87$$

Seymour, Aro, & Erskine et al. (2003), British Journal of Psychology

# Componential Model of Reading





Bronfenbrenner's (1979) ecological approach applied to children's reading acquisition

# Microsystem: Home Literacy Environment

HLE is the key explanatory variable in explicating the SES and socio-cultural difference in literacy skills.

- SES ~ storybook telling/parental involvement

Hamilton et al.(2016); Hermmerchts et al.(2016)

- Read book daily: 64% Caucasian, 48% African-American; 42% Hispanic parents

- Caucasian children: more books, and other language learning materials and devices.

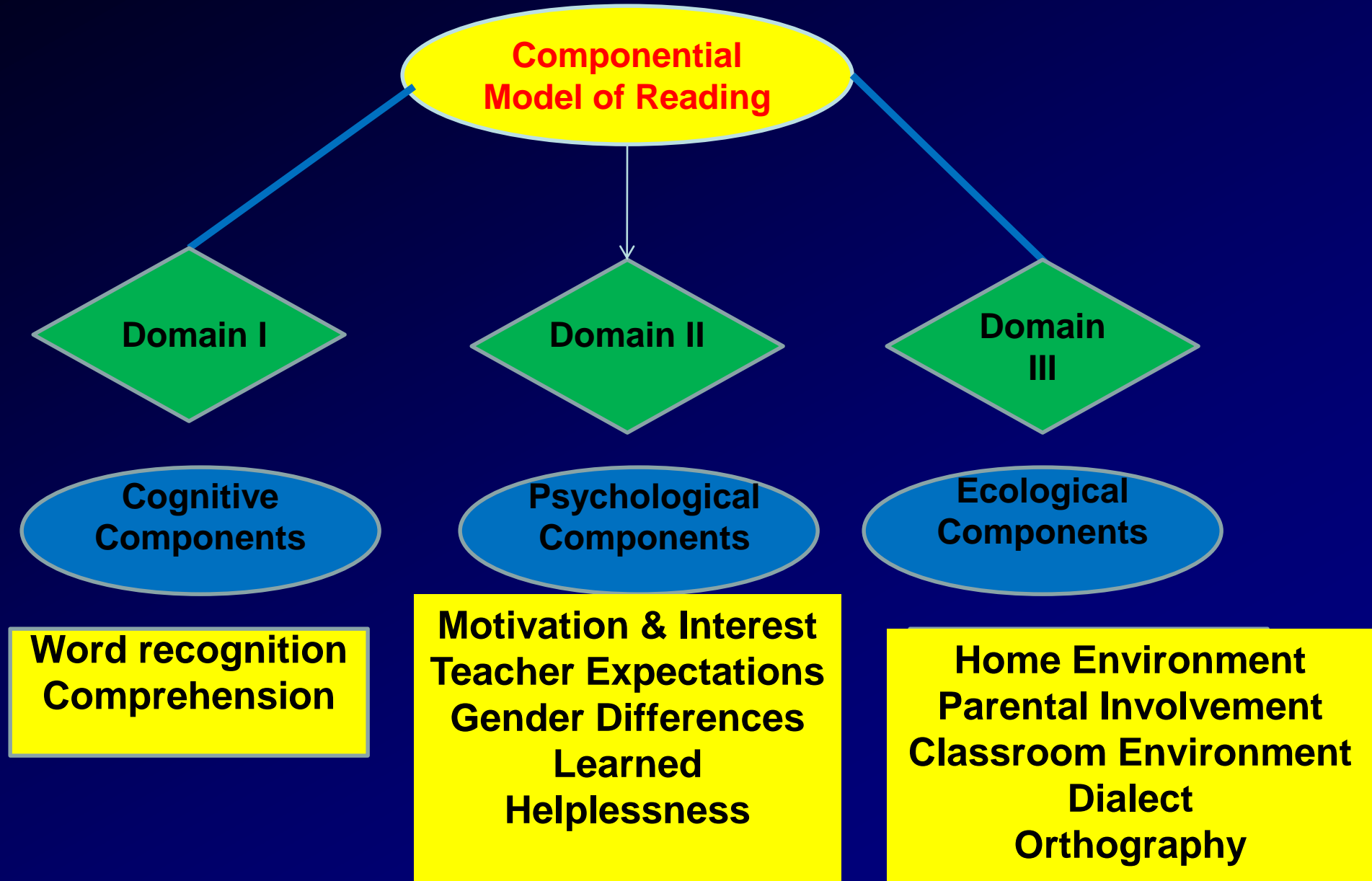
- Racial gap shrinks after controlling for SES

- Bradley et al.(2001); Brooks-Gun & Markman(2005); Yarosz & Barnett(2001)

- Caution: lower SES families still do provide supportive HLE for children

Drummond & Stipek(2004); Payne, Whitehurst, & Angell.(1994); Purcell-Gates(1996)

# Componential Model of Reading



# Writing Systems

Logographic  
(Morpho  
syllabic)

Syllabic

Alphabetic

Kanji  
Chinese

No phonemic  
representation

Potential  
phonemic  
representation

Roman alphabet  
Cyrillic alphabet







Kana  
*ba vs bi*  
*ti vs gi*

Korean Hangul  
Devanagari  
*ba vs bi*  
*ti vs gi*



# A. PICTOGRAPHIC

read as what it pictures\*:

	origins	old	modern
rì 'sun'			
shān 'hill'			
zǐ 'child'			
nǚ 'woman'			
niǎo 'bird'			
mù 'tree'			
shuǐ 'water'			
mǎ 'horse'			
yáng 'sheep'			
tián 'field'			

# B. IDEOGRAPHIC

a) read as a related idea\*:

 gāo 'high' (picture of a tower)

b) read as the result of the 2 Ideas pictured:

 hǎo 'good' [ 女 + 子 ]  
 ['woman' 'child']

 míng 'sing' [ 口 + 鳥 ]  
 ['mouth' 'bird']

 lín 'forest' [ 木 + 木 ]  
 ['tree' 'tree']

\* "pictures," here and elsewhere, refer to the original forms, now hardly recognizable because of stylization.

\* "idea," here and elsewhere, refers to characters used as meaning-indicators in contrast to speech-sound indicators. However, characters always represent definite words of spoken Chinese, not ideas that may be stated in different ways.

あ	a
か	ka
さ	sa
た	ta
な	na
は	ha
ま	ma
や	ya
ら	ra
わ	wa
ん	n

い	i
き	ki
し	shi
ち	chi
に	ni
ひ	hi
み	mi
り	ri

う	u
く	ku
す	su
つ	tsu
ぬ	nu
ふ	fu
む	mu
ゆ	yu
る	ru

え	e
け	ke
せ	se
て	te
ね	ne
へ	he
め	me
れ	re

お	o
こ	ko
そ	so
と	to
の	no
ほ	ho
も	mo
よ	yo
ろ	ro
を	wo

ಅ ಆ ಇ ಈ ಉ ಊ ಋ ಎ ಏ ಐ ಒ ಓ ಔ ಅಂ ಅಃ

# ಕ ಕಾ ಕಿ ಕೀ ಕು ಕೂ ಕ್ಯ ಕೆ ಕೇ ಕೈ ಕೊ ಕೋ ಕೌ ಕಂ ಕಃ (Ka, Ki, Ke, Ko, . . .

- ಖ ಖಾ ಖಿ ಖೀ ಖು ಖೂ ಖ್ಯ ಖೆ ಖೇ ಖೈ ಖೊ ಖೋ ಖೌ ಖಂ ಖಃ
- ಗ ಗಾ ಗಿ ಗೀ ಗು ಗೂ ಗ್ಯ ಗೆ ಗೇ ಗೈ ಗೊ ಗೋ ಗೌ ಗಂ ಗಃ
- ಘ ಘಾ ಘಿ ಘೀ ಘು ಘೂ ಘ್ಯ ಘೆ ಘೇ ಘೈ ಘೊ ಘೋ ಘೌ ಘಂ ಘಃ
- ಙ ಙಾ ಙಿ ಙೀ ಙು ಙೂ ಙ್ಯ ಙೆ ಙೇ ಙೈ ಙೊ ಙೋ ಙೌ ಙಂ ಙಃ
- ಚ ಚಾ ಚಿ ಚೀ ಚು ಚೂ ಚ್ಯ ಚೆ ಚೇ ಚೈ ಚೊ ಚೋ ಚೌ ಚಂ ಚಃ
- ಛ ಛಾ ಛಿ ಛೀ ಛು ಛೂ ಛ್ಯ ಛೆ ಛೇ ಛೈ ಛೊ ಛೋ ಛೌ ಛಂ ಛಃ
- ಜ ಜಾ ಜಿ ಜೀ ಜು ಜೂ ಜ್ಯ ಜೆ ಜೇ ಜೈ ಜೊ ಜೋ ಜೌ ಜಂ ಜಃ
- ಝ ಝಾ ಝಿ ಝೀ ಝು ಝೂ ಝ್ಯ ಝೆ ಝೇ ಝೈ ಝೊ ಝೋ ಝೌ ಝಂ ಝಃ
- ಞ ಞಾ ಞಿ ಞೀ ಞು ಞೂ ಞ್ಯ ಞೆ ಞೇ ಞೈ ಞೊ ಞೋ ಞೌ ಞಂ ಞಃ
- ತ ತಾ ತಿ ತೀ ತು ತೂ ತ್ಯ ತೆ ತೇ ತೈ ತೊ ತೋ ತೌ ತಂ ತಃ
- ಥ ಥಾ ಥಿ ಥೀ ಥು ಥೂ ಥ್ಯ ಥೆ ಥೇ ಥೈ ಥೊ ಥೋ ಥೌ ಥಂ ಥಃ
- ದ ದಾ ದಿ ದೀ ದು ದೂ ದ್ಯ ದೆ ದೇ ದೈ ದೊ ದೋ ದೌ ದಂ ದಃ
- ಧ ಧಾ ಧಿ ಧೀ ಧು ಧೂ ಧ್ಯ ಧೆ ಧೇ ಧೈ ಧೊ ಧೋ ಧೌ ಧಂ ಧಃ
- ನ ನಾ ನಿ ನೀ ನು ನೂ ನ್ಯ ನೆ ನೇ ನೈ ನೊ ನೋ ನೌ ನಂ ನಃ
- ಟ ಟಾ ಟಿ ಟೀ ಟು ಟೂ ಟ್ಯ ಟೆ ಟೇ ಟೈ ಟೊ ಟೋ ಟೌ ಟಂ ಟಃ

# ರ ರಾ ರಿ ರೀ ರು ರೂ ರ್ಯ ರೆ ರೇ ರೈ ರೊ ರೋ ರೌ ರಂ ರಃ

- ಡ ಡಾ ಡಿ ಡೀ ಡು ಡೂ ಡ್ಯ ಡೆ ಡೇ ಡೈ ಡೊ ಡೋ ಡೌ ಡಂ ಡಃ
- ಢ ಢಾ ಢಿ ಢೀ ಢು ಢೂ ಢ್ಯ ಢೆ ಢೇ ಢೈ ಢೊ ಢೋ ಢೌ ಢಂ ಢಃ
- ಣ ಣಾ ಣಿ ಣೀ ಣು ಣೂ ಣ್ಯ ಣೆ ಣೇ ಣೈ ಣೊ ಣೋ ಣೌ ಣಂ ಣಃ
- ಪ ಪಾ ಪಿ ಪೀ ಪು ಪೂ ಪ್ಯ ಪೆ ಪೇ ಪೈ ಪೊ ಪೋ ಪೌ ಪಂ ಪಃ
- ಫ ಫಾ ಫಿ ಫೀ ಫು ಫೂ ಫ್ಯ ಫೆ ಫೇ ಫೈ ಫೊ ಫೋ ಫೌ ಫಂ ಫಃ
- ಬ ಬಾ ಬಿ ಬೀ ಬು ಬೂ ಬ್ಯ ಬೆ ಬೇ ಬೈ ಬೊ ಬೋ ಬೌ ಬಂ ಬಃ
- ಭ ಭಾ ಭಿ ಭೀ ಭು ಭೂ ಭ್ಯ ಭೆ ಭೇ ಭೈ ಭೊ ಭೋ ಭೌ ಭಂ ಭಃ
- ಮ ಮಾ ಮಿ ಮೀ ಮು ಮೂ ಮ್ಯ ಮೆ ಮೇ ಮೈ ಮೊ ಮೋ ಮೌ ಮಂ ಮಃ
- ಯ ಯಾ ಯಿ ಯೀ ಯು ಯೂ ಯ್ಯ ಯೆ ಯೇ ಯೈ ಯೊ ಯೋ ಯೌ ಯಂ ಯಃ

# ರ ರಾ ರಿ ರೀ ರು ರೂ ರ್ಯ ರೆ ರೇ ರೈ ರೊ ರೋ ರೌ ರಂ ರಃ (ra, ri, re, ro, . . . .

- ಲ ಲಾ ಲಿ ಲೀ ಲು ಲೂ ಲ್ಯ ಲೆ ಲೇ ಲೈ ಲೊ ಲೋ ಲೌ ಲಂ ಲಃ
- ವ ವಾ ವಿ ವೀ ವು ವೂ ವ್ಯ ವೆ ವೇ ವೈ ವೊ ವೋ ವೌ ವಂ ವಃ
- ಶ ಶಾ ಶಿ ಶೀ ಶು ಶೂ ಶ್ಯ ಶೆ ಶೇ ಶೈ ಶೊ ಶೋ ಶೌ ಶಂ ಶಃ
- ಷ ಷಾ ಷಿ ಷೀ ಷು ಷೂ ಷ್ಯ ಷೆ ಷೇ ಷೈ ಷೊ ಷೋ ಷೌ ಷಂ ಷಃ
- ಸ ಸಾ ಸಿ ಸೀ ಸು ಸೂ ಸ್ಯ ಸೆ ಸೇ ಸೈ ಸೊ ಸೋ ಸೌ ಸಂ ಸಃ
- ಹ ಹಾ ಹಿ ಹೀ ಹು ಹೂ ಹ್ಯ ಹೆ ಹೇ ಹೈ ಹೊ ಹೋ ಹೌ ಹಂ ಹಃ
- ಳ ಳಾ ಳಿ ಳೀ ಳು ಳೂ ಳ್ಯ ಳೆ ಳೇ ಳೈ ಳೊ ಳೋ ಳೌ ಳಂ ಳಃ

# Orthographic Depth

*Shallow*.....*Deep*

S  
y  
l  
l  
a  
b  
i  
c

S  
t  
r  
u  
c  
t  
u  
r  
e

<b>Simple</b>	<b>Finnish</b>	<b>Greek Italian Spanish</b>	<b>Portuguese</b>	<b>French</b>	
<b>Complex</b>		<b>German Norwegian Icelandic</b>	<b>Dutch Swedish</b>	<b>Danish</b>	<b>English</b>

Source. Seymour, Aro, and Erskine (2003).

	English	French	Czech	German	Spanish
<b>No. of letters</b>	<b>26</b>	<b>26</b>	<b>39</b> <b>(13v + 26C)</b>	<b>30</b>	<b>28-29 (w)</b>
<b>No. of phonemes</b>	<b>44</b> <b>(20V + 24C)</b>	<b>38</b> <b>(19V + 19C)</b>	<b>37</b> <b>(6V + 25C)</b>	<b>≈30</b>	<b>29</b> <b>(5V + 17C)</b>
<b>Phoneme - letter ratio</b>	<b>1.7:1</b>	<b>1.5:1</b>	<b>1:1</b>	<b>1:1</b>	<b>1:1</b>
<b>No. of graphemes</b>	<b>≈ 250</b>	<b>≈165</b>	<b>42</b>	<b>≈30</b>	<b>29</b>

- Cognitive Components of CMR in Different Orthographies
- Simple View of Reading:
- Gough & Tunmer (1986)
- Hoover & Gough (1990)
- $RC = D \times LC$
- If  $D = 0$ ; then  $RC = 0$ ; if  $LC = 0$ , then also  $RC = 0$
- English – Spanish bilinguals
- Grades 1-4                      50-60%

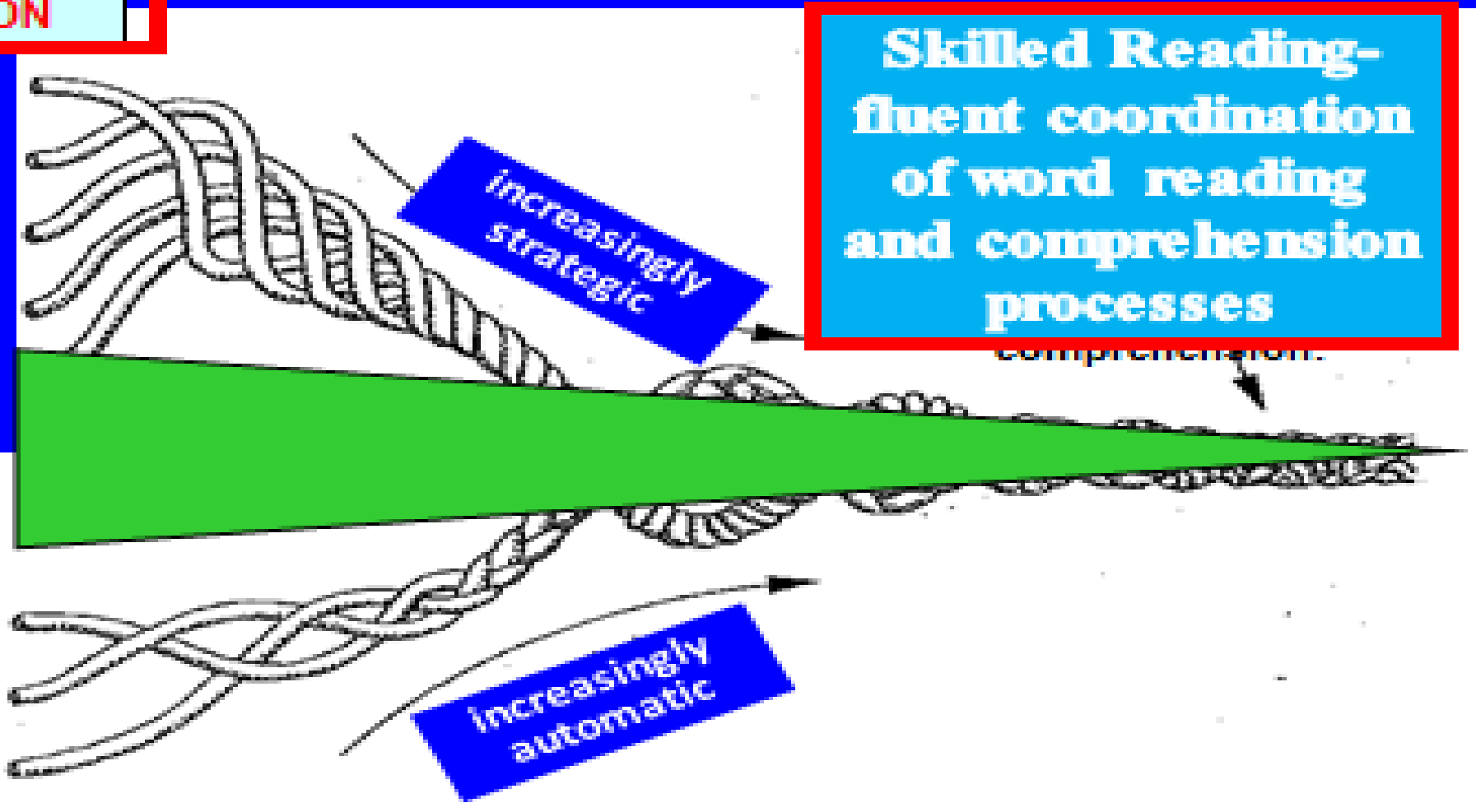
# The Many Strands that are Woven into Skilled Reading (Scarborough, 2001)

## LANGUAGE COMPREHENSION

- BACKGROUND KNOWLEDGE
- VOCABULARY KNOWLEDGE
- LANGUAGE STRUCTURES
- VERBAL REASONING
- LITERACY KNOWLEDGE

## WORD RECOGNITION

- PHON. AWARENESS
- DECODING (and SPELLING)
- SIGHT RECOGNITION



Skilled Reading-fluent coordination of word reading and comprehension processes

Reading is a multifaceted skill, gradually acquired over years of instruction and practice.

# Distribution of different types of reading disabilities (Grades 3, 4, & 6; 198 participants)

Adeq. Decoding  
Poor comp

7%

poor decoding  
adeq. Comp

8%

poor decoding  
poor comp.

8%

Aaron, P.G. & Joshi, R.M. (1999). Not all reading disabilities are alike. *Journal of Learning Disabilities, 32*, 120-137.

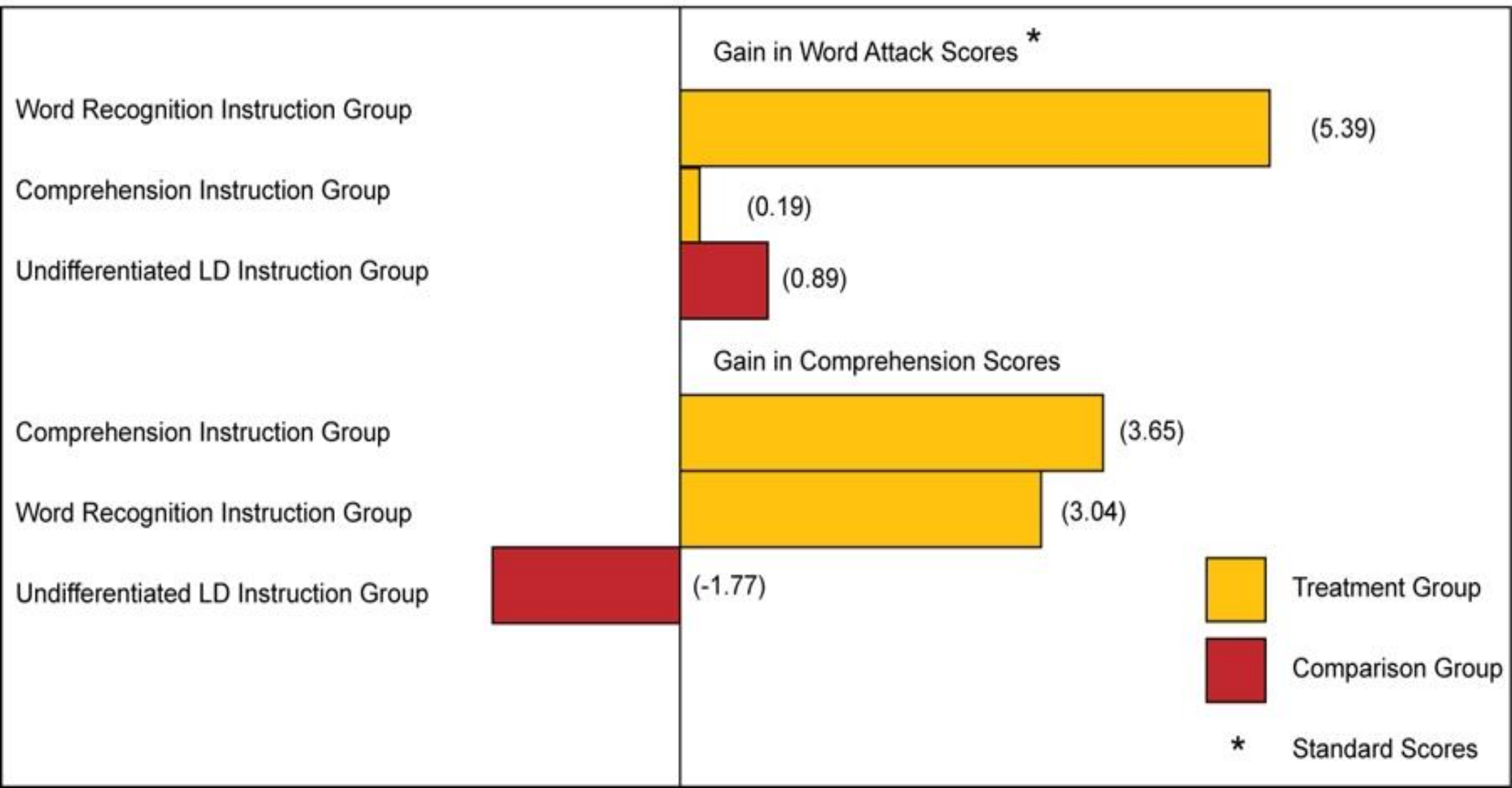
Also see Leach, Scarborough, and Rescorla (2003); Stothard & Hulme (1994); Oakhill & Bryant (2003)

Aaron, P. G., Joshi, R.M., Boulware-Gooden, R., & Bentum, K. (2008). Diagnosis and treatment of reading disabilities based on the Component Model of reading: An alternative to the Discrepancy Model of Learning Disabilities. *Journal of Learning Disabilities, 41*, 67-84.



	<b>Control Group</b> <b>Pretest-Post-test</b>	<b>Treatment Group</b> <b>Pretest-Post-test</b>
<b>Decoding deficit:</b> <b>Decoding training</b>	<b>86.19 (12.553)</b> <b>87.08 (11.485)</b> <b>(n=62)</b>	<b>84.66 (9.965)</b> <b>90.05 (11.418)</b> <b>(n=125)</b>
<b>Decoding deficit:</b> <b>Comp. training</b>	<b>86.19 (12.553)</b> <b>87.08 (11.485)</b> <b>(n=62)</b>	<b>88.55 (12.083)</b> <b>88.74 (12.811)</b> <b>(n=46)</b>
<b>Comp. deficit:</b> <b>decoding training</b>	<b>86.67 (14.124)</b> <b>84.90 (12.974)</b> <b>(n=97)</b>	<b>88.14 (12.403)</b> <b>91.79 (12.486)</b> <b>(n=125)</b>
<b>Comp. deficit:</b> <b>Comp. training</b>	<b>86.67 (14.124)</b> <b>84.90 (12.974)</b> <b>(n=97)</b>	<b>88.50 (9.477)</b> <b>102.54 (10.608)</b> <b>(n=46)</b>

# Gains in word attack and comprehension scores by treatment and comparison groups.



Language	Grade levels	Total variance explained	Results
<b><u>English</u></b> Tilstra et al. (2009)	2-10	40-70%; Grade 4 = 61% Grade 7 = 48% Grade 9 = 38%	Decoding: 4th graders = 42%; 7th graders = 13% L C: 4th graders = 19%; 7th graders = 35%
<b><u>French</u></b> (Megherbi, Seigneuric, & Ehrlich 2006)	1 & 2	>50%	Grade 1: Decoding = 27%; LC = 39% (10% shared) Grade 2 : Decoding = 16%; LC = 44% (8% shared)
<b><u>Norwegian</u></b> Høien-Tengesdal & Høien (2012)	6	49%	Mostly explained by LC; minimal contribution from decoding to RC from age 9
<b><u>Swedish</u></b> Høien-Tengesdal & Høien (2012)	6	50%	Mostly explained by LC; minimal contribution from decoding to RC from age 9
<b><u>Dutch</u></b> : de Jong and van der Leij (2002)	1-3	50%	LC contributed much of the variance after grade 1
<b><u>Greek</u></b> : Protopapas, Sideridis, Mouzaki & Simos, (2007)	2-6		
<b><u>Italian</u></b> : Tobia & Bonifacci (2015)	1-5		
<b><u>Persian</u></b> : Sadeghi, Everatt & McNeil (2016)	2-5		

# Application of CMR to other languages

## Spanish: (Joshi, Aaron, Tao Sha, & Quiroz, 2012)

Grade	English	Spanish
2	(n=49) LC & D = 47%	(n=38) LC & D = 57%
3	(n=54) LC & D = 48%	(n=42) LC & D = 60%
4	(n=55) LC & D = 50%	
2	LC=33%; D=35%	LC=45%; D=25%
3	LC=37%; D=35%	LC=47%; D=15%
4	LC=41%; D=14%	

- SVR in Chinese (Mandarin; Joshi, Aaron, Tao, Quiroz, 2012):
- Grade 2; Character recognition & LC = 25%
- Grade 4; Character recognition & LC = 42%
- Character Rec. Grade 2 = 22% ; Grade 4 = 32%
- Listening Comp. Grade 2 = 11%; Grade 4 = 31%
- SVR in Chinese Cantonese (Ho et al., 2016)
- Hong Kong; grades 3-4
- Character Recog. + Fluency & LC = 74%
- Listening Comp. = 70%
- CR & Reading Fluency = 42%

- SVR in Hebrew: (Joshi et al., 2015)
- 1002 students from grades 2 to 10 – N. Israel
- Phonological coding; orthographic coding; Listening Comprehension, & Reading Comprehension
- Results:
  - 37% (Grade 6) to 70% (Grade 4)
  - DC Grades 2 = 27%; 4 = 26%; 5 = 20%; 6 = 8%
  - LC Grades 2 = 17%; 3 = 26%; 9 = 60%

- SVR in Arabic (Asadi, Khateb, & Shany, 2016)
- 1,385 grades 1-6
- D, LC, RC, orthographic and morphological measures
- SVR
- Grade 1 = 56%; 2 = 53; 3 = 50; 4 = 41; 5 = 38; 6 = 40
- OA & MA
- Gr. 1 & 2 = 10%; 3 & 4 = 14%; 5 = 22%; 6 = 16%
- 56 – 66%

- ESL

- First study of SVR (Hoover & Gough) was based on bilingual/ESL population
- Geva & Farnia (2012)
- Longitudinal study grades 2-5
- ELL and EL1 showed similar trend (explaining more than 60% of the variance)
- Decoding more important in early grade levels
- However, in EL1 LC contributed more to RC earlier and ELL struggled with language tasks
- Verhoeven & van Leeuwe; Dutch as a second language



- EFL (Erbeli & Joshi, submitted) Slovenia
- N = 480 seventh graders (271 = skilled)  
(209 = LS)
- Even though 60% of the variance was explained by two factors, LC was a better predictor of RC for skilled readers
- Decoding for less skilled readers.

- Nakamura, Joshi, de Hoop, & Ji (2016, 2017, in Press)

## Context of the Study



- N = 556
- Grades 2-5
- Schools from urban 'slum' communities and rural villages
- Multilingual
- Biliteracy in Primary Literacy (Lit1) Kannada/Telugu; and Secondary Literacy (Lit2) English
- Mother Tongues: Kannada (N= 78); Telugu (N=132); Marathi (N=6); Tamil (N=45); Hindi (N=3); Urdu (N=10)

# Multiple Regressions by Grade

	Low Elementary			High Elementary		
	<i>B</i>	<i>SE B</i>	$\beta$	<i>B</i>	<i>SE B</i>	$\beta$
PA	.11	.12	.13	-.11	.10	-.11
Dec	.69	.17	.56***	.68	.14	.53***
LC	.08	.21	.08	.41	.15	.28**
	R <sup>2</sup> = 45%			R <sup>2</sup> = 49%		

**Note.** PA = Phonological Awareness; Dec = Decoding; LC = Language Comprehension; RC = Reading Comprehension; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

- Approximately 50% of the variance was explained by the two factors
- Decoding in 'akshara' plays a stronger role even at the fifth grade level.
- L2 much better after a threshold (0.6) is reached in L1

- CMR applied to bilinguals

Decoding

good

poor

good

Normal Reader

Dyslexia

poor

Hyperlexia

Low Ability  
Reader

Comprehension

# • Dyslexia in bilinguals

- Hinshelwood (1895)
- 58 year old teacher of French and German languages
- Hinshelwood (1902), ‘ . . . how is it that there are so few recorded cases of these partial forms of word-blindness, that is, cases of dissociation in polyglots? I think the reason is simply that the patient is not thoroughly examined by testing his power of reading all the characters and all the languages with which he is familiar

- Obler (2012): Unfortunately, there is virtually no literature on childhood dyslexia in bilinguals.
- Klein and Doctor (2003) studied 3 cases of biscriptal dyslexics of English and Afrikaans.
- Problems in both the languages
- Abu-Rabia & Siegel (2002)
- Arabic-English bilinguals in Canada
- Poor in Arabic were also poor in English tasks; bilingual poor readers performed better on certain tasks (non word; spelling) than monolingual English poor readers



- Abu-Rabia & Siegel (2003)
- Less skilled readers were poor in phonological ability in Arabic, Hebrew and English.
- Wydell & Butterworth (1999)
- 16 year-old English/Japanese bilingual boy
- Problem only in English but not in Japanese

- McBride-Chang, Liu, Wong, Wong, & Shu (2014)
- PC, PE, & PB: poor in PA tasks;
- PC & PB: poor in MA
- PB: RAN
- Psycholinguistic Grain Size theory (Ziegler & Goswami, 2005): differences in strategy during the reading acquisition process arise from the size of the speech unit represented by each written unit in a script.

# Writing Systems

Logographic  
(Morpho  
syllabic)

Syllabic

Alphabetic

Kanji  
Chinese

No phonemic  
representation

Potential  
phonemic  
representation

Roman alphabet  
Cyrillic alphabet

Kana  
*ba vs bi*  
*ti vs gi*

Korean Hangu

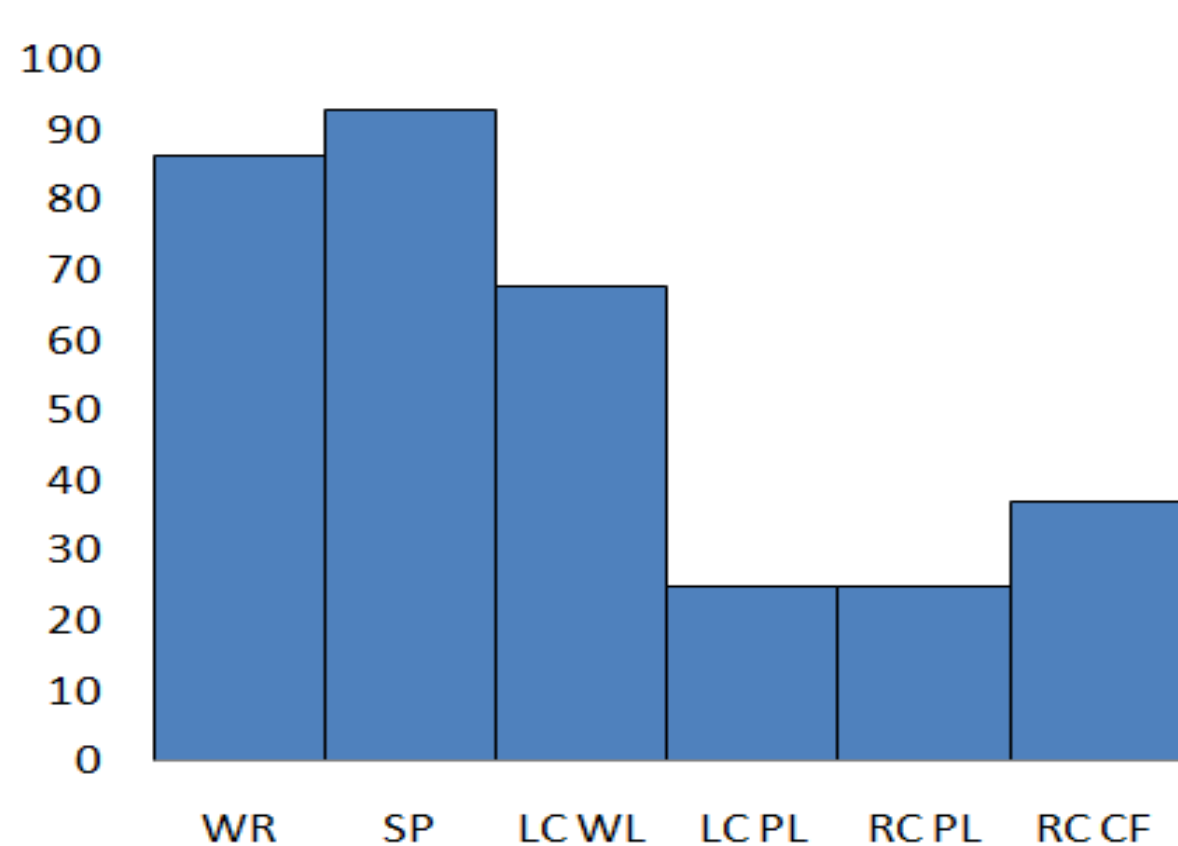
- **MS** and **VN**: 16 years
- Comparison (8): 3-10; 3-16; and 2-14 years
- Background:

# Tests administered

- Raven's Progressive Matrices (RPM)
- Letter/character naming: English & Kannada
- Decoding (nonword and real word): English & Kannada
- Listening Comp. : Word level (synonym judgment; grave-tomb) and passage level
- Reading Comp. : passage and cloze formats
- Spelling (dictation)
- Speed: letters/words
- PA
- (Joshi, et al., *Dyslexia*, 2010)

# MS's performance in English and Kannada

## MS English



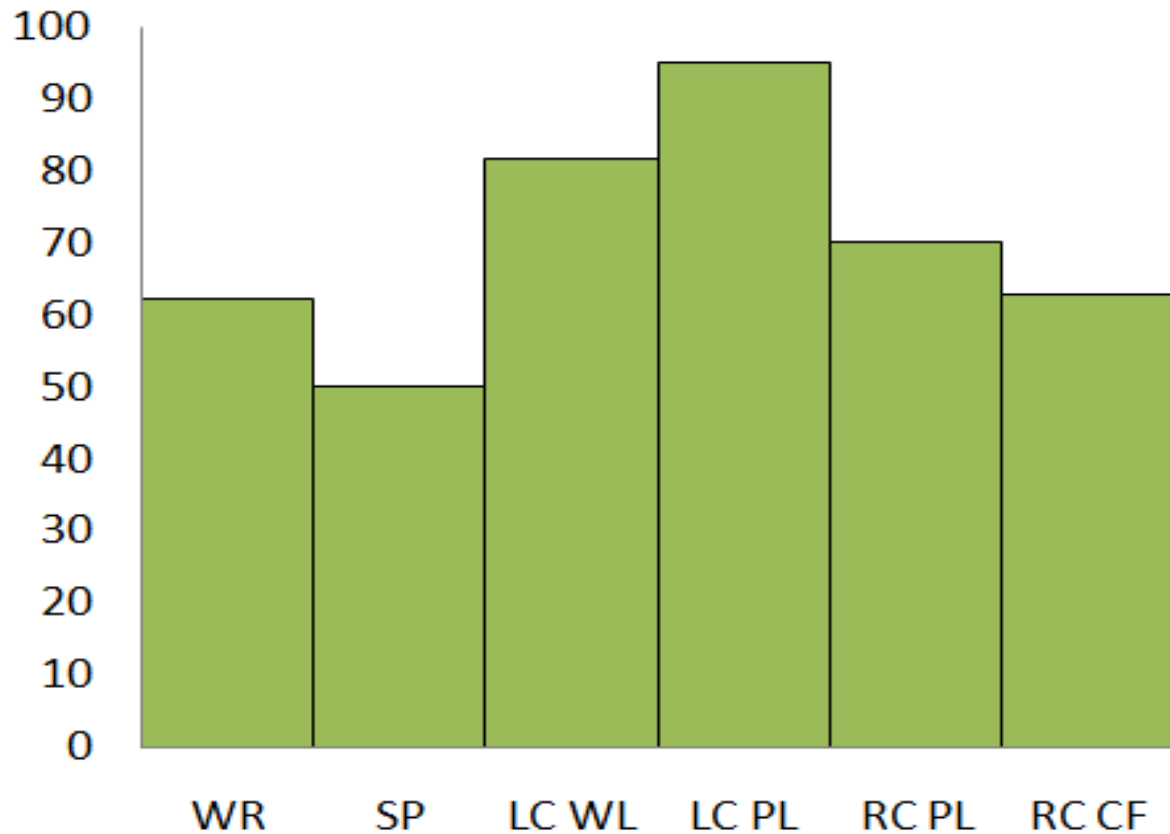
## MS Kannada



Key: WR = Word Reading, LC WL = Listening Comprehension Word Level, LC PL = Listening Comprehension Passage Level, RC PL = Reading Comprehension Passage Level, RC CF = Reading Comprehension Cloze Format, SP = Spelling

# VN's performance in English and Kannada

## VN English



## VN Kannada



Key: WR = Word Reading, LC WL = Listening Comprehension Word Level, LC PL = Listening Comprehension Passage Level, RC PL = Reading Comprehension Passage Level, RC CF = Reading Comprehension Cloze Format, SP = Spelling

- Dialectal Influences

- Treiman, Goswami, Tincoff, & Leeves (1997)

- US children

- Doctor      dkr, deor,  
                  docktur
- Hurt         hrt, hrte,
- Card         crd, crdi, kird
- Girl          grl

- British Children

- docke, docd, dot
- hut, hoot,
- cud, cade
- gel



- University students (Treiman & Barry, 2000).
- British university students:
- Leper → lepa
- Panther → pantha
- Ether → etha
- (only 1% of the U.S. students made errors like that).

- High incidence of reading problems among African Americans has been partly attributed to the differences in the spoken English and the Academic English (Scarborough, Charity)
- Teachers can readily understand the difficulties with reading and spelling experienced by many students learning English as a second language, but they may be baffled by the difficulties encountered by students who speak AAVE (African American Vernacular English).

- Characteristics of AAVE

- Omission of the verb form *be* in certain sentence patterns: *He old* for “He is old”

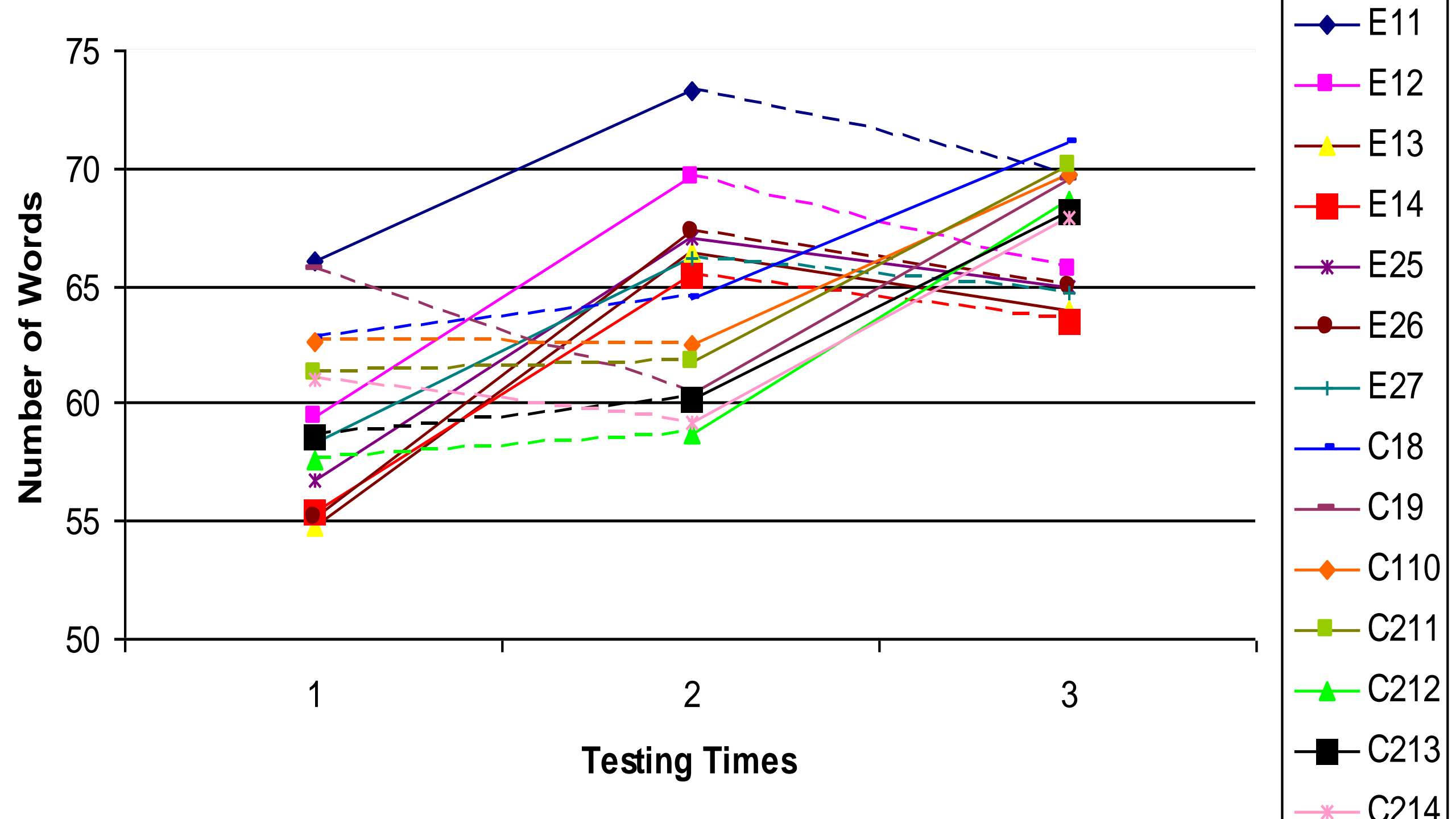
Past tense may not be marked by *ed*

- *walked* -> *walk*; *called* -> *call*. However, *came* and *went* are used correctly
- Differences in preposition use: *He teach at Wilson Elementary* for *He teaches at Wilson Elementary*
- To express a remote event, AAVE speakers will use stressed **BÍN**.
- AAVE: He **BÍN** married
- AE: He has been married for a very long time

- Pittman, Joshi, Carreker (2014)
- School: An inner city school in Houston and was Academically Unacceptable
- Participants: 124 sixth graders (2 teachers)
  - 65 females                      59 males
  - 57 comparison                67 treatment
- Fall semester: randomly assigned the participants
- December – Teacher training
- Language Variation Status (LVS) of the Diagnostic Evaluation of Language Variation (DELV; Seymour, Roeper, & de Villiers, 2003)
- Spring semester – intervention started 25 minutes a week for 3 days a week for 8 weeks

- Means for the Comparison and Treatment Groups*

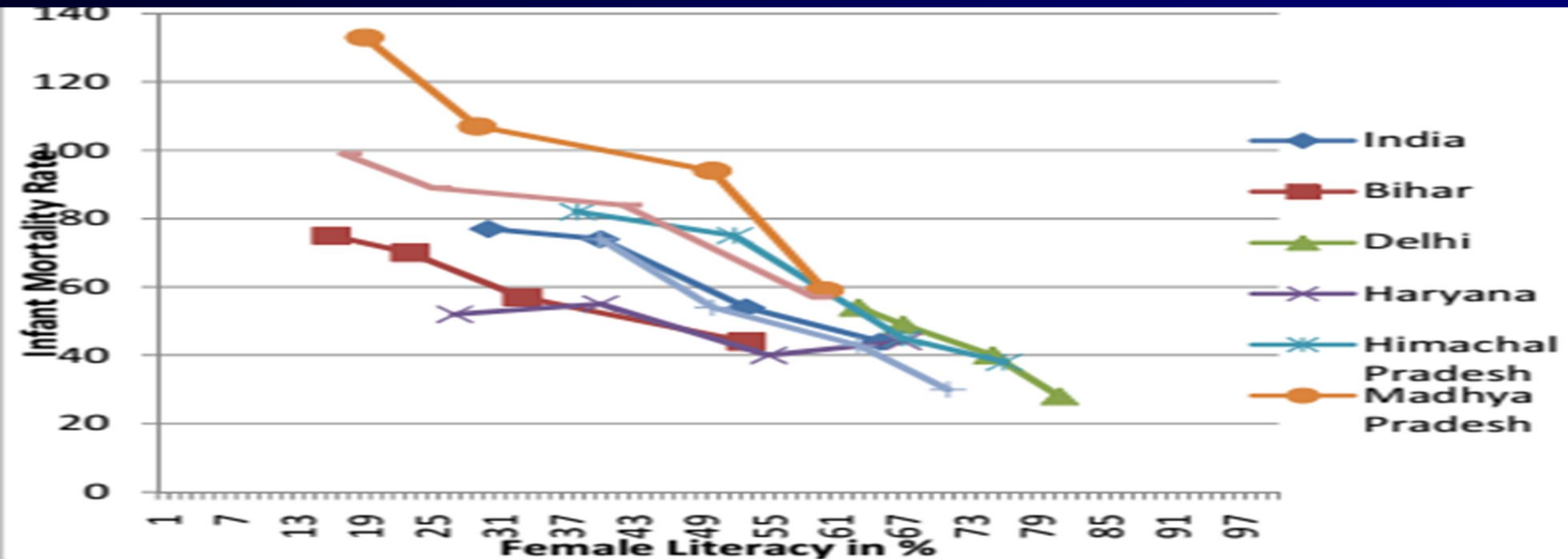
<b>Group</b>	<b>DELV</b>	<b>Spel-pre</b>	<b>Spel-2</b>	<b>Spel 3</b>
<b>Treatment</b>	<b>7.91</b>	<b>57.63</b>	<b>67.78</b>	<b>65.22</b>
<b>Comparison</b>	<b>7.79</b>	<b>61.40</b>	<b>61.26</b>	<b>69.37</b>



# Environmental Influences: (Home, school, and classroom)

Home (Hart & Richey; Chiu & McBride-Chang)

Inverse relationship between female literacy and infant mortality



# Classroom Influences

Teacher knowledge

Moats (1994)

Bos et al., Cunningham et al., McCutchen et al.,



# Are they poor in all aspects of linguistic knowledge?

	Phonemic knowledge	Syllabic knowledge
Moats (1994) (n=89) Inservice teachers	25% (number of phonemes in ox)	19% knew all six syllable types
Bos et al (2001) 252 (PS) & 286 (IS)	Box: 8% & 15%	Definition of a syllable: 53% & 64%
Mather et al. (2001) 293 (PS) & 131 (IS)	Box: 2% & 19%	Definition of a syllable: 52% and 66%
Fielding-Barnsley & Purdie (2005) 93 (PS); 209 (IS-sp.ed.); 38 (IS-sp.ed.)	Box: 15%; 26%; 37%	47%; 53%; 76%
Cunningham et al. (2004) (720- IS 30% with Master's degree)	4%	46.5 % High perceived KG (n=490) 44.8% low perceived KG (n=207) 48.5%
Joshi et al.	42%	>90%*

	No. of syllables correctly identified	No. of morphemes correctly identified
Heaven	92%	40%
Observer	96%	26%
Teacher	92%	48%
Frogs	88%	29%
Spinster	90%	19%

	University faculty	First Year Teachers
<b>define and count the number of syllables correctly</b>	<b>≈ 92%</b>	<b>≈ 92%</b>
<b>Identifying the definition of a phoneme</b>	<b>98%</b>	<b>89%</b>
<b>correctly recognize that “chef” and “shoe” begin with the same sound.</b>	<b>92%</b>	<b>88%</b>
<b>correctly recognize a word with two closed syllables (napkin)</b>	<b>65%</b>	<b>53%</b>
<b>correctly recognize the definition of phonological awareness</b>	<b>58%</b>	<b>47%</b>
<b>No. of morphemes: heaven</b>	<b>40%</b>	<b>21%</b>
<b>Observer</b>	<b>26%</b>	<b>18%</b>
<b>Frogs</b>	<b>29%</b>	<b>24%</b>
<b>Name all the 5 components of NRP (3/20)</b>	<b>15%</b>	<b>0%</b>

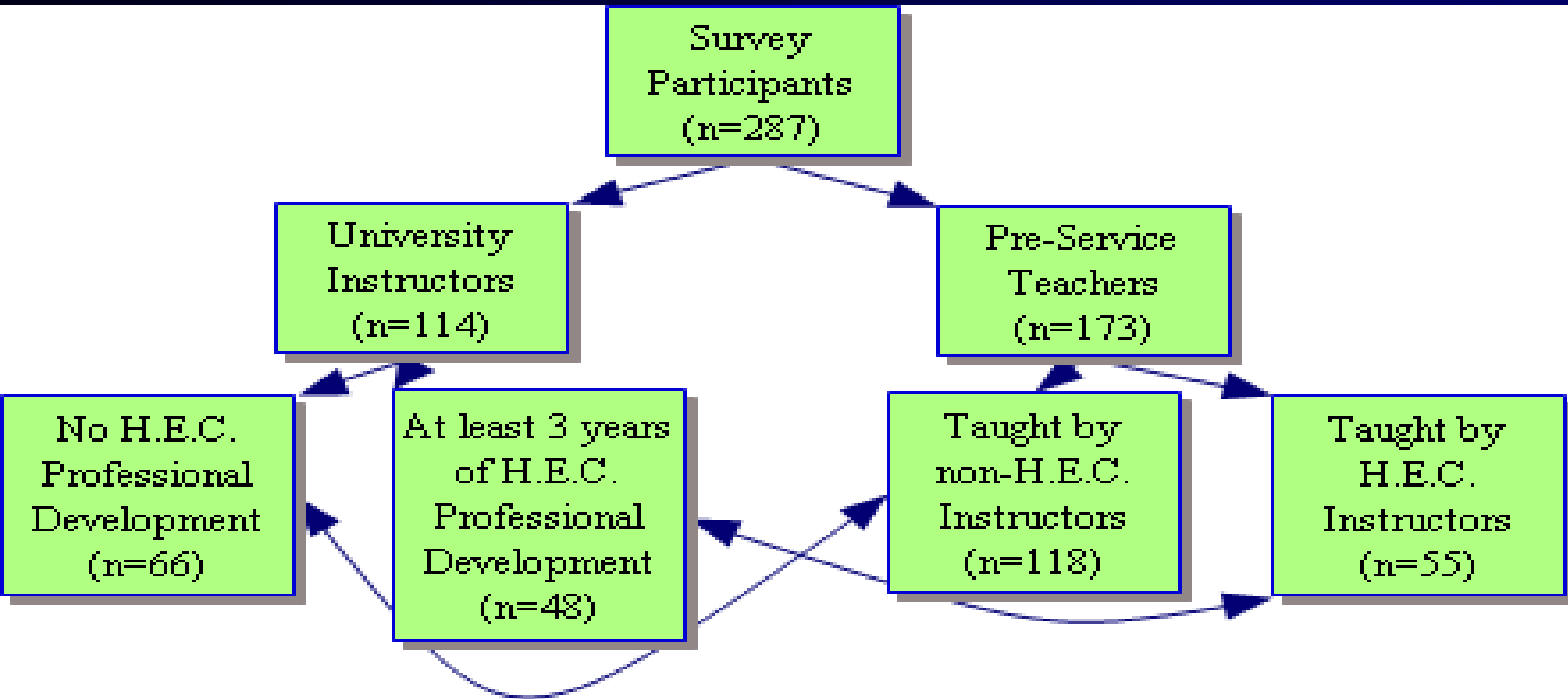
Similar findings from other English countries and China,  
Korea, German, . . . .

Solution: Professional Development

Texas Higher Education Collaborative (HEC)

Provide seminars based on SBRR, support with the  
preparation of syllabi, free supply of reading materials, . . . .

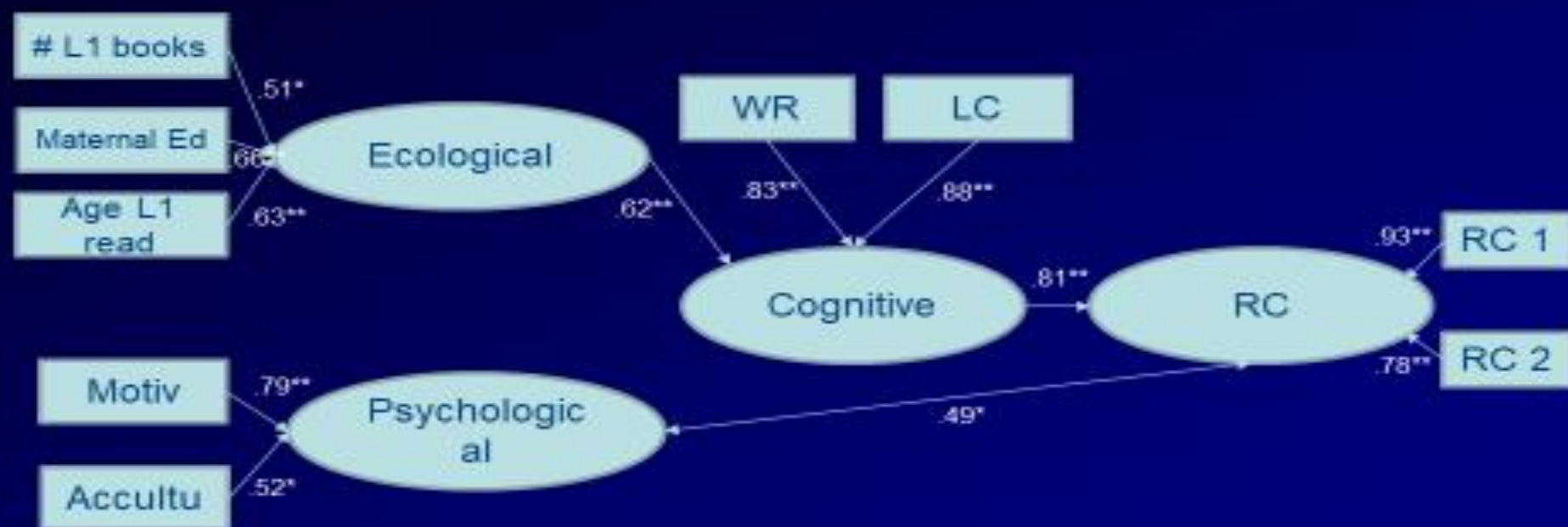
# Breakdown of Survey Participants



# Means and Standard Deviations for Scores of Sample Subsets by Item Category

Item Category	Overall	Non-HEC University Instructors	HEC University Instructors	Non-HEC Pre-Service Teachers	HEC Pre-Service Teachers
<b>Knowledge</b>	<b>0.5261</b> <i>(0.4994)</i>	<b>0.5619</b> <i>(0.4965)</i>	<b>0.7535</b> <i>(0.4314)</i>	<b>0.3729</b> <i>(0.4837)</i>	<b>0.6136</b> <i>(0.4873)</i>
<b>Ability</b>	<b>0.6221</b> <i>(0.4849)</i>	<b>0.5950</b> <i>(0.4910)</i>	<b>0.7821</b> <i>(0.4130)</i>	<b>0.5511</b> <i>(0.4975)</i>	<b>0.6790</b> <i>(0.4670)</i>
<b>Morphological</b>	<b>0.3297</b> <i>(0.4702)</i>	<b>0.2652</b> <i>(0.4418)</i>	<b>0.6380</b> <i>(0.4812)</i>	<b>0.2150</b> <i>(0.4111)</i>	<b>0.3841</b> <i>(0.4869)</i>
<b>Phonemic</b>	<b>0.6408</b> <i>(0.4798)</i>	<b>0.6235</b> <i>(0.4848)</i>	<b>0.7901</b> <i>(0.4076)</i>	<b>0.5313</b> <i>(0.4992)</i>	<b>0.7664</b> <i>(0.4234)</i>
<b>Phonics</b>	<b>0.5029</b> <i>(0.5001)</i>	<b>0.5556</b> <i>(0.4973)</i>	<b>0.7222</b> <i>(0.4484)</i>	<b>0.3484</b> <i>(0.4767)</i>	<b>0.5798</b> <i>(0.4941)</i>

# Li, Joshi, et al



( $\chi^2(18) = 30.09, p = 0.31, RMSEA = .05, CFI = .96, SRMR = .05$ )

- Different contribution of each domain to Reading comprehension
  - Cognitive (1<sup>st</sup>)
  - Psychological (2<sup>nd</sup>)
  - Ecological (3<sup>rd</sup>)
- Unique (direct and indirect) relation of each domain with reading comprehension
  - Cognitive (direct)
  - Psychological (direct)
  - Ecological (indirect)



- Cognitive domain: Mediator
- Cognitive domain is more associated with ecological domain than with psychological domain
- Reciprocal relationship between psychological domain ↔ reading comprehension

- 1. Matthew Effect in Reading
- (rich getting richer poor getting poorer)
- 2. John Effect in Reading
- (In the beginning was the word)
- 3. Peter Effect in Reading (Joshi et al., 2012, 2015)
- (one cannot give to others what s/he does not have)

## • Conclusions

- 1. Illiteracy is of global concern and affects individual, society, and nation
- 2. Decoding (D) and linguistic comprehension (LC) can explain much of the variance in reading comprehension (RC) while IQ scores predict about 25% of the variance in RC.

- **3.** Decoding contributes more at the early grade levels and comprehension more at the upper grade levels. Decoding may play an important role in reading comprehension for a more prolonged time in a more opaque orthography. Language comprehension becomes more important for reading comprehension from the beginning to the more advanced stage.
- **4.** Literacy acquisition and literacy problems among bilinguals may be influenced by the type of writing systems and the 'orthographic distance' between the two languages.

- 5. When University instructors were provided with the knowledge through professional development and mentoring, there was a gain in the knowledge among both instructors and preservice teachers.
- 6. Considering that the majority of the world's population is bilinguals, more research studies on bilinguals are needed

- 7. Classification of writing systems/orthographies needs reorganization
- Share and Daniels (2015), Daniels and Share (2017):
- classifying orthographies on ten different dimensions such as, linguistic distance, visual complexity, spelling constancy despite morphophonemic alternation, omission of phonological elements, allography, dual purpose letters, ligaturing, . . . . .

# Writing Systems

Logographic  
(Morpho  
syllabic)

Syllabic

Alphabetic

Kanji  
Chinese

No phonemic  
representation

Potential  
phonemic  
representation

Roman alphabet  
Cyrillic alphabet

Kana  
*ba vs bi*  
*ti vs gi*

Aksharas  
Abugidas

Korean Hangu

10  
dimensions  
abjads

**Thank you**

**Kiitos paljon**

**Hartelijk Dank**

**شكراً جزيلاً 谢谢**

**고맙습니다 धन्यवाद**

**Danke schön Спасибо**

**Muchisimas Gracias תודה רבה**

**Merci beaucoup ευχαριστώ**

**Děkuji Mnohokrát**

**Tack så mycket**