The biliterate learning environment – insights from brain and behaviour

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Reading and the Brain

- Born to speak but learned to read. Spoken language is a biological specialization, but written language is largely a cultural invention.

- Spoken language is mastered naturally while reading is learned.

- But the development of fluent reading skills is essential for success in the modern world.
NEUROPLASTICITY

• The ability of the brain to change structurally and functionally based on environmental input is called neuroplasticity.

New Connections = Learning

Learning is the most elegant example of ‘neuroplasticity’.
How does the brain learn to read?

- Print
- Meaning
- Sounds
Three components for learning to read

1. Sound awareness
2. Print awareness
3. Comprehension
No single area in the brain is used for reading but a network of brain areas is involved.
READING IS CULTURAL
20 officially recognized spoken languages

11 Officially recognized scripts

Biliteracy -
2 Official Languages
– Hindi and English
Researcher’s Dream and Nightmare
Multiliterate Learning Environment

Three language formula

English
Hindi
State Language

Two language formula

English
Hindi

Simultaneous Instruction in both writing systems
Sequential instruction – native followed by English
BUT EVERYONE HAS TO LEARN TO READ AT LEAST TWO LANGUAGES
<table>
<thead>
<tr>
<th>Reading in English</th>
<th>Reading in Indian Languages, e.g., Hindi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. small number of letters</td>
<td>large number of aksharas</td>
</tr>
<tr>
<td>2. sound – symbol mapping; one letter → many sounds,</td>
<td>sound – symbol mapping; one akshara → one sound</td>
</tr>
<tr>
<td>consonant represent only</td>
<td>consonant aksharas include a vowel sound,</td>
</tr>
<tr>
<td>consonant sounds, separate vowel letters</td>
<td>words may not have vowels,</td>
</tr>
<tr>
<td>e.g., H+U+T = /hʌt/</td>
<td>e.g., ḫ+ṭ = /hʌt/</td>
</tr>
<tr>
<td>3. writing is linear, letters written left to right</td>
<td>writing is nonlinear,</td>
</tr>
<tr>
<td>4.</td>
<td>खाल, खेल, खिल, खुल,</td>
</tr>
</tbody>
</table>
fMRI – functional magnetic resonance imaging
The Salwan Reading Study

Behaviour — Measured phonological and Reading skills

Functional Neuroimaging — Brain Activity measured while reading words in English and Hindi obtained from children’s text books.

Participants: — 40 children between 8-10 years of age performed reading tasks in English and Hindi. Equal number of boys and girls
Good Hindi (native) learners are good English learners!
School children read English and Hindi words aloud while their brain activity was recorded.
Reading = new connections. Reading is Biological

(Cherodath et al, Brain and Language, 2015)
HINDI, MARATHI, KANNADA, ENGLISH

DELHI, NCR
ALLAHABAD
PUNE
MUMBAI
MYSORE

1009 children (classes 1 – 5)
Children were assessed on 9 skills

Vocabulary
  - Picture naming
  - Semantic Fluency (words/min from a category)
  - Verbal Fluency (words/min beginning with the /p/, /f/)

Phonological skills
  - Rhyming and phoneme/syllable replacement

Literacy
  - Word reading,
  - Nonword reading,
  - Dictation,
  - Comprehension
Oral Language is the most reliable predictor of literacy in any language.

Mother Tongue Literacy is the best predictor of Other Tongue (English) Literacy
Unique Literacy environment in India

NO CLEAR POLICY ON HOW THIS IS INTRODUCED IN SCHOOL

SIMULTANEOUS OR SEQUENTIAL
BUT EVERYONE HAS TO LEARN READ AT LEAST TWO LANGUAGES
Dyslexia in India

Worldwide incidence 15-17% (IDA)

Population of children between 0-14 years is nearly 350 million.

Incidence of 10% - 35 million children with learning disability.

Population growth rate of 1.34%, this is only set to increase further

Only 5 out of 100 dyslexics are identified and receive assistance.
Difficulty in diagnosis of dyslexia in India

- Lack of awareness amongst teachers and parents
- Absence of standardised assessment tests in Indian Languages

CONCERNS

- Blind usage of tests in English for Indian children
- English is not the native language of children in India
- No norms, adaptations or standardisations for Indian children
• Early screening for children at risk for dyslexia
• Remediation and intervention can help children cope with dyslexia.
• Teachers can help in early screening for children at risk for dyslexia?
Dyslexia Assessment for Languages of India

dali

Screening Tools for Teachers and Assessment Tools for Psychologists

National Brain Research Centre
Dept. of Biotechnology

Government of India Department of Science & Technology
WHY IS DALI SIGNIFICANT

The first standardised validated screening and assessment tool in regional Indian Languages.

Four Languages – Hindi, Marathi, Kannada and English

4840 children in five cities – Delhi-NCR, Allahabad, Pune, Mumbai and Mysore were tested for this tool.
WHAT DOES DALI CONSIST OF JST, MST AND i-LAB

Two screening tools for school teachers (in FOUR LANGUAGES)

1) JST – Junior Screening Tool (classes 1 and 2)
2) MST – Middle Screening Tool (classes 3, 4 and 5)
3) iLAB – Indian Language Assessment Battery
4) Assessment Battery Manual
5) Suggestions for Remediation
Every child in class

Class teacher and language teacher administer screening tool

Is screening score $\geq$ cut off score?

- YES
  - Language Assessment Battery administered by Psychologist
  - Identify deficits and Plan Remediation
- NO
  - Monitor -
The Indian biliteracy problem

HOME
Oral Language (Mother tongue)

SCHOOL
Print exposure (Other tongue)

LITERACY ???
SOLUTION 1

HOME

Oral skills
Mother tongue

SCHOOL

Print exposure
(Mother tongue)

Mother Tongue Literacy
SOLUTION 2

HOME

Oral Skills
Mother tongue

SCHOOL

Oral Skills
Other tongue

SCHOOL

Print exposure
(Other tongue)

Other Tongue Literacy
Learnings from Neuroscience Research

• Written words are composed of elementary objects and letters – each of these letters or groups of letters (graphemes) correspond to a speech sound

• **Phonics** not whole word reading is the fastest most efficient way of making children efficient readers
  
  • (Ehri et al, 2001)
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