

Multilingual Education in India: Effects of Language of Instruction on the development of Literacy and Mathematical Skills

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Multilingualism and Multiliteracy: Raising Learning Outcomes in challenging contexts in primary schools across India (May 2016 – April 2020)



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Some preliminaries

- **Multilingualism is a natural phenomenon and has always existed, it's not something new, e.g.**
 - 3rd millenium BC Mesopotamia;
 - Roman empire;
 - England: English: common people, French: ruling class, Latin: church;
 - Ottoman empire;
 - ...

Some preliminaries

- **Multilingualism is possible with or without Multiliteracy;**
 - A soldier in the Roman army didn't have to be literate in multiple languages;
 - An administrator did;
- **(Multi)literacy depends on education;**
 - Does the education system offer opportunities for people to become multiliterate?
 - Do all children go to school?



Mesopotamia (Sumerian-Akkadian -> Babylonian glossary, Louvre)



Some preliminaries

- In the past literacy was for the elite, not anymore;
- Literacy skills is a necessity to function in the 21st century:
 - navigating through a city;
 - rent contract,
 - employment contract,
 - instructions for gadgets;
 - terms and conditions ... for Apps on mobile phones,
 - passing a test to get the citizenship of a host country,
 - ...

Some preliminaries

- Literacy skills is a necessity to function in the 21st century:





Some preliminaries

- **And yet, some people in our societies lack basic literacy skills or have low literacy skills:**
 - people who didn't attend school for various reasons;
 - people who dropped out of school;
 - people who had low educational achievement in school.
- **These are usually people from the most disadvantaged backgrounds.**
- **We wanted to investigate children from disadvantaged backgrounds in India → what factors lead to high/low learning outcomes at school.**



Learning outcomes in schools in India

ASER (Annual Status of Education Report) studies with 600,000 children across India:

- more than half of all children in Standard 5 (grade 5) could not read a Standard 2 (grade 2) level text fluently, and nearly half of them could not solve Standard 2 level subtraction task;
- Low literacy and numeracy can limit other important capabilities, e.g., critical thinking and problem solving;

Learning outcomes in schools in India



- Low educational achievement may lead to school **drop out**;
- High dropout rate in schools **affects girls more than boys** (UNESCO's Education Report, 2015; Annual Status of Education Report Pratham, 2014);
- The **gap between state and private schools** increases every year.

Multilingualism in India



Although multilingualism is the norm in India, the level of proficiency in the home language varies primarily as a function of **whether or not education includes the home language.**
(Panda & Mohanty 2013; ASER 2014)



Education and the language of instruction

- Reports from developing countries suggest that **221 million children are educated in a language they do not speak at home;**
- Poor education quality, drop-out rates, low literacy outcomes (Cummins 2009).



The role of Mother-tongue literacy/education

In children attending schooling in the L2, there are

benefits of Mother-tongue literacy in:

- The strength of the minority language in its mental (conceptual and processing) competition with the majority language;
- Working memory;
- Efficient transfer of basic and higher level literacy skills.

Baker (2000), Cummins (2000),
Skutnabb-Kangas (2000),
Tsimpli (2017)



Mothertongue literacy & cognition

Biliteracy effects on cognitive and language abilities in different groups of bilingual children with varied socio-economic status: the ***strongest cognitive advantage*** was found in the group with *literacy skills in both the Mothertongue and the L2*.

(Dosi, Papadopoulou & Tsimpli, 2016)



Bilingualism: some advantages

Bilingualism has been shown to have beneficial effects on:

- **Cognitive control** (e.g. Bialystok et al 2008; 2011):
 - a. working memory;
 - b. cognitive flexibility, allocation of attention resources and inhibition of inappropriate/incorrect response biases.
- **Delay of dementia and cognitive decline in the elderly** (Alladi et al 2013; 2014)
- **Creativity** (Kharkhurin 2012, for adults; Leikin 2012, for children)

The trigger



Problem:

Low learning outcomes of primary school children in multilingual India



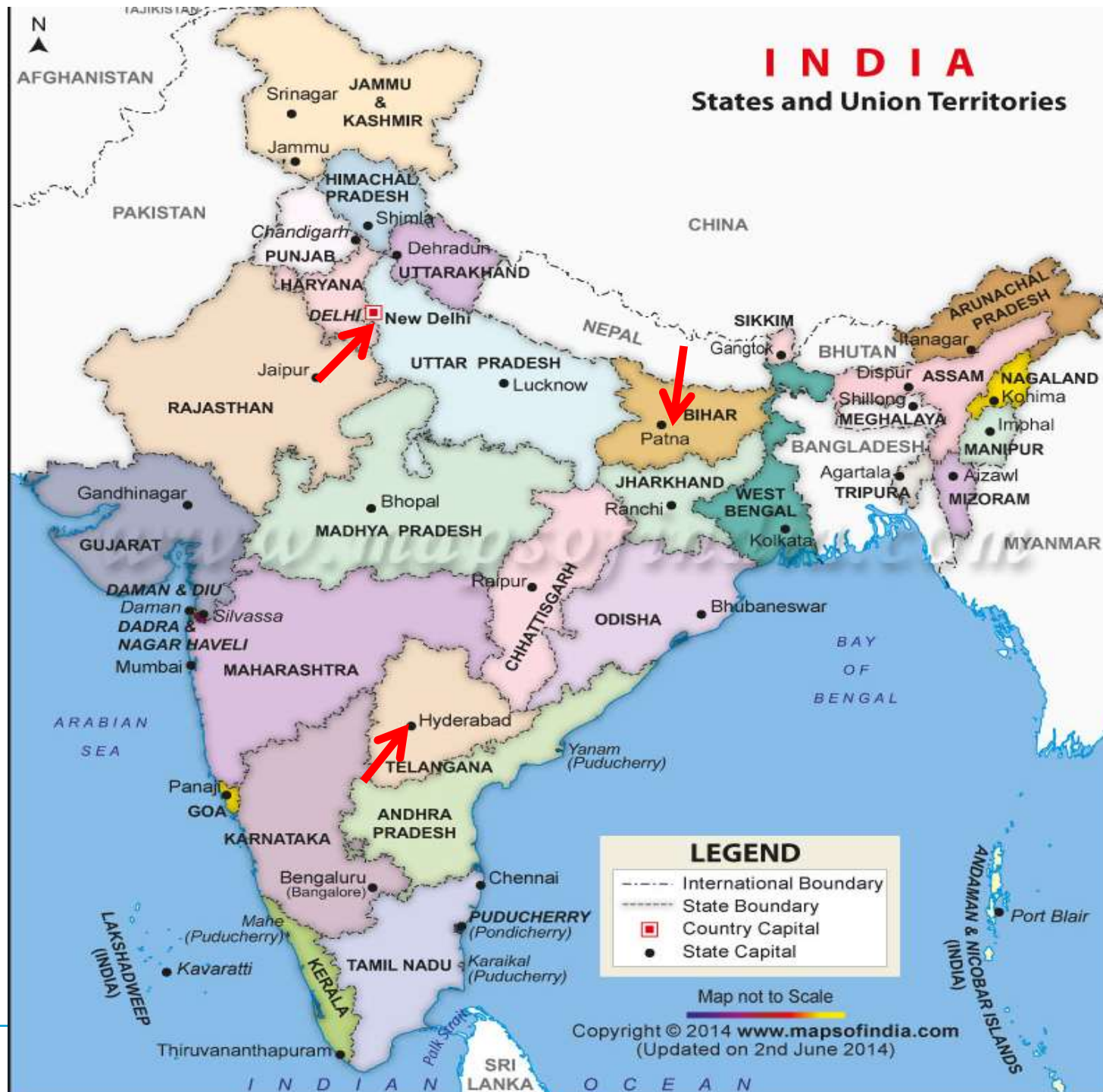
Context:

Advantages to being bilingual or multilingual in attention and learning skills



Question:

Why do some children in India not benefit from being bilingual or multilingual to the same degree as children in other contexts?





Languages in India

- Apart from the state languages, there are more than 1,000 **indigenous languages** belonging to four major language families (Indo-Aryan and Dravidian being spoken by the majority of the population followed by Austroasiatic and Sino-Tibetan languages).
- In our project, the languages used in the assessment tools are: **Hindi**, **Telugu** and **English**, although other home languages are included in the assessment of one task.



Languages in India and medium of instruction

- **Education in India:** three-language formula (from 1957): all children should be taught through the medium of a **regional language** or **mother tongue**, to which an additional **modern Indian language** (e.g. Hindi) and **English** can be added as curricular subjects
- **Hindi** and **English** function as **link languages**: the central government recognises Hindi as the official language and English as the provisional sub-language (Devy, 2018)



Languages in India and medium of instruction

- **English:** the language of power and a gateway to improving one's socio-economic position.
- Parental pressure to introduce English as early as Grade 3 (or even at Grade 1), and to use English as the medium of instruction (EMI), particularly in private schools (Annamalai, 2013).
- Problems: in many cases levels of English remain low because the **teachers' own levels of English are limited** and **appropriate resources are not available** (Dearden, 2014; Erling, Adinolfi and Hultgren, 2017).
 - → English medium *in name* only, and actual teaching takes place in the regional or local languages (Annamalai, 2004; Mohanty et al. 2010)

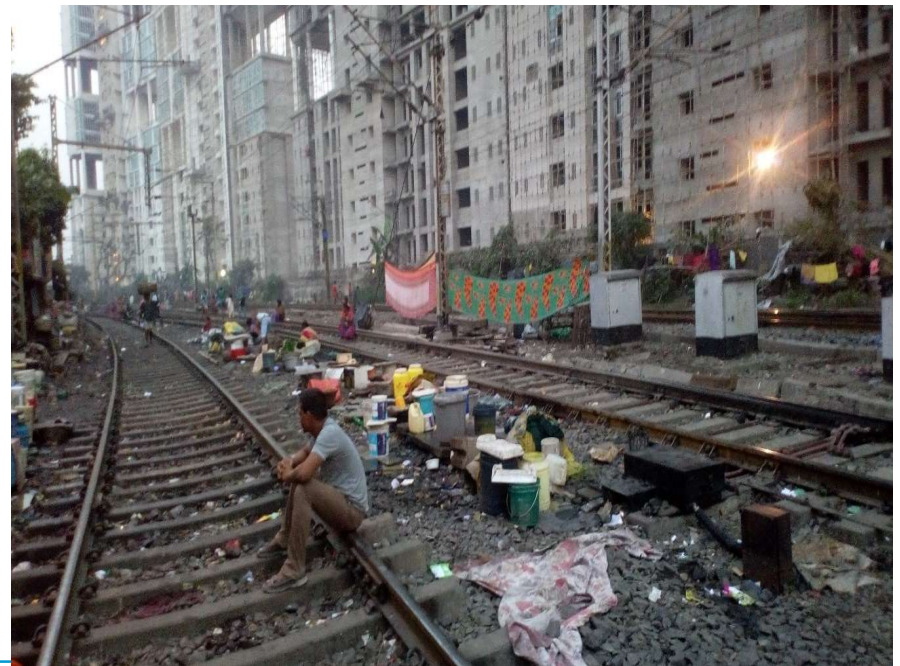


Other ‘realities’ of education in India

- **Large class sizes, poor resources** and teacher-centered pedagogies (Brinkmann, 2015)
- **Critical thinking not prioritised** (Dyer and Choksi, 2002), little room for creativity or expression of independent thought (Jambunathan, 2005).
- **Overage children:** negative or positive factor (Alcott & Rose, 2017)
- Impressive initiatives to improve basic literacy and arithmetic skills among primary school children in India are undertaken as part of **Pratham’s large-scale “Read India” initiative** (Banerji & Chavan, 2016).

Geographical and social factors

- UN report 'The Challenge of Slums' (2003); "slums are a multidimensional concept involving aspects of poor housing, overcrowding, lack of services and insecure tenure."
- 17% of urban citizens in India live in slums. These include a large number of internal migrants who may speak other languages or varieties of the regional language.

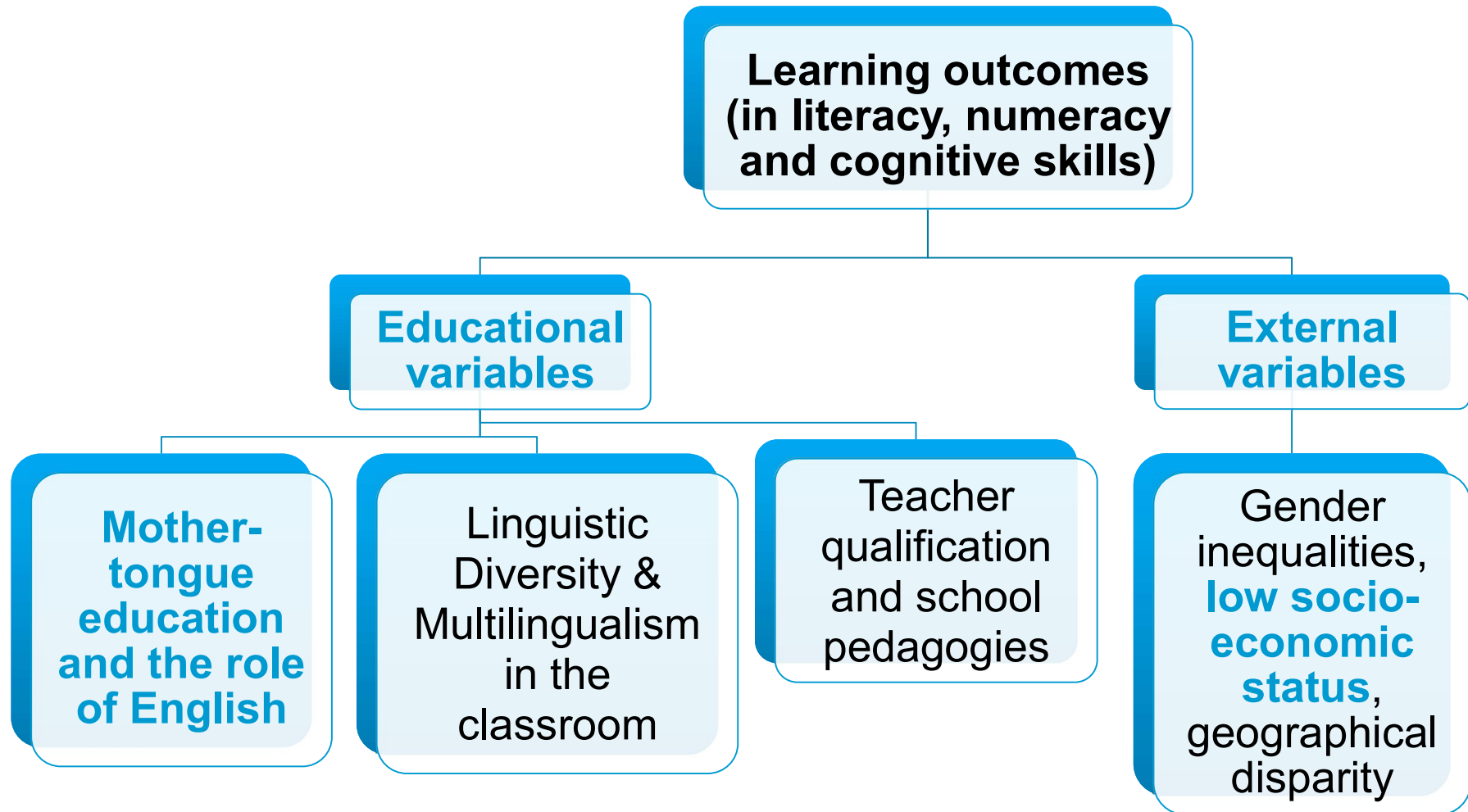


Schools in urban slums

- Overall school attendance rates in Delhi schools in 2004: 90%;
- For children living in Delhi slums: around 54% (Tsujita, 2009);
- Around 73% of children in slums attending Standard I in Delhi schools are over-aged.



RESEARCH FOCUS





The present study

- We developed a **set of tools** to examine directly or indirectly:
 - the children's **school skills** (literacy and numeracy),
 - their **cognitive skills** which *support* learning and development,
 - their **school environment** (teachers, methods, attitudes)
- We use the same set of tools in each of the **sites**: Delhi, Hyderabad, Bihar (Patna and non-remote rural areas)
- We visit schools where children from **slum and non-slum** areas go and we invite all children who are willing to participate.

Surveys and questionnaires

- ***Language* questionnaire** (child): Demographic info, Language use, socioeconomic variables;
- ***Headteacher* questionnaire:** language policy;
- ***Teacher* questionnaire:** teaching practice (language & maths);
- ***Classroom observation* tool.**





Direct measures

1. Cognition:

- General Intelligence (Raven's Progressive matrices);
- **Inhibitory control (Flankers);**
- **Working memory (2-back).**

2. Language:

- Narrative task (re-telling).

3. Literacy:

- **Letter naming, single word reading, reading of sentences, reading of passages** and a couple of comprehension questions

4. Numeracy:

- **Subtraction & division;**
- **Mathematical reasoning (word problems & meta-maths).**



Talk today

Question 1:

Are there any effects of medium of instruction in tasks measuring the children's cognitive abilities, literacy, and numeracy?

Delhi cohort: 397 children (Age: 8-12, Mean: 8.77, SD: 0.63)

Site	n	Medium of Instruction	n	Gender	n
Slum	194	English	251	Girls	198
Non-slum	203	Hindi	146	Boys	199

Delhi team



Prof. Minati Panda



Nainy Rao



Shitika Chowdhary



Shalini Yadav



Yashika Chandna

1. Cognitive tasks

Flankers task: Executive function task measuring *inhibitory control*.

Reaction time and accuracy measured in conflict and non-conflict conditions.

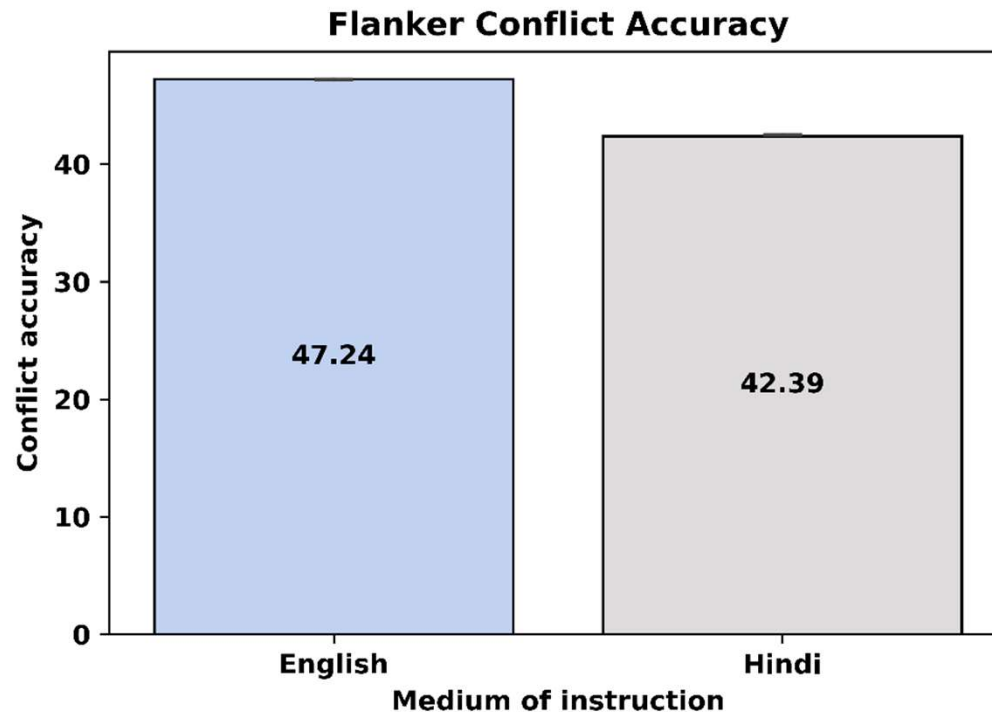


Non-conflict condition



Conflict condition

Flankers Conflict effect (inhibition)



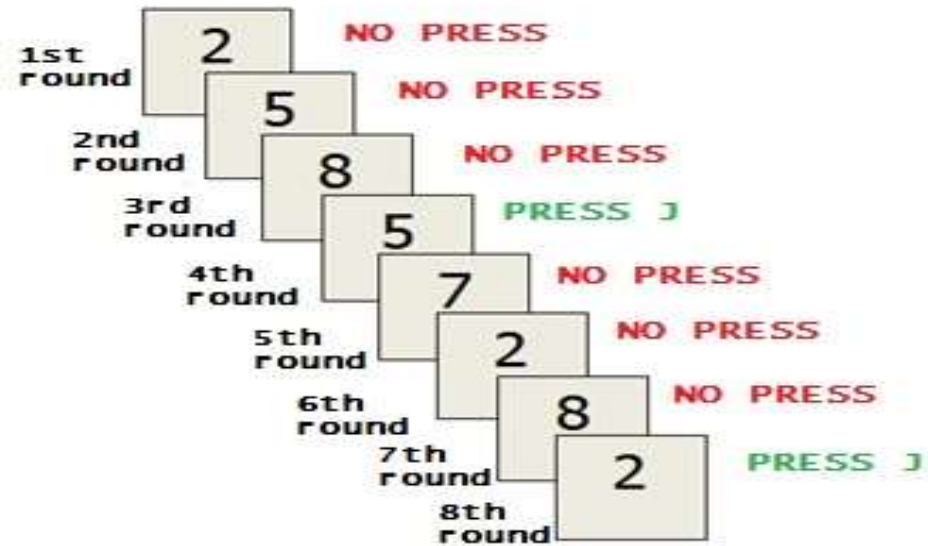
Hindi > English

$t(395) = 2.15$ ($p = .03$)*

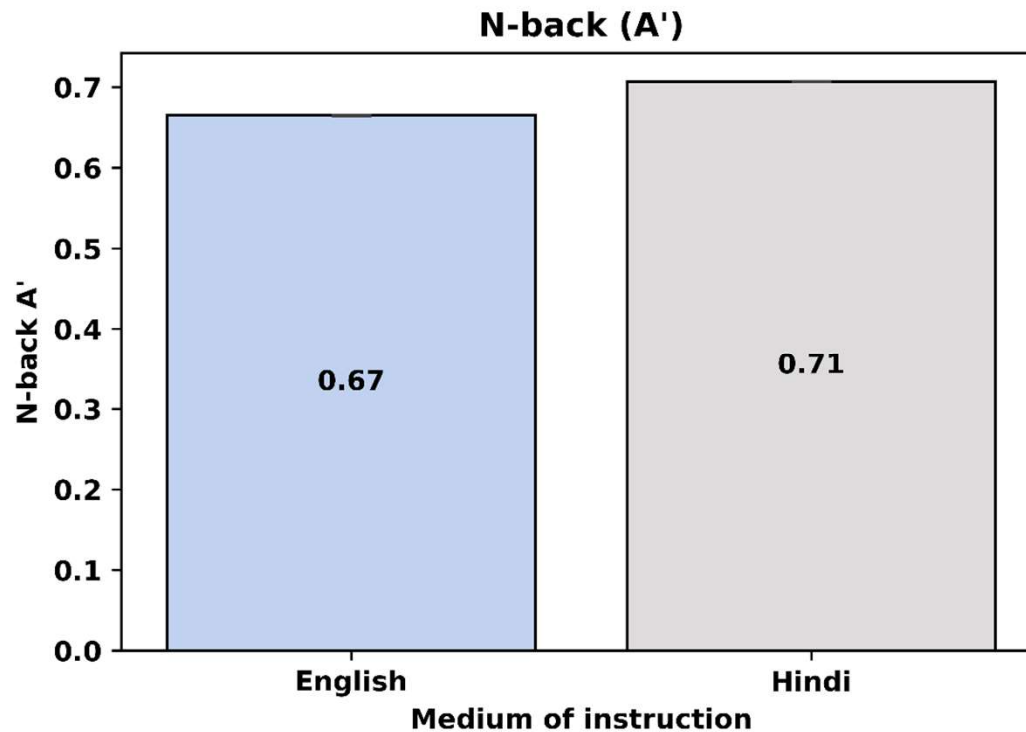
1. Cognitive tasks

2-back task: examines working memory (attention, updating and inhibition)

Numbers appear for 500 msecs followed by a blank page which lasts 2500 msecs



2-back task (working memory)



Hindi > English

$U=15695$ ($p = .017$)*

2. Literacy

- ASER (Basic literacy – www.asercentre.org):
- Letter naming, single word reading, reading of sentences, reading of passages and a couple of comprehension questions.
- Administered in the school language and English.

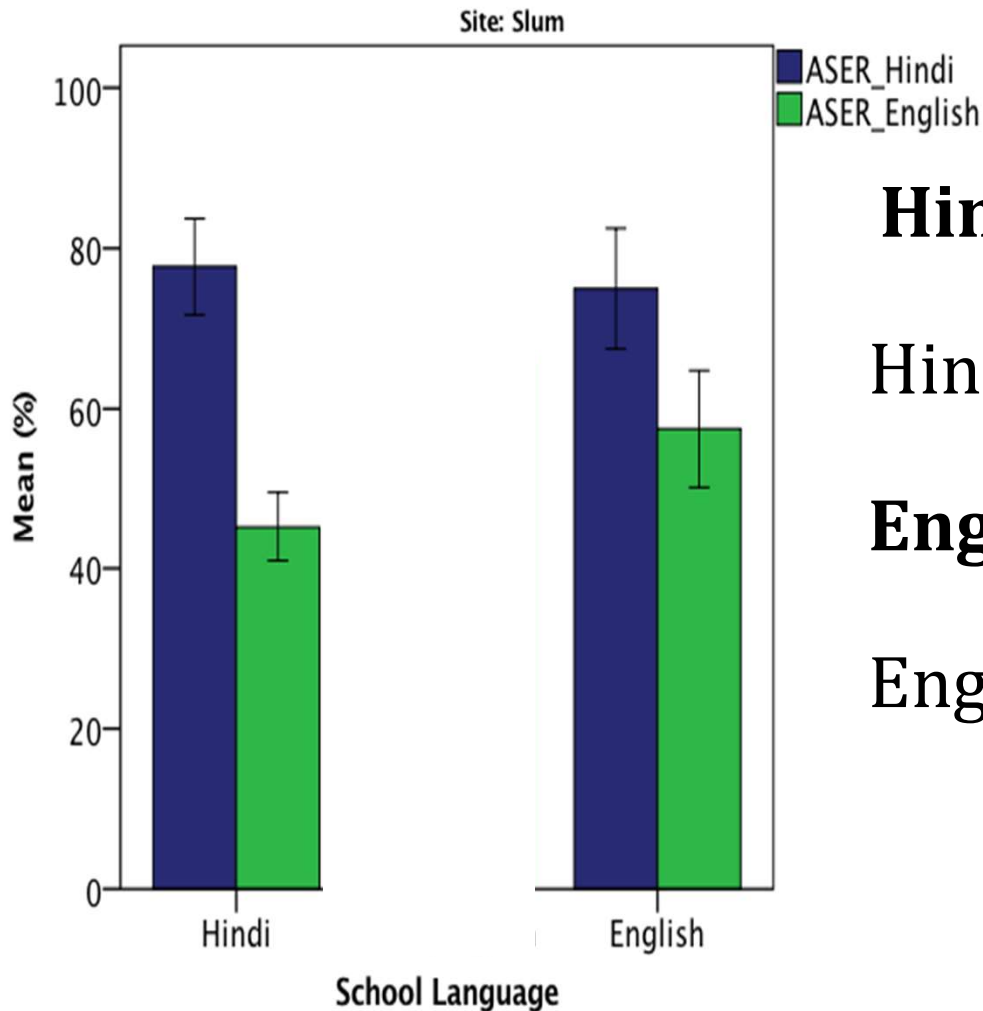
Word

ring	sun
ball	
cold	king
clap	foot
fan	
girl	crow

Story

A big tree stood in a garden. It was alone and lonely. One day a bird came and sat on it. The bird held a seed in its beak. It dropped the seed near the tree. A small plant grew there. Soon there was another tree. The big tree was happy.

2. Literacy: Hindi, English



Hindi:

Hindi = English

English:

English > Hindi

3. Basic Numeracy

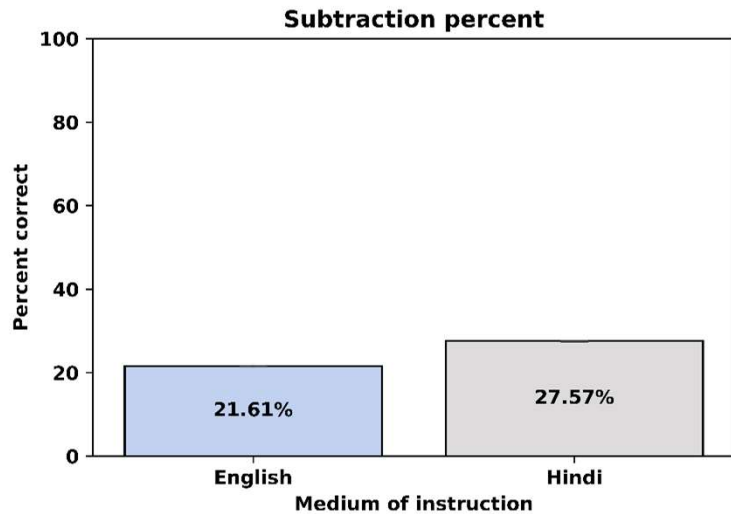
- ASER (Basic numeracy task, subtraction and division):

Subtraction	
$\begin{array}{r} 41 \\ - 13 \\ \hline \end{array}$	$\begin{array}{r} 64 \\ - 48 \\ \hline \end{array}$
$\begin{array}{r} 84 \\ - 49 \\ \hline \end{array}$	$\begin{array}{r} 73 \\ - 36 \\ \hline \end{array}$
$\begin{array}{r} 56 \\ - 37 \\ \hline \end{array}$	$\begin{array}{r} 31 \\ - 13 \\ \hline \end{array}$
$\begin{array}{r} 45 \\ - 18 \\ \hline \end{array}$	$\begin{array}{r} 53 \\ - 24 \\ \hline \end{array}$

Division
$7 \overline{) 928}$
$6 \overline{) 769}$
$8 \overline{) 987}$
$4 \overline{) 519}$

- Subtraction and Division tasks have a better discriminant value compared to Addition and Multiplication
- Division is the hardest of all four.

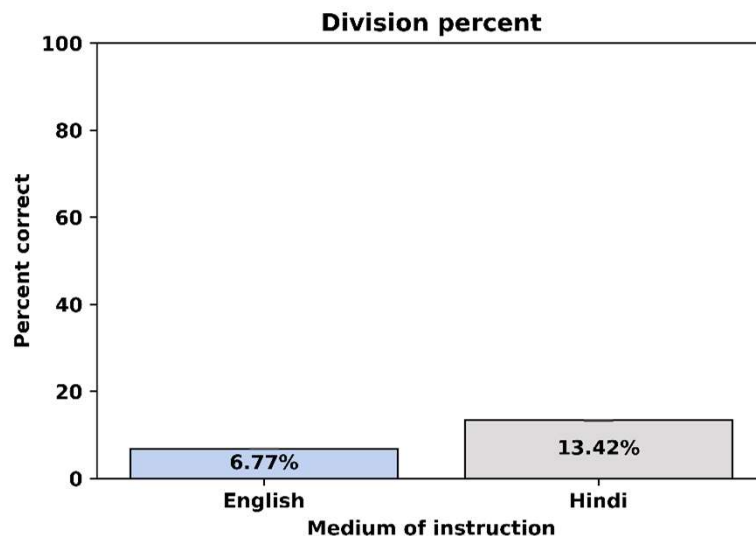
3. Basic Numeracy



Subtraction:

Hindi > English

$U=15558$ ($p = .008$)**

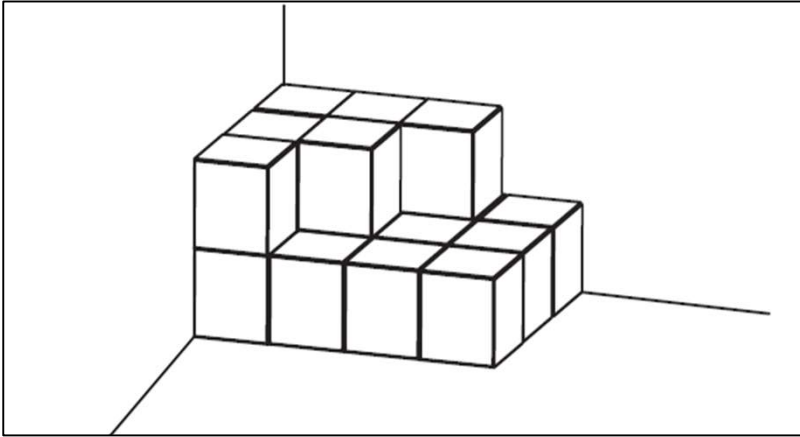


Division:

Hindi > English

$U= 14842$ ($p<0.001$)**

3. Mathematical reasoning: word problems



- **Word-problems** require good reading comprehension levels (Bjork & Bowyer-Crane, 2012).
- Most children asked the experimenter to present the word problem orally in the regional language (Hindi or Telugu)

Question 1:

Sita stacks the boxes (image 1) in the corner of the room. All boxes are the same size. How many boxes has she used, in total?
[Please tick/circle]

- ☐ A 25
- ☐ B 19
- ☐ C 18
- ☐ D 13

3. Mathematical reasoning: meta-maths

QUESTION 1

Here is how Nita solves two addition problems.

19

+13

212

17

+9

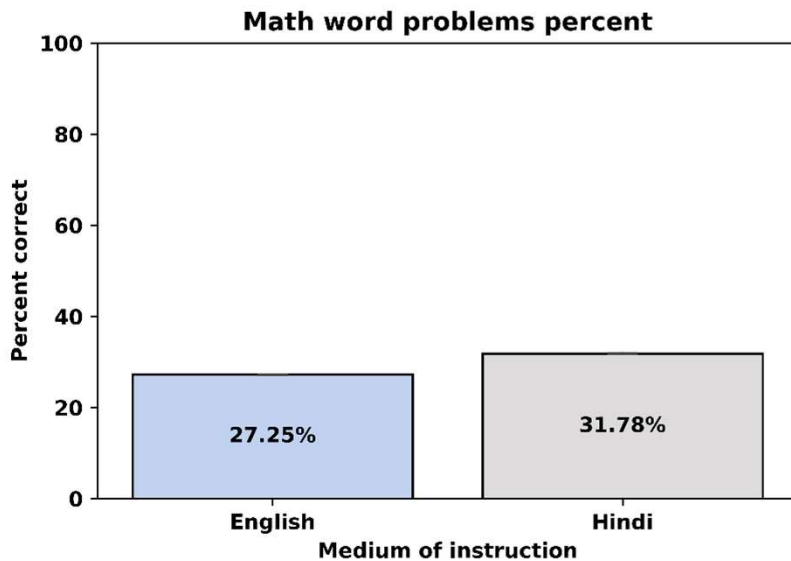
116

Do you think that the problems are solved correctly? If not, why is Nita wrong in her responses?

Answer:

- 1 Nita doesn't know how to add numbers
- 2 Nita doesn't know place value and carry forward of values
- 3 Nita was not attentive
- 4 I don't know
- 5 Any other

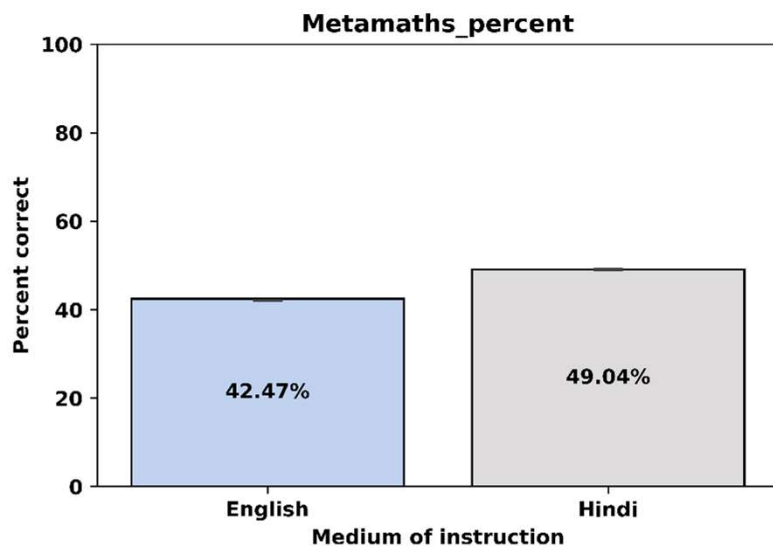
Mathematical reasoning



Word problems:

Hindi > English

$U=15803$ ($p=0.01$)**



Meta-maths:

Hindi > English

$U=15921$ ($p=0.02$)*

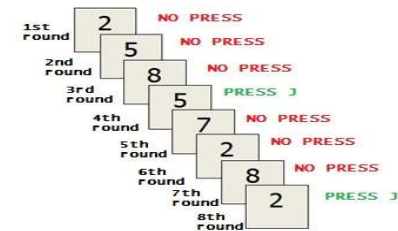
Summary

1. Question:

Are there any effects of medium of instruction in tasks measuring the children's cognitive abilities, literacy, and numeracy?

Cognition:

- Inhibitory control: **Hindi > English** 
- Working memory & updating: **Hindi > English**





Summary

Literacy:

- Hindi literacy: **NO**
- English literacy: **English > Hindi**

Numeracy:

- Subtraction & division: **Hindi > English**
- Word problems: **Hindi > English**
- Meta-maths: **Hindi > English**



What does that mean (medium of instruction)

- **Literacy:** English medium schools and schools that have some content learning in English **boost English literacy skills;**
- **Maths:** Better development of numeracy skills and mathematical reasoning **when the medium of instruction in school is a language spoken in the home (& a language children are good at);**

Implication → English medium of instruction is not the ticket for success; it can lead to lower educational outcomes for children!

Question 2:

Are there any effects of **socio-economic deprivation** in tasks measuring the children's cognitive abilities, literacy, and numeracy?

Delhi cohort: 413 children

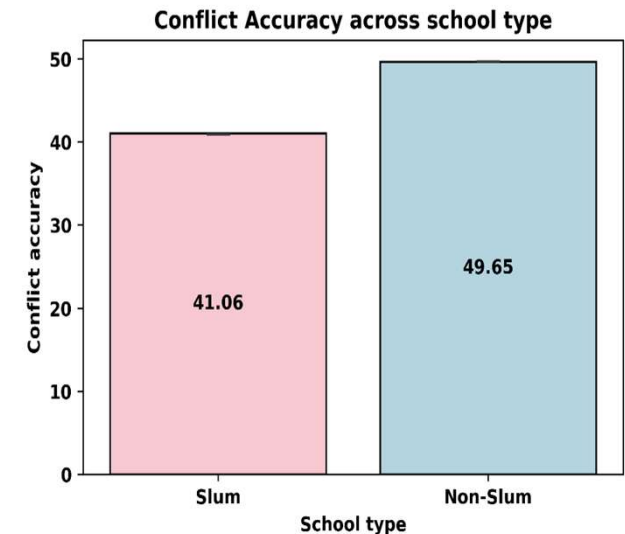
- 214 in non-slum areas,
- 199 in slum areas.

Cognitive tasks: Flanker (inhibition)

Conflict effect: Difference between incongruent and congruent trials

Task	Slum vs. Non-slum
Conflict effect (Accuracy)	$U=24217.5$ ($p<.001$)**

Children living in a slum had a smaller conflict effect than the ones who don't live in a slum.

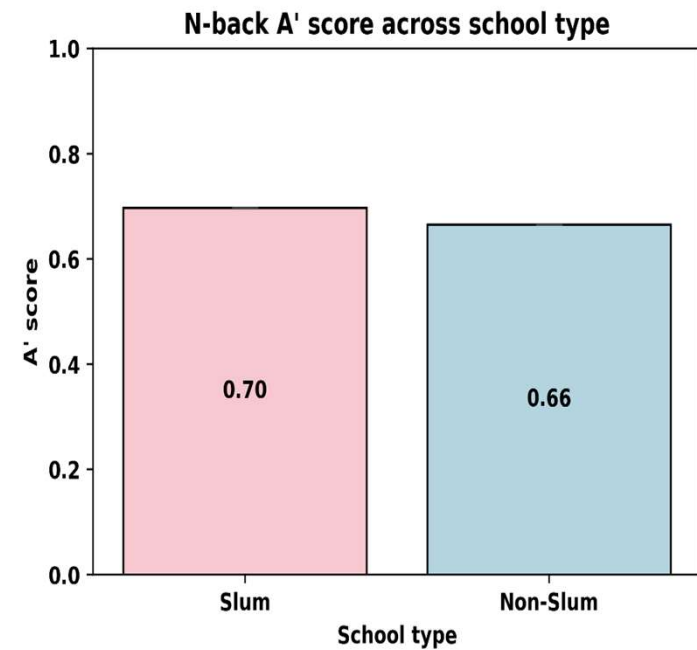


N-back (2-back)



Slum vs. Non-slum

U= 17731.50 (p=.08)

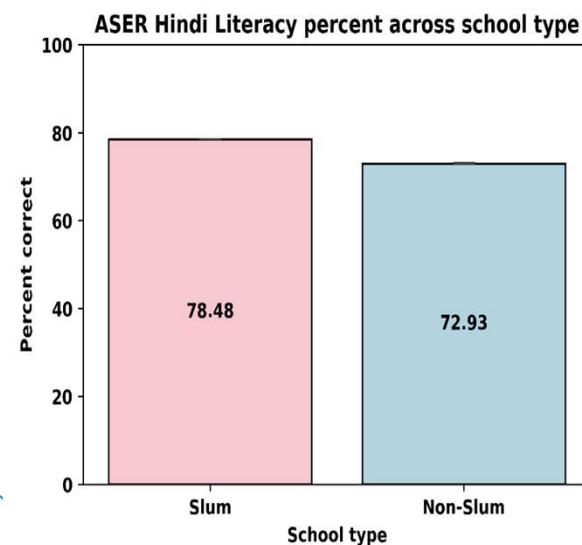
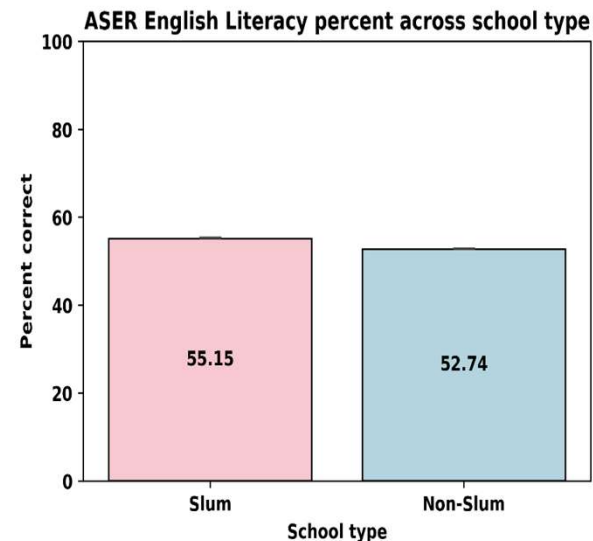


Basic literacy – English & Hindi



Slum = Non-slum

Task	Slum vs. Non-slum
ASER(English)	U= 18147 (p= .17)
ASER(Hindi)	U=18580.5 (p=.33)

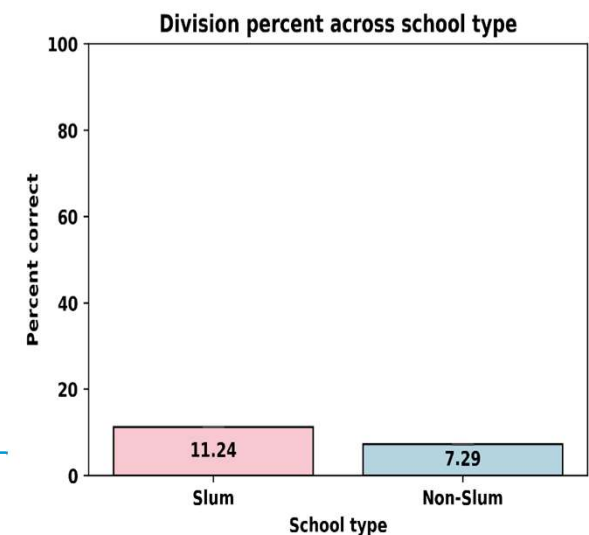
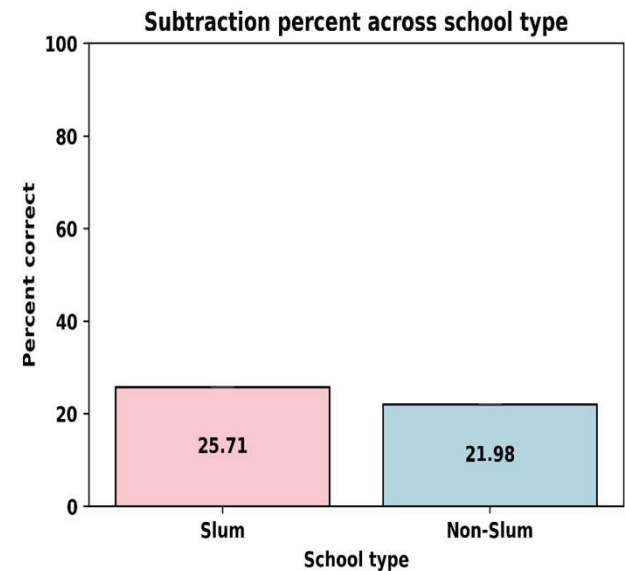


Subtraction and Division

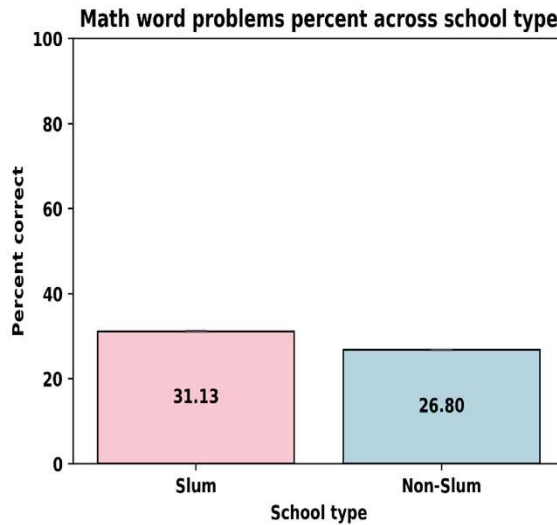


Slum > Non-slum

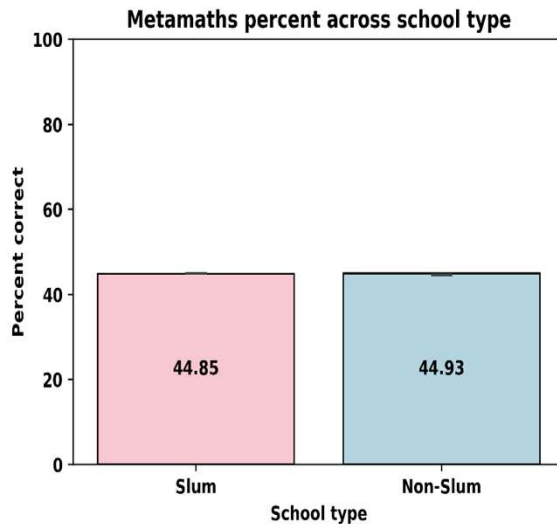
Task	Slum vs. Non-slum
Subtraction percent	U= 17841 (p= .08)
Division percent	U=17644 (p=.02)*



Mathematical Reasoning skills



Slum > Non-slum



Task

Slum vs. Non-slum

Math word problems $U = 17267$ ($p = .02$)*

Metamaths

$U = 19155$ ($p = .63$)

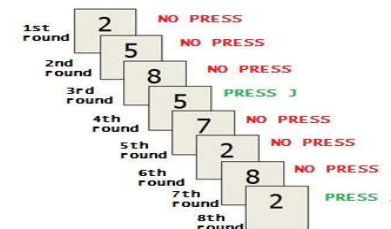
Summary

2. Question:

Are there any effects of **socio-economic deprivation** in tasks measuring the children's cognitive abilities, literacy, and numeracy?

Cognition:

- Inhibitory control: **YES slum > non-slum**
- Working memory & updating: **NO**





Summary

Literacy:

- Hindi literacy: **NO**
- English literacy: **NO**

Numeracy:

- Subtraction: **NO**
- Division: **Slum > Non-slum**
- Word problems: **Slum > Non-slum**
- Meta-maths: **NO**

What does that mean (children living in slums)

- **Cognition:** working memory not affected by environmental factors, but children who live in slums have **better attention/inhibitory control**;
- **Literacy:** Literacy not affected by environmental factors;
- **Maths:** Children who live in slums have better mathematical abilities.

**Children in living in a slum often help their parents in various activities that include counting and doing mental calculations → advantage in mathematical skills?
→ effect of motivation?**



Many open questions

- Which factors predict success in literacy & maths?
Analyses ongoing
- Is there a difference between children living in rural vs. urban areas? **Data inputting ongoing**
- What is the role of teaching practice and teacher training? **Teacher questionnaire & observations**
- Are there differences in development? **Longitudinal aspect**



Many open questions

- **Other factors (not considered yet):**
 - Low school attendance rates (child and teacher);
 - Links between the school and the society? (in materials or method of teaching);
 - Distance between language of instruction and oral language (bookish Hindi and spoken Hindi);
 - Distance between language of instruction and home language (Hindi / Bhojpuri);
 - Noise in the classroom.



Take home messages

- **Mothertongue education** → advantages in educational outcomes
- **English medium schools** → advantages in English literacy
- **Effects of SES in western countries may not map directly to countries like India (differences in attitudes & motivation).**

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