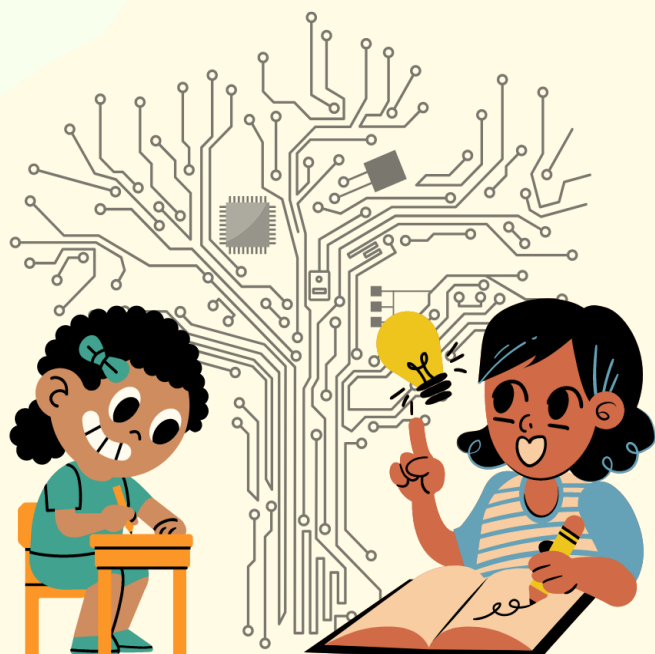


# Insights from a Study of Middle School Students' Foundational Mathematics and Language Skills

IT for Change  
September 2022



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# **Insights from a Study of Middle School Students' Foundational Mathematics and Language Skills**

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## **Introduction**

As a part of the project, “Technology Integration for Inclusive Education (TIIE)” of IT for Change, a baseline module was developed with an aim to understand the contexts and learning needs of students in grades 6 and 7 in government higher primary schools in Bengaluru. The baseline was conducted as a series of activities wherein students worked individually, in pairs or in small groups and their abilities in foundational mathematics and language were assessed based on their responses. The baseline engaged around 175 students from five schools and helped get insights about students’ levels of learning, their engagement, and their challenges.

## **Objectives**

1. To understand students’ learning needs in Mathematics, Kannada and English subject areas through an evaluation of their foundational knowledge and skills.
2. To identify learning difficulties that students are facing and particular areas where they need help.
3. To identify students showing signs of moderate/mild learning difficulties (MLD).
4. To assess students’ abilities in listening and reading comprehension, speaking, writing, computation, pattern recognition and understanding of basic geometric concepts.

## **Baseline module design**

Prior to conducting the baseline study, ice-breaker activities were planned and conducted to build rapport with students and get an understanding of the children and the schools. A baseline module was developed which included a series of activities to assess students’ abilities, particularly in Mathematics, Kannada and English languages. Resources and tools available on the internet such as the assessment tools of Annual Status of Education Report (ASER), stories on Storyweaver, Geogebra files, and other assessment tools and activities available on the web were

used as a reference to design assessment activities and rubrics suitable to the context of the schools. Conscious efforts were made to ensure that students didn't feel like they were taking a 'test' or being judged.

To assess number operation abilities, we interacted with each child individually to see if they recognized single and two-digit numbers, then single-digit addition, followed by addition with carry over. Similarly, if the child was able to perform a single digit subtraction, the facilitator proceeded to check the child's ability to subtract by borrowing (regrouping). If the child was able to perform addition and subtraction, the child's abilities to solve single and double-digit multiplication, and similarly single, double and triple digit division problems were assessed next.

In order to understand each child's basic geometrical knowledge, students were engaged in a conversation about the formation of angles and the estimation of angle size by displaying images of angles. Worksheets were used to check their familiarity with geometric shapes like circles, squares, rectangles, and triangles as well as their basic algebraic ability in recognizing various patterns including tiles, shapes, numbers, and alphabets.

Different activities and strategies were used to assess students' language abilities in Kannada and English. To assess the listening abilities of students, prerecorded audio clips of words were played through digital devices and the students had to identify the object from a collection of pictures displayed on device. In the next activity, some phrases or sentences were played for the students, based on which they had to color certain objects in the pictures provided to them in a worksheet.

A 'Pick and Speak' activity was conducted to assess the speaking abilities of students, where they needed to identify and describe an object which they use in their daily life. After this, the child was asked to respond to a simple question based on their life and/or experiences.

For the reading activity in Kannada and English, student abilities to read letters, words, sentences and a paragraph, were assessed by interacting with each child individually and only asking them to attempt what they were comfortable with.

For the writing exercise, students were given a dictation activity as well as a worksheet containing a picture which they had to observe, and then describe in writing using appropriate words / phrases and sentences.

Experts and practitioners working in the field of inclusive education were consulted for reviewing the activities, and some of the assessment activities were modified based on their recommendations.

## **Methodology**

The teams discussed all the baseline activities together and defined the objectives and process for each activity, followed by creation of resources for the same. Around 175 students from five different schools participated in the baseline study; with around 35–40 students from each school. Interactions with students happened twice a week for a total of around 80 minutes in each of the schools. The team initially decided to carry out baseline assessment activities at a pilot school (School 1), in order to test the baseline module, with all the facilitators participating in that task. Eight facilitators, divided into two teams of four, visited a single school. As soon as the piloting was complete, the module was revised wherever deemed necessary in terms of its content, materials, worksheet design, method of interaction, and then used in other schools.

Baseline assessment was conducted over a month long period. Based on the objectives of the baseline module, some assessment activities were designed as worksheets, while others were intended for individual student interactions and observations. While this was going on, the rest of the students were kept with non-assessment-related learning activities. Data from each (individual or group) activity was collected as per pre-designed rubrics and updated in the teams' internal database. The baseline module can be accessed [here \(https://tinyurl.com/TIIE-baseline-module\)](https://tinyurl.com/TIIE-baseline-module).

## Observations and Findings

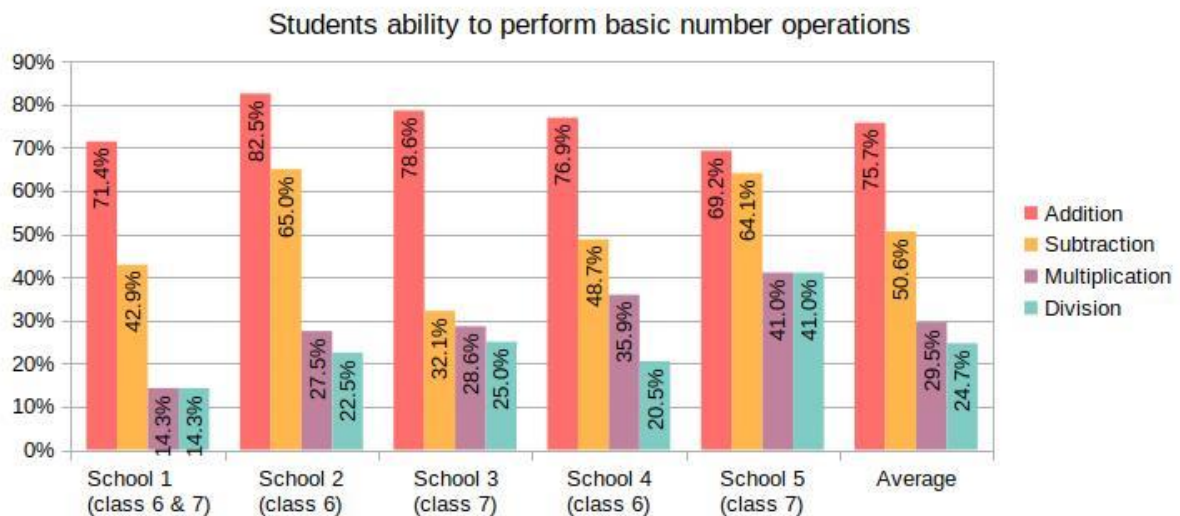


Chart indicating school-wise percentages of students able to perform the four basic number operations using standard procedure

### Number operations:

On an average, **about 25% of the students face challenges in solving addition problems** involving carry-over. About 10% of the students find it challenging to solve even simple addition problems without carry-over. They may have either forgotten the procedure, have **confusion** associated with it or do not have a clear understanding of the concept.

**Nearly half of all students assessed find it difficult to perform subtraction requiring regrouping**, with over a quarter of them finding it difficult to solve even problems that do not require regrouping.

**Over 70- 75% of students have difficulties in performing multiplication and division using the algorithm respectively**, with a significant number failing to even recognize the multiplication and division signs. While some of them are aware of multiplication tables, several others are not. A lot of the students have partial knowledge of the procedure and make errors in one or more of the intermediate steps possibly because they are not aware of the reasons for why the procedure is followed/works.

Focus is necessary strengthening students' understanding of the base-10 system, place value, concept of multiplication and division (what does  $a \times b$  or  $a \div b$  mean).

Only a handful of students across schools and grades are aware of what an angle is, how it is formed and what are the different types. Some students reported having seen the image of an angle / heard the word angle or *kona* in mathematics but said they don't recall what exactly it means.

### Listening Comprehension

In the listening activity, students had to listen to the phrases that were read out by the facilitator and color the specified object in the picture given to them.

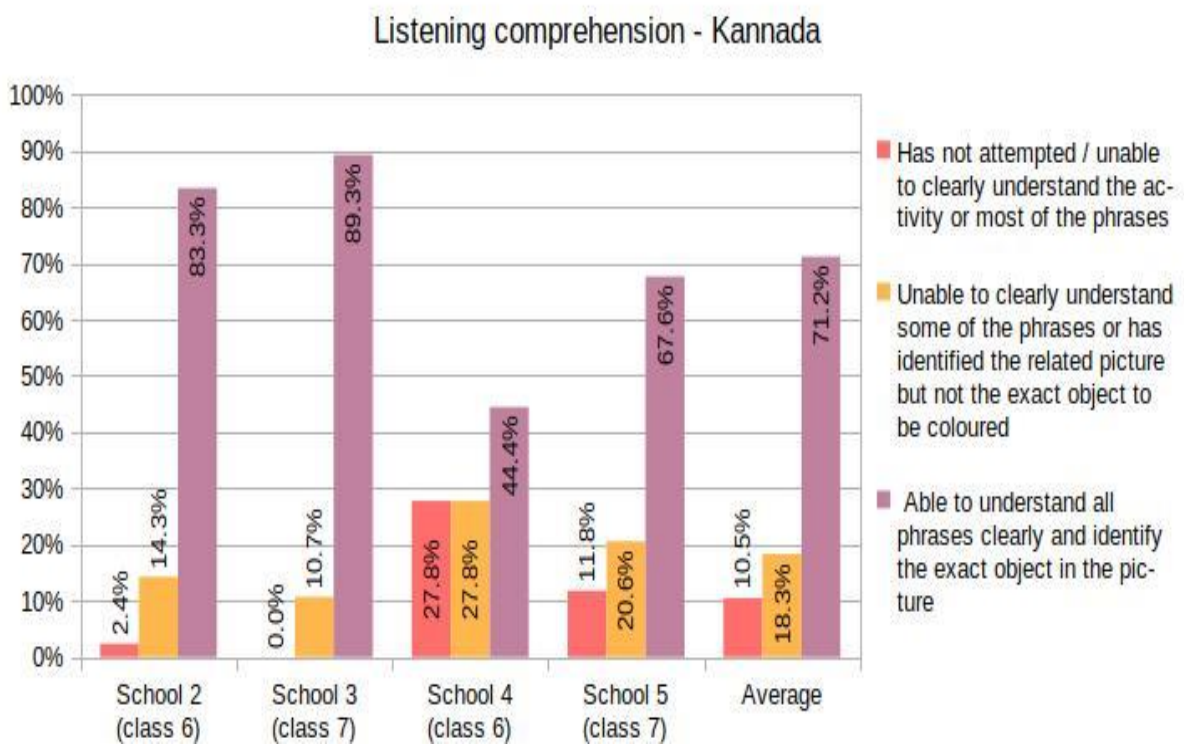


Chart indicating school-wise performance of students in the listening comprehension activity in Kannada

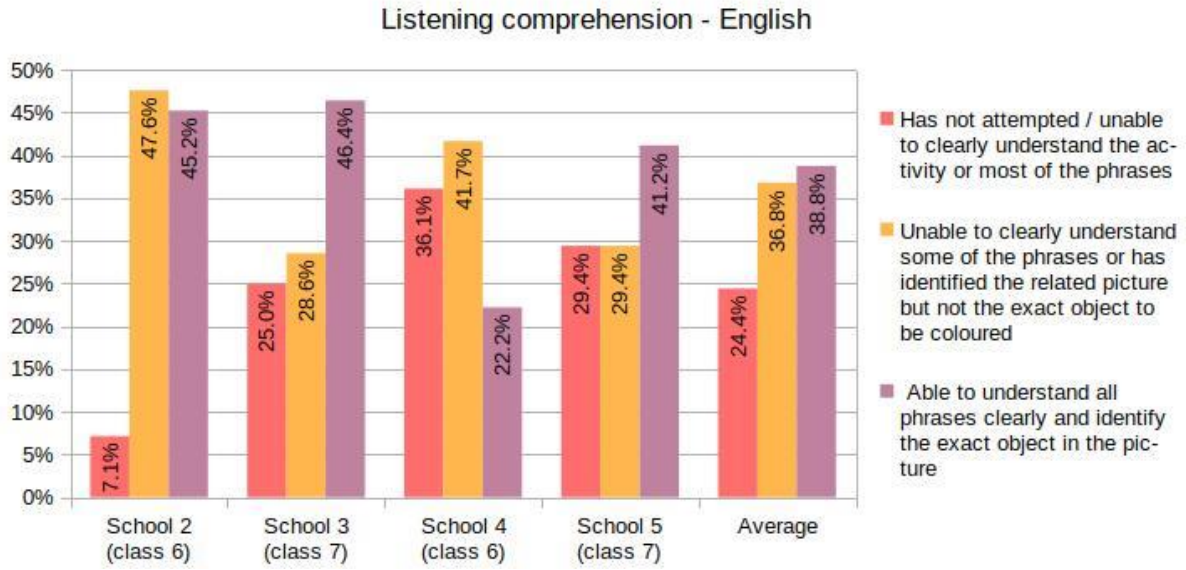


Chart indicating school-wise performance of students in the listening comprehension activity in English

Note: The activity for listening comprehension was piloted in School 1 and later modified to be conducted in the other schools. Since the process and the rubrics changed, the data from School 1 has not been included for analysis.

On an average, **71.2% students were able to understand all the Kannada phrases and identify the exact object in the given picture, but in English, only 38.8% students did so correctly.**

24.4 % of students were unable to understand any of the English phrases, whereas 36.8 % of students partially understood the English phrases, identified corresponding pictures but could not color the specific object.

Among these four schools, students from School 2 and School 3 performed better in both English and Kannada Listening Comprehension exercises. In comparison, students from School 4 faced greater difficulty.

### **Speaking: Kannada**

Part 1: In the speaking activity each child was asked to select a picture of an everyday object, identify and describe it.

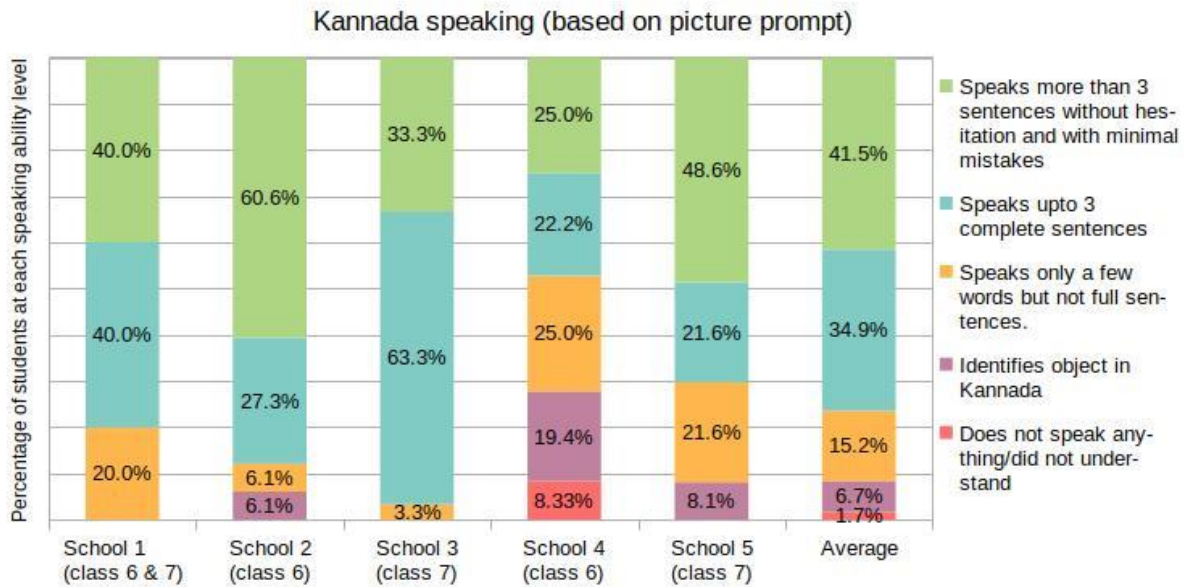


Chart indicating school-wise variations in students' speaking abilities in Kannada

**On an average of 8.4% of all students only recognized and named the object or did not speak anything in Kannada or did not understand the activity.**

In School 4, ~20% of students only identified the object, and 8.3% of students did not even recognize the objects in Kannada.

About 15% of the students across schools could only speak a few words in Kannada but not form sentences and about 34% could speak up to three sentences with minor errors or hesitation.

**On an average, only about 41% of students across schools could speak more than three sentences without hesitation and with minimal mistakes.** In school 4, this number is only 25% while in school 2 it is 60.6%.



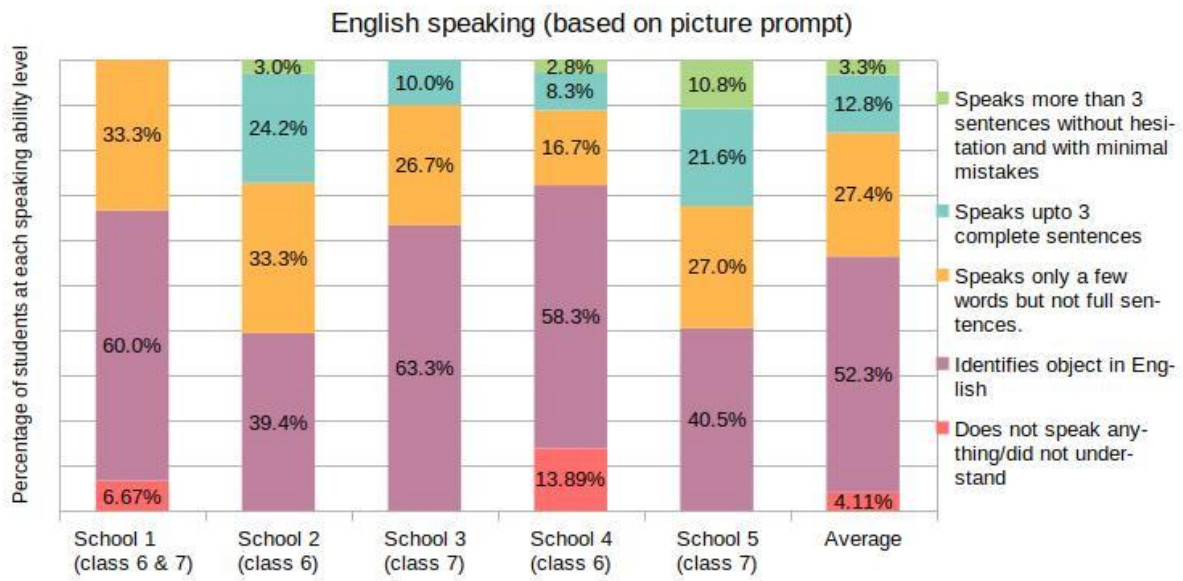


Chart indicating school-wise variations in students' speaking abilities in English

Note: The bars in the chart are representative of the percentage of students who are unique to each speaking level. The speaking levels themselves are designed in a cumulative manner.

**On an average of 52.3% of all students could only recognize objects in English but not describe it, with about 4% of students not even recognizing the object/ not attempting. In school 1 this number is 6.7% and in school 4 this number is 13.9%.**

27.4% of the students on average can speak only a few words but not full sentences and about 12% can speak up to three complete sentences. In school 1, none of the students could speak a full sentence in English.

**On an average, only 3.3% of students across schools could speak more than three sentences in English without hesitation and with minimal mistakes.**

Across schools, it was observed that the students are more confident speaking in Kannada than English, with several refusing to even attempt.

Part 2: Students were asked to think and respond to questions in at least three sentences which are related to their day-to-day life.

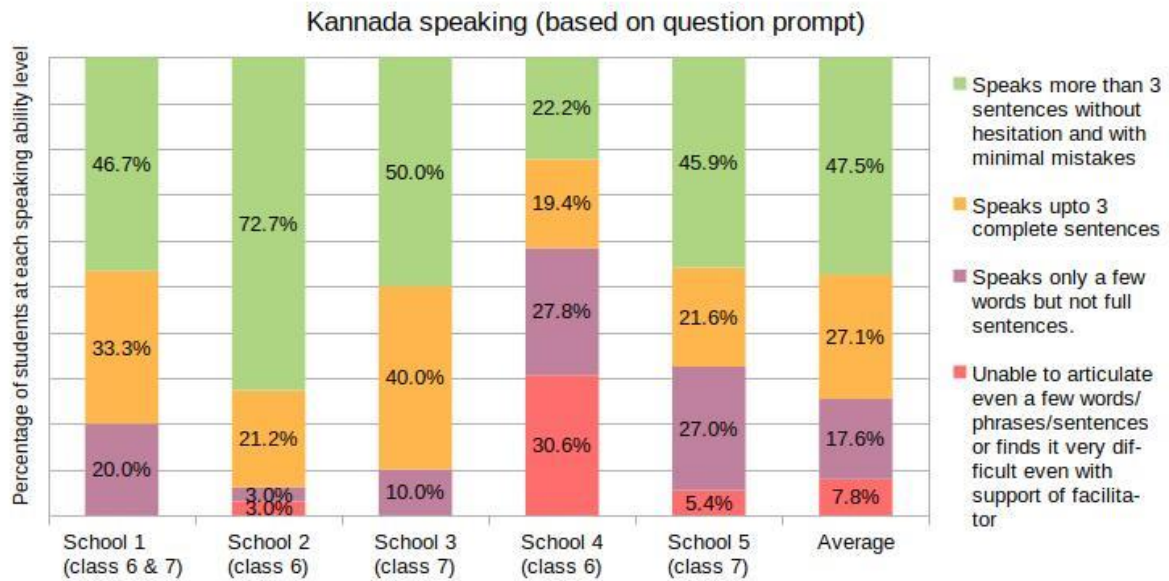


Chart represents percentage of students who responded to a question prompt related to their everyday life

**On an average of 17.6% of all students were responded with few words but not full sentences in Kannada. In School 4, 30.6 % of students were unable to articulate even a few words/phrases/sentences.**

**Around 27% of the students on average could speak up to three complete sentences and about 47% could speak more than three sentences without hesitation and with minimal mistakes.**

There is huge variation between schools in the number of students who can confidently speak more than three sentences. While over 70% can do so in school 2, the number is only about 22% in school 4.

## Reading: Kannada

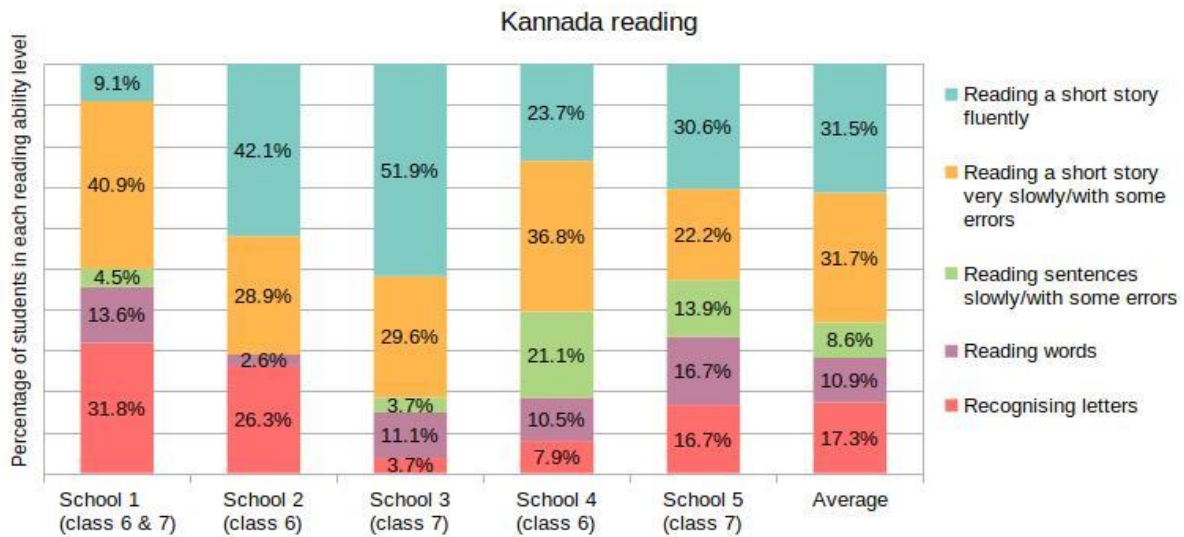


Chart indicating school-wise variations in students' reading abilities in Kannada

Note: The bars in the chart are representative of the percentage of students who are unique to each reading level. The reading levels themselves are designed in a cumulative manner.

**On an average of 17% of all students can only recognize letters in Kannada.** In School 1 and School 2, this number is 26% – 30%.

11% of the students on average can only read simple words and about 8% can read sentences very slowly or with some minor errors.

On an average, only about 31% of students across schools can fluently read a short story in Kannada. In School 1 this number less than 10%.

Of those who were able to read sentences or the short story, several found it challenging to read words with *gunitakshara* and *ottakshara*.

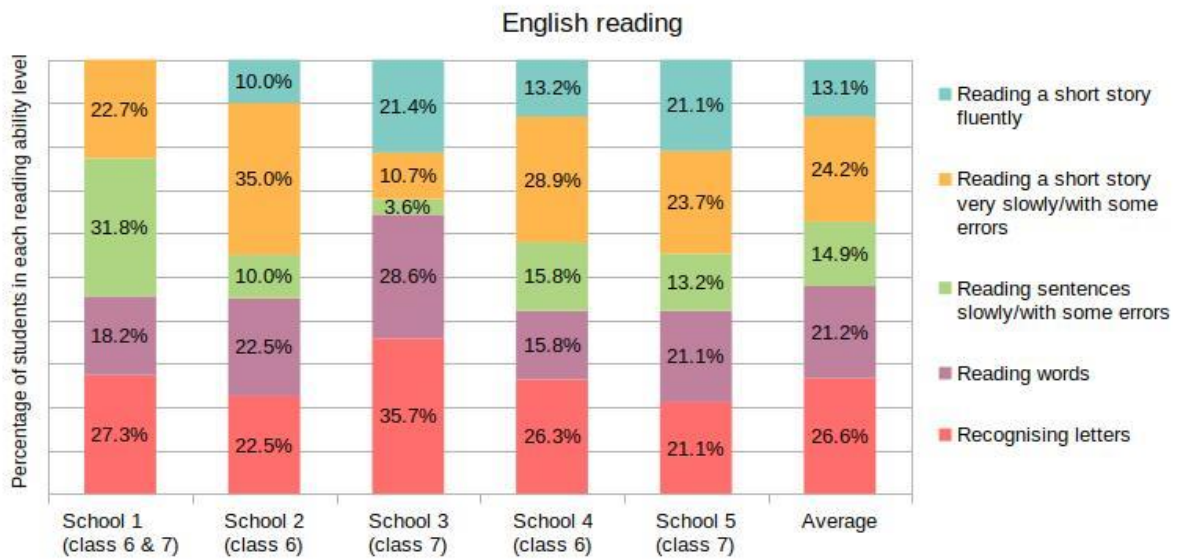


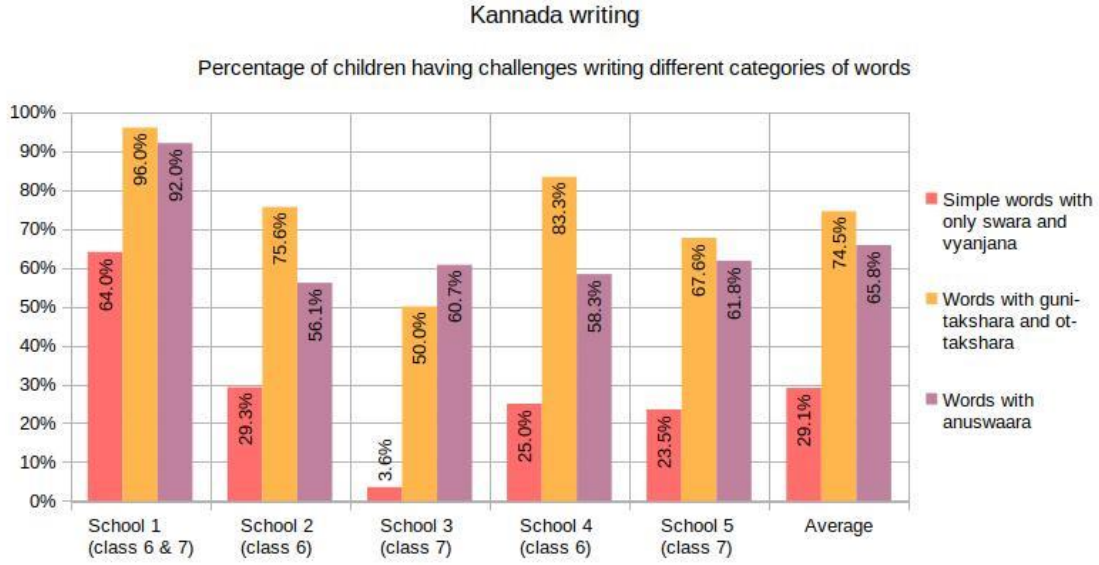
Chart indicating school-wise variations in students' reading abilities in English

Note: The bars in the chart are representative of the percentage of students who are unique to each reading level. The reading levels themselves are designed in a cumulative manner.

In English reading, 26% of students can only recognize the letters and 21% can only read simple words. **Only 13% of students on average were able to fluently read a short story.**

Many students who were able to read simple sentences and attempted to read the short story, had difficulty reading words like holding, grown, cycle, waves.

## Writing: Kannada



**Across schools, close to 75% of students have challenges in writing Kannada words with *gunitakshara* and *ottakshara* and close to 30% students on average have challenges writing even simple words with just *swara*'s and *vyanjana***

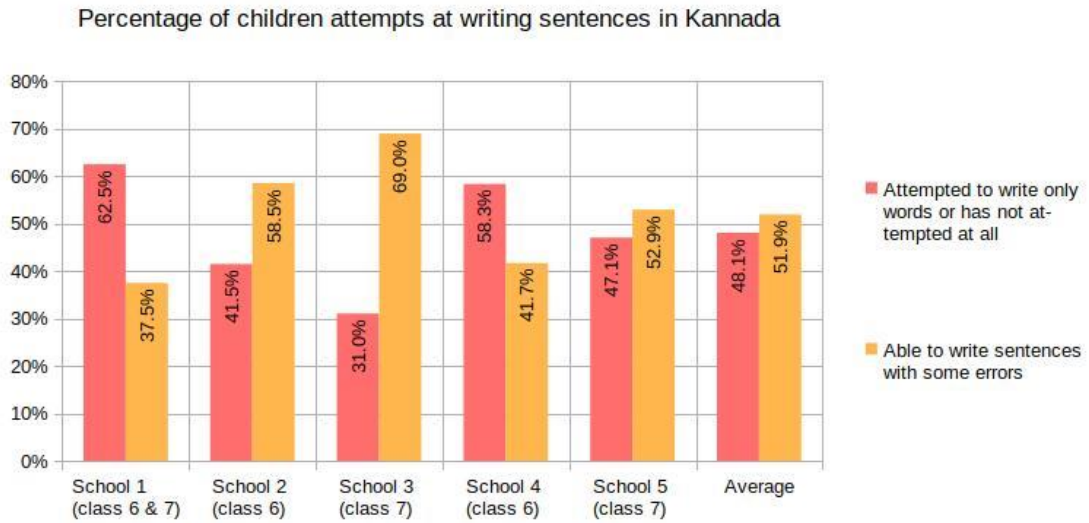


Chart indicating analysis of students attempts at writing sentences in Kannada

About 65% of students on average have challenges writing words with *anuswaara*(ಊ). Words like *panche*, *angaDi* were written as *pache*, *aagaDi*.

## Writing: English

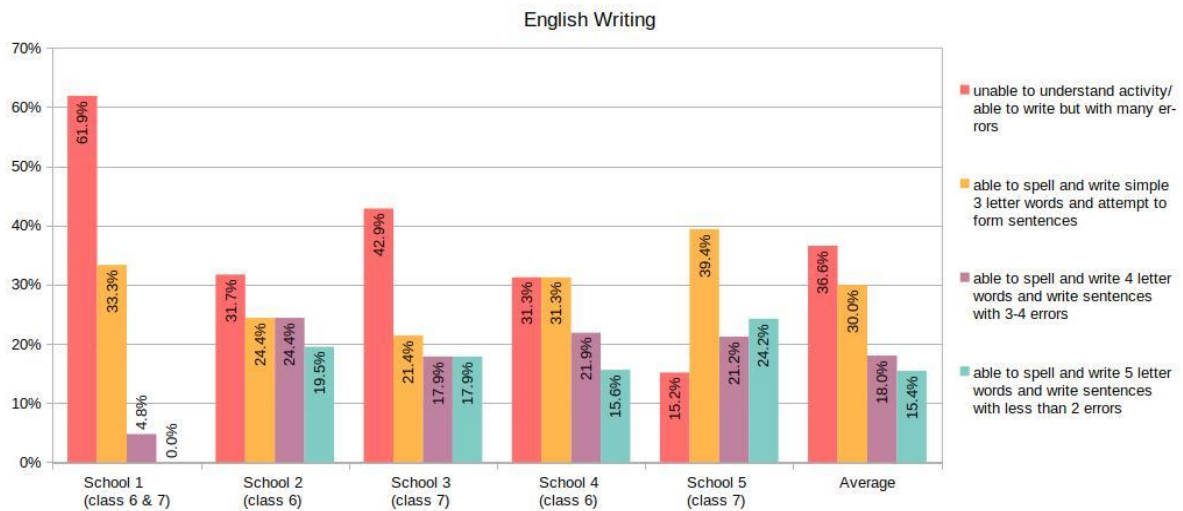


Chart indicating students' abilities of writing different categories of words and sentences in English.

On an average, **around 37% of students found it difficult to understand basic verbal instructions in English and spell even simple words.** This number is highest for School1 with up to 62% of students being unable to spell common three-letter words.

This may be indicative of the impact that two years of pandemic and school closures has had on students' learning and retention.

The errors included **incorrect use of capitalization, lack of punctuation and spelling mistakes.** Particularly in spelling words, students are able to connect certain sounds to letters, but seem to be **unfamiliar with phonetics.** Very few students are able to read even simple/common words on sight (**sight words**).

Transliteration was also evident in student responses across schools wherein some have attempted to answer the questions using English words written in Kannada script.

### Overall observations from school visits:

1. All children have been pushed to their age-appropriate grades without taking into account their learning needs and difficulties. As a result, some students have dropped out and

several others seem to be disengaged in the classroom transactions, putting them at the risk of dropping out in the future.

2. Interpersonal skills seem to be gravely affected in students perhaps due to lack of opportunities for social interactions during the pandemic induced school closures. Instances of bullying, delinquency and use of inappropriate language have been observed across schools and grades. Despite schools being co-educational, both boys and girls are unwilling to interact and collaborate with peers of the opposite sex.
3. Several students who cannot speak/read/write Kannada were seen to be mechanically copying down answers in Kannada for the Kalika Chetarike worksheets written on the blackboard or from peers. As a result, there seem to be limited meaningful learning opportunities for students to develop their knowledge and skills.
4. The Kalika Chetarike material currently being used is designed to bridge the pandemic-induced learning loss. This is pegged at grade level or 1 grade below but students' levels are even lower. There seems to exist wide disparities in students' understanding and the retention of concepts previously taught even within the same grade in the same school.

## **Conclusion & Suggestions**

The baseline study provided an in-depth understanding of the students' foundational knowledge and skills in mathematics as well as Kannada and English languages at present. From the results and observations of the baseline study, the impact of the pandemic and school closures is clearly evident. Students across schools seem to be struggling with concepts at their grade level and in most cases even those below their grade level, even 2+ grades below grade level. Students' learning needs are to be further assessed and apt pedagogic strategies need to be applied. Chief among the changes is incorporating strategies that can accommodate multilevel and multilingual teaching-learning.

Following are some suggestions for addressing these issues:

1. Multilingual resources and approaches need to be used to accommodate students who have migrated from English/other medium schools and have difficulties understanding classroom transactions in Kannada.

2. If teachers are able to use some materials or activities that help revisit concepts from 1-2, (and even more) grades below for children who require it, it might help students learn according to their needs. Department should to issue a circular that encourages teachers to use the required Kalika Chetarike material relevant to each child's needs irrespective of their grade. It is absolutely necessary for each and every learner to find the classroom process meaningful. If any learner finds the process meaningless (is unable to make meaning), such a student is at risk of dropping out of school. Even if the student continues schooling (and is promoted every year), s/he will lag further and further behind grade levels.
3. Teacher workshops and trainings can be organized on multilevel and multilingual teaching strategies. For example, in Tamil Nadu, cluster level meetings are being organized on a monthly basis for their foundational language and mathematics learning program. Similarly, meetings could be planned in Karnataka for teachers to discuss and formulate ways to help student's learning better.
4. A program on the lines of Subject Teacher Forum – Karnataka Open Educational Resources can be planned to provide ongoing support to teachers to access, adapt, and revise resources for their contextual use and also share with their peers across the state. This will enable teacher-teacher cooperation and collaboration on materials and methods, on a continuous basis.



### **Other projects by ITfC**

- [Professional Learning Communities, an ICT integrated model of in-service teacher education](https://tinyurl.com/PLC-teacher-education)  
(<https://tinyurl.com/PLC-teacher-education>)
- [Teachers' Community of Learning \(TCOL\) in Government Aided High Schools](https://tinyurl.com/TCOL-18-21) (<https://tinyurl.com/TCOL-18-21>)
- [Teachers' Community of Learning \(TCOL\) in Government High Schools](https://tinyurl.com/subject-teacher-forum) <https://tinyurl.com/subject-teacher-forum>