

|  |
| --- |
| Report on teaching strategies to support literacy development of children with visual impairments in Mali  February 2019 |



###### Authors:

Dr Paul Lynch, Department of Disability, Inclusion and Special Needs, University of Birmingham, UK.

Laurene Leclercq, West Africa Technical Lead in education and social inclusion, Sightsavers

Contents

[Introduction 4](#_Toc1391578)

[A short review of teaching practices in Mali 5](#_Toc1391579)

[Consultations with reading and writing materials and teaching specialists in Mali 6](#_Toc1391580)

[Teaching reading to children with visual impairments 8](#_Toc1391581)

[Summary and general conclusions and way forward 12](#_Toc1391582)

[Proposed five day training programme for Mali MEN representatives and trainers 13](#_Toc1391583)

[Useful reference books and guides for the module 14](#_Toc1391584)

### Introduction

This report aims to provide a rationale and a justification for suggesting a repertoire of teaching strategies that can be adopted by different teaching cadres (e.g. pedagogical advisers, inspectors, teachers and itinerant teachers) whilst supporting the literacy development of children who have a visual impairment (both low vision and blind). The report summarises key documentation pertaining to the reading approaches used in Malian classrooms in relation to support children’s reading and writing in early grades at primary schools. It will then focus on the specific (additional) skills sets that children with visual impairment require when beginning literacy as well as discussions with key stakeholders supporting early literacy in Mali.

In earlier reports, we have reviewed the literature on literacy teaching for children with visual impairments through print and braille followed by a synthesis on modifications required to reading assessments such as the Early Grade Reading Assessment (EGRA) as a precursor to administering a consultation questionnaire on teaching approaches to literacy for children with visual impairment in Mali. Based on the literature and a review of what came out of the questionnaire, we proceeded to give specific advice on how the EGRA could be adapted for use with children who have low vision and blind. These recommended changes were then made to the assessment protocol based on the French version of EGRA aimed at children with VI. The newly adapted EGRA tests and protocol were then piloted with 56 children (21 braille and 35 print users) in seven schools in Mali. We then produced a summary report which presented findings from the analysis of a sample of EGRA Assessments that were carried out in May 2018 using the newly developed guidelines for students with visual impairment. The report highlighted some of the observations that were made by the assessors in relation to children’s reading performance.

The next stage of the project consists of providing a targeted training to a small group of teaching personnel on how to support children with visual impairment literacy development in the classroom and at home. The next sections of this report summarise some of the main findings from a review of the different reports and curricula that were collected during a visit to Mali in November 2018 as well as a review of the tried and tested approaches that have led to children with visual impairment become proficient readers and successful scholars.

### A short review of teaching practices in Mali

One of the biggest challenges many schools and colleges face, is deciding on what critical reading and writing skills children need to develop in order to become proficient readers and scholars and at what ages these children should have attained these skills. We also grapple with the problem of identifying the most effective strategies and materials to best ensure that students develop the key foundation skills (e.g. word attack skills) that will help to support their reading and learning in the school classroom and at home. Thirdly, and equally importantly, is around what training teachers and pedagogical advisers need to be competent and feel confident to teach literacy to children with visual impairment. In addition, we also need to consider the cultural and linguistic contexts and decide on how effective are tested reading approaches and materials from the Global North can be used within the Malian school setting. These considerations should be taken into consideration when planning an intervention to develop the literacy development of children with visual impairments in mainstream primary and special school settings.

Organisations working in children’s education in Africa (UNESCO, UNICEF, World Bank) publish children’s literacy and numeracy grades in documents such as the Global Education Monitoring Report in which they often raise concerns about the low literacy and numeracy rates of children passing through primary school grades. In the instance of Mali, only around 42% of learners in Grade 2 classes have a good use of their own language and can communicate well and around 48% of children in Grade 6 are able to master French. UNESCO and the Ministry of Education launched a programme (CapEFA) to improve the system of teaching reading and writing in schools by working to improve different skill areas in reading and writing through games, short stories, guided reading, free writing with teaching on the mechanics of the language (phonics and phoneme awareness).

The Ministry of Education in 2009 introduced five ways to support the development of children’s reading and writing in schools by:

1. Introducing mechanisms of the language (phonemic awareness and phonics)
2. Increasing children’s vocabulary
3. Encouraging greater reading fluidity
4. Increasing access to comprehension texts
5. Ensuring rules on how to correctly are also taught in the classroom.

Teachers and pedagogical advisers need to give learners opportunities to become proficient in all aspects of language by:

teaching children to decode words and make sense of them,

encouraging them to apply reading strategies to read (decode, infer, appreciate the text)

giving learners plenty of opportunities (at least once a week) to listen to stories, read their own stories for pleasure, read key curriculum texts

giving learners plenty of opportunities to write words, short phrases, short, meaningful texts as soon as they start school.

In spite of these efforts to change the way reading and writing are taught in schools, high illiteracy rates still prevail in many schools.

In many respects, the EGRA assesses the above skills through a series of sub-tests and acts as a useful benchmark for teachers and assessors to measure children’s literacy levels across the primary school cycle in formative and summative ways. An analysis of how children perform at the EGRA (both for sighted and visually impaired learners) shows that there are strong links between a learner’s level of fluency and levels of comprehension. Learners who are unable to read any words have will almost certainly have no comprehension of a given text. Arguably, comprehension increases in relation to the number of words a learner can read correctly and a learner who is unable to decode words and lacks reading fluency will encounter problems with comprehension. A study by the Ministry of Education in 2009 found that children who performed better at the EGRA in 2nd Grade were those who had been to pre-school, possess a textbook, children who read at home and those who did homework.

It is also helpful to point out that many schools do not teach strategies in the early primary years for children to acquire the basic fundamentals of reading – the relationship between a grapheme (a written symbol that represents a sound) and a phoneme (the sound the written symbol represents), phonemic awareness (the ability to break words into syllables or sounds and blend these parts together again) and a good knowledge of vocabulary and good comprehension skills. These are essential building tools to becoming a fluent reader and successful scholar.

### Consultations with reading and writing materials and teaching specialists in Mali

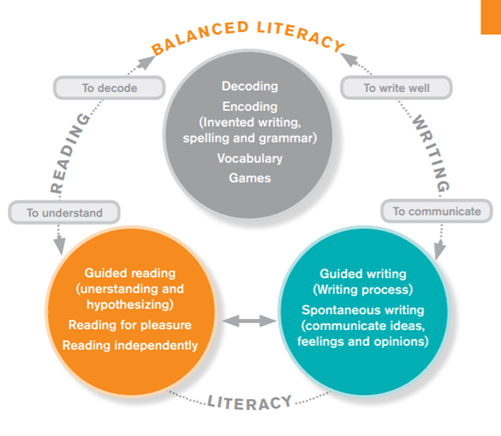
As part of our visit to better understand the approaches educators use to teach reading and writing in Malian schools, we visited a small number of key stakeholders who are responsible for the development and delivery of teacher training in Mali.

Mali uses two different curricula: the majority of schools follow a “classic” curriculum, in which French is the language of instruction, and other schools use a “bilingual” curriculum, in which students are taught first in one of Mali’s eleven approved native languages and then in French. We have managed to collect some examples of how reading is taught in schools. One example uses a rather old approach using a manual called ‘Repartition Hebdomadaire des Leçons de Lecture’ as the basis for teaching reading by breaking the components up into learning one or more letters per week. For example, in week one, children are introduced to four vowels - o-a-i-e- é, then in week two, they learn additional vowels - è- ê. Once children have grasped the vowels they then move onto consonants for ten weeks followed by diphthongs and vowel sounds – ‘ou-eu-oi-an’, etc. Teachers are then expected to draw or provide pictures of words that contain the letters and the learners are expected to repeat the letters after the teacher. This didactic method of teaching has been used for many years in schools, not only in Mali, with mixed results.

More recently, there has been a push for children to be given time in the first term of the 1st grade to become acquainted with the concept of the written form e.g. know are 26 letters in the alphabet and 36 phonemes in the French language. Teachers are issued with a manual - ‘Pédagogie Générale,’ which gives some instruction on how reading should be taught in class from 1st Grade to 6th Grade. This ‘global’ type method of teaching (called “méthode équilibrée”) comprises of a series of posters, one per week which forms the basis of a discussion about what is happening in the scene. Children start with the whole story then they are asked to discuss the images in the poster and then read the whole sentence which they are expected to learn off by heart. They are also taught the sounds of the letters within the word by splitting the word in letters and focus on discovering one or two letters. As stipulated by the curriculum, schools are expected to engage with the pictures and match the words with the images. As part of pre-literacy development, children are asked to follow simple instructions to ensure they know parts of their body, prepositions of place and movement (e.g. go towards, go fast, go slowly, etc.), as well as understand common sounds, colors, days of the week and the seasons, etc. Once they have mastered these, teachers introduce vowels, consonants, diphthongs and vocabulary. In 2nd Grade, children are expected to start reading letters and syllables and build their list of sight words (vocabulary). By the end of the second year, they are expected to be able to read a range of simple texts with relative ease but there is an emphasis on quiet reading. As children advance through to 3rd grade, they are expected to be able to provide a summary of what they have read from a collection of reading books. At the same time, they are taught French grammar, including how to conjugate verbs, spelling and writing. Once children have mastered the different components of reading, they are, then, expected to read short texts and be able to respond to the teacher’s questions about the book or short story they have read. The EGRA very much reflects the different stages children take when learning to read in primary schools.

Unsurprisingly, all the above approaches rely heavily on the teacher’s own knowledge and ability to teach reading to children in a careful and structured way. Teachers who are able to use a balanced approach to literacy where learning to read is broken into careful sequencing of steps, could be considered as an effective way of helping children not only learn the essential mechanisms of the language but are able to apply them to their reading. This could be achieved through guided reading (teacher reading with child) hopefully leading to reading for pleasure. The development of writing is also an important part of becoming literate and should be taught as part of the balanced literacy approach (see figure 1).

Figure 1: A balanced literacy approach: reading, writing and literacy



During a visit in November 2019 to Bamako, Paul Lynch (University of Birmingham) and Laurene Leclercq (Sightsavers) met the Director of the IFM (Institut de Formation des Maîtres: Teacher Training Colleges) in Bamako and a Professor of literature to discuss the content of teacher training on literacy approaches used to instruct children to read and write. The lecturers reported that trainee teachers are given 4 hours per week on how to teach literacy to children over a 6 month period at teacher training college. They also have to complete a 3-month placement as an assistant teacher in a classroom in order to validate their degree. It was pointed out that trainee teachers do not receive a manual explaining how to teach reading methods to students.

In 2017, the MoE formally issued a policy stating that the reading approach should now be based on teaching reading through ‘syllabic’ method only, which, if interpreted correctly, means teaching phonemic awareness and phonics. Apparently, the current reading curriculum has been revised on this basis, although visits to schools do not seem to confirm this change of teaching approach yet. The IFM plans to train its own lecturers on this approach in 2019 which will be ready to roll out in new teacher training in 2020.

In this project, we are faced with the challenge of teaching literacy to children who have a visual impairment. The next sections of this report will discuss the complexities of teaching reading to children with low vision who use print and for blind children who learn to read through touch. Learners with visual impairment constitute a group within which there is a wide spectrum of characteristics, abilities and educational support needs. In addition, visual impairment is associated with significant barriers to curriculum access that can result in developmental delay and increasing dependence on others. Both mainstream and specialist teachers can work together to seek solutions on how best to support a child’s access to the curriculum (amongst other educational and psycho-social needs) and develop an individualised programme that addresses his/her language needs by setting realistic and achievable targets for each grade. The teaching profile should be aligned to the primary curriculum in a meaningful and balanced way.

### Teaching reading to children with visual impairments

Douglas et al (2018) in their report on adapting EGRA for children with visual impairment in Mali, briefly discussed some of the difficulties that children with low vision and blindness experience when learning to read. When considering how best to support the literacy development of children with low vision, it is always useful to have a good understanding of how each child accesses print.

It may seem an easy solution to offer children with low vision large print sizes but this is not everything that can be done to ensure children access reading materials. Douglas et al (2009) argue that low vision devices provide users with ‘independent’ access to print with children using mobile phones and tablets to help them access print. This is not always a realistic solution in resource-constrained settings where access to technology such as tablets is not a viable option. It is therefore important to consider ways of introducing simple, low cost non-optical devices such as reading stands and optical devices such as a range of magnifying glasses which can be used in combination with reading glasses and wide brimmed hats (e.g. children with albinism), lighting and time of the day when reading is performed. Importantly, we need to consider ways to reducing the barriers to access to literacy through the deployment of dedicated teaching approaches that will benefit all these children.

We recognize that these support needs can be addressed through inclusive pedagogical approaches for all children in combination with targeted and distinctive approaches for learners with visual impairment. Specialist input is considered to be integral to promoting these approaches through itinerant teachers.

Interestingly, in the EGRA tests provides a useful example of how children with low vision require special arrangements when asked to read words or texts under timed conditions. It must be stressed that the children had different levels of visual acuity and levels of literacy. Some children attended a Catholic private school which is often seen as higher performing schools and is located in the centre of Bamako. Table 1 shows the performance of 35 print users, children in 2nd grade were only able to read about half of the words correctly (26/50), whereas children in 3rd grade performed better reading on average 30/50 words correctly. The scores improved with 4th grade children with 8 children reading 38+ words out of a total of 50 words in less than two minutes. It is difficult to come to any firm conclusions based on the small sample number, however, it is apparent that children in the lower grades require the additional time to read the words.

Table 1: List of results for section 3 (reading familiar words) children with low vision in 5 pilot mainstream schools

| **Grade** | **Child** | **Number of words correctly read/ Total number of words read** | **Time needed** | **Summary** |
| --- | --- | --- | --- | --- |
| 1st Grade | No data were collected from 1st Grade students.[[1]](#footnote-1) | | | |
| 2nd Grade | Child 1  Child 2  Child 3  Child 4  Child 5  Child 6  Child 7 | 46/50  14/29  18/34  25/34  7/20  26/44  47/50 | 1 min 30’  2 min  2 min  2 min  2 min  2 min  1 min 50’ | Given a list of 50 words and up to 2 minutes to read the words, the children on average read 26 words correctly. On average, they needed 1 minute 54 seconds to read these words. |
| 3rd Grade | Child 1  Child 2  Child 3  Child 4  Child 5  Child 6  Child 7  Child 8  Child 9  Child 10  Child 11  Child 12 | 34/50  33/38  27/34  29/50  0/5  1/20  0/5  49/50  49/50  47/50  49/50  40/46 | 1 min 30’  2 min  2 min  2 min  Stopped[[2]](#footnote-2)  2 min  Stopped  1 min 26’  44’  1 min 44’  1 min  2 min | Given a list of 50 words and up to 2 minutes to read the words, the children on average read 30 words correctly. On average, it took them 1 minute 38 seconds to read these words. |
| 4th Grade | Child 1  Child 2  Child 3  Child 4  Child 5  Child 6  Child 7  Child 8  Child 9  Child 10  Child 11  Child 12  Child 13  Child 14  Child 15  Child 16 | 17/22  18/35  0/5  0/5  34/50  6/41  49/50  50/50  50/50  46/50  26/50  47/50  43/50  18/31  38/50  50/50 | 2 min  2 min  Stopped  Stopped  1 min 22’  2 min  2 min  1 min 50’  53’  1 min 13’  1 min 45’  1 min  1 min 10’  2 min  1 min 23’  56’ | Given a list of 50 words and up to 2 minutes to read the words, the children on average read 31 words correctly. On average, it took them 1 minute 33 seconds to read these words. |

To conclude, it is important to take into account the additional material and equipment and time children with low vision will require when teaching children to read. We do not necessarily advocate for a different teaching strategy for teaching literacy to children with low vision, but it is important for teachers to be aware of each child’s visual acuity and environmental preferences when accessing print. A list of the suggested changes for children with low vision for the EGRA can be applied to the instruction of reading skills in the classroom.

In the case of braille readers, children who have had very little exposure to the braille code, do not perform well in the EGRA. The results below (see table 2) show that the 5 children in 1st Grade were unable to read more than 6 words out of 50 in spite of the increase in time from 1 minute to 3 minutes for braille readers. There is a small improvement in 2nd Grade, but again children are struggling to complete the timed sub-test correctly within the 3 minute time allocation. We see an improvement in reading scores in 3rd and 4th grades signifying that children are only beginning to grasp the braille code and corresponding phonemes after 2 to 3 years of pre-braille tuition. We must stress that this analysis is based on a total of 21 EGRA tests, so numbers are quite low (see appendix for more analysis of the tests). We have to take into account other significant factors such as a child having an additional impairment, including cognitive impairment or physical limitations that may limit their ability to read braille. In general, children with visual impairments have not seen models of reading and writing to the extent that sighted children have by the time they go to school, and so have had fewer experiences with print or braille literacy to assist them in acquiring beginning literacy skills.

Table 2: List of results for section 3 (reading familiar words) blind children in 2 pilot special schools

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Grade** | **Child** | **Number of words correctly read/ Total number of words read** | **Time needed** | **Summary** |
| 1st Grade | Child 1  Child 2  Child 3  Child 4  Child 5 | 0/5  0/5  1/13  6/36  6/23 | Stopped[[3]](#footnote-3)  Stopped  3 min  3 min  3 min | Given a list of 50 words and up to 3 minutes to read the words, the children on average read 3 words correctly. On average, it took them 3 minutes to read these words. |
| 2nd Grade | Child 1  Child 2  Child 3  Child 4  Child 5  Child 6 | 21/37  14/21  9/19  0/5  14/22  5/23 | 3 min  3 min  3 min  Stopped  3 min  3 min | Given a list of 50 words and up to 3 minutes to read the words, the children on average read 11 words correctly. On average, it took them 3 minutes to read these words. |
| 3rd Grade | Child 1  Child 2  Child 3 | 48/50  28/31  26/32 | 1 min 40’  3 min  3 min | Given a list of 50 words and up to 3 minutes to read the words, the children on average read 34 words correctly. On average, it took them 2 minutes 33 seconds to read these words. |
| 4th Grade | Child 1  Child 2  Child 3  Child 4  Child 5  Child 6  Child 7 | 18/40  0/5  47/50  48/50  33/50  25/29  16/50 | 3 min  Stopped  2 min 36’  2 min 50’  3 min  3 min  3 min | Given a list of 50 words and up to 3 minutes to read the words, the children on average read 27 words correctly. On average, it took them 2 minutes 27 seconds. |

To conclude, unlike sighted-readers, blind children do not have constant exposure to their literacy medium (braille) – even though they may not yet be able to read it. Teachers supporting children’s braille development in specialist schools often have a good understanding of how braille works and the ways it can be taught to children. In education, we often talk about creating a braille-rich environment which will help learners to develop the concept of what reading and writing braille is all about. It is important for teachers to take children through the steps of a braille literacy programme that encourages them to develop their tactile perception and recognize letters through tracking activities. Once learners have mastered the sounds of letters and blended the syllables, they should be able to move onto building key words that have meaning – e.g. their name, age, their favourite toys, etc. Often the development of phonemic awareness can be built upon words and sounds that a learner already knows and are meaningful to him/her. The more the teacher can integrate what is meaningful to the learner into instruction, the more likely he/she will succeed in learning to read. Research shows that phonemic awareness grows with increased exposure to reading tasks and with actual engagement with reading materials. Children who use slates and stylus to write braille have the additional learning task of having to write the braille in the opposite direction to the way they read (left to right). Having some access to Perkins braillers would help to reduce this cognitive load and give children greater freedom to freely braille in the same sense as they read.

All the above points will be taken into consideration when developing a short course for teachers supporting the literacy skills of children who are blind.

### Summary and general conclusions and way forward

This final section summarizes some of the main points discussed in the previous sections.

During our visit to Bamako in November 2019, we learnt that there are moves to change how literacy will be taught in primary schools in 2019/20. The current school literacy programme places an emphasis on what is commonly called ‘language experience approach’ which focuses on use of children’s oral language and real-life experiences as the basis for creating literacy skills. There are some elements of introducing phonemic awareness through the use of a balanced approach which helps the learner pass through different stages of language development (e.g. decoding of key words, guided reading, matching of images to words). This approach may be beneficial to some children with low vision who are able to access the learning materials without having to call upon low vision devices. Children who use braille as their reading and writing medium benefit much less from this approach and so require more one-on-one tuition from specialist teachers who can teach reading and writing from 1st to 6th grade.

To summarise, much of the curriculum for each grade covers topic or subject areas but doesn’t describe or go into detail about how reading and writing should be taught. It is therefore our duty to address these lacunae by proposing a teaching approach that respects current curriculum delivery and enhances teachers’ knowledge and understanding of how reading should be taught to visually impaired learners. During the training, we will draw on a widely distributed document - UNESCO (2015) – Enseignement de la lecture/écriture’ in conjunction with the curriculum, specifically for 1st to 4th grades. This approach sets out the key reading and writing skills that teachers need to develop and suggests useful activities that will help teachers to develop literacy skills of children with visual impairment (e.g. teaching syllables, initial sounds of words and the phonemes in words).

This proposed short course (module) is targeted at Ministry of Education personnel who have different levels of knowledge and experience of teaching children with visual impairment in mainstream and specialist schools in Mali. The course is based on the principles set out in the ‘Read Right Now!

|  |
| --- |
| ***Read Right Now!*** provides clear and comprehensive strategies that effectively support ministries of education, educators, and parents as they grow skilled readers and writers (both children and youth). It produces:  Learners who read and write meaningfully, purposefully, and with enjoyment  Teachers who know how and why to teach reading and writing  Families and communities that support learning to read and write  School leaders who support the development of literacy teachers  Materials developers who produce content that motivates and enables learners to read and write  Ministries that create and implement policies that improve literacy teaching  http://rrn.edc.org |

### Proposed five day training programme for Mali MEN representatives and trainers

The course (module) will be divided into five days:

**Day one:** a review of how best support literacy development to teachers who have different levels of knowledge or experience of teaching children with visual impairment.

**Days two and three:** aimed at mainstream teachers who work with children with low vision and inspectors

**Day three, four and five:** aimed at specialist teachers supporting literacy skills of children who use braille.

Day One (Generic)

1. **Basics of teaching reading to children**
2. Current system of teaching reading to children in primary schools ‘Classic curriculum’ vs bilingual curriculum approaches
3. Balanced literacy and teaching alphabet and phonemic awareness and phonic approaches
4. Guided and paired reading (child/child, child/parent) and turn taking
5. Understanding the names of the letters (e.g. a is for apple)
6. Names of letters in relation to their sounds (grapheme – phoneme)
7. Sounding out distinct sounds in words
8. Ability to divide words into syllables and pronounce the syllables in each word
9. Grammatical rules ex. use of nouns, adjectives and verbs and adverbs
10. Understanding the role of punctuation and paragraphs
11. Activities to develop fluidity- repetition and self-correction
12. Reading for meaning and answering questions on short comprehension texts
13. Ways to encourage children’s reading and writing at school and home

Days Two and Three

1. **Teaching reading to children with low vision**
2. Understanding of difficulties children with low vision have when reading e.g. nystagmus, photophobia, strabismus, myopia
3. Identifying and producing appropriate font sizes for readers
4. Introducing assistive devices (loops, reading stand) to help with reading
5. Difficulties children encounter when taking EGRA reading test
6. Preparing children with low vision for different sub-domains of the EGRA test (syllables, short words, nonsense words, sentences)
7. Creating an environment to encourage children’s enjoyment of reading
8. Writing techniques for children with low vision (on chalkboard, note books) – hand-writing and graphics

Days Three, Four and Five

1. **Teaching reading to blind children**
2. Difficulties blind children encounter when starting Braille
3. New words – creating flash cards and word boxes (low vision and blind) – games eg: bingo, snap
4. Teaching and learning first key words through decoding – the Braille cell – dots at top, middle and bottom
5. Letter recognition and tracking activities – avoiding scrubbing, light touch
6. Finger dexterity and increasing reading speeds
7. Developing vocabulary beginning with consonants – eg: bete, balle,
8. Creating short books – one word per page building up to three words per page
9. Working on different sub-domains of the EGRA test (syllables, short words, nonsense words, sentences)
10. Creating a braille rich environment to encourage children’s enjoyment of reading
11. Preparing children with low vision for different sub-domains of the EGRA test (syllables, short words, nonsense words, sentences)
12. Practising Brailling with Slate and stylus

### Useful reference books and guides for the module

Books used in the classroom: “Langage Lecture” (Hatier), “Nouveau syllabaire de Mamadou et Bineta », A. Davesne (EDICEF)

UNESCO (2015) Enseignement de la lecture/Ecriture

Wormsley (2003) Braille Literacy : A functional Approach, AFB Press.

EGRA guidelines

MEN – Pédagogie Générale

Use of translated children’s books into braille donated by Sightsavers

1. This is presumably because there were no children with low vision in the sample schools or because the children with low vision had not yet been identified. [↑](#footnote-ref-1)
2. When the child could not read the first five words, the administrator stopped the test, as per the EGRA guidelines. When calculating the average number of words read by the children for each grade, the totals for these children (i.e. zero) were included in this calculation. However, when calculating the average time taken by children in each grade to read the words, we did not include the times of these children in this calculation. [↑](#footnote-ref-2)
3. When the child could not read the first five words, the administrator stopped the test, as per the EGRA guidelines. When calculating the average number of words read by the children for each grade, the totals for these children (i.e. zero) were included in this calculation. However, when calculating the average time taken by children in each grade to read the words, we did not include the times of these children. [↑](#footnote-ref-3)