



AniBooks: Scalable and Likeable, But Readable?

Final Project Report, June 28, 2018

Supported by:



Study by:



PlanetRead contact:

Nirav Shah, COO

Parthibhan Amudhan, General Manager

nirav@planetread.org

parthibhan@planetread.org

Disclaimer: "This study is made possible by the generous support of the American People through the United States Agency for International Development (USAID). The contents of this study are the responsibility of Centre for microFinance (CmF) and PlanetRead and do not necessarily reflect the views of USAID or the United States Government.

Contents (Click to navigate)

[Summary](#)

[Introduction: AniBooks](#)

[E-Library Programme](#)

[Reading Performance of Schools](#)

[Methodology](#)

[Findings](#)

[Conclusion](#)

[Appendix A: Photos and Videos](#)

[Appendix B: School Data](#)

[Appendix C: Reading Assessment Form \(attachment\)](#)

[Appendix D: Sample survey form \(attachment\)](#)

Summary ([back to contents](#))



Photo: School children from Amthala, Rajasthan

An e-Library programme has been active in 10 government primary schools in Abu Road, that gives low-income children in-school access to curated educational content on tablets. The content includes several AniBooks in Hindi. AniBooks are animated stories with Same Language Subtitling (SLS). This study aims to determine whether children actually read along with SLS while watching AniBooks, and if so, how much? What are some ways in which reading along with SLS can be encouraged?

Eye-tracking research was conducted in three of the schools, namely Amthala (high e-Library engagement) and Mordu and Ganka (relatively low e-Library engagement). In Session 1, a total of 211 children in Grades 2-5 from all 3 schools were shown 3 familiar AniBooks in Hindi, with and without SLS. The AniBooks were specifically chosen at low, medium and high level of reading difficulty. Session 2 eye-tracked the same AniBooks as in Session 1, but without narration, to a total of 72 students in Grades 2-3 from Amthala and Mordu. Session 3 eye-tracked 3 new/unfamiliar AniBooks with 25 Grade 4 children in Amthala and Mordu.

Children's viewing of the AniBooks was eye-tracked, without their knowledge. The number of eye-fixations in the SLS band (Area of Interest, AOI), with and without SLS, was compared separately for every AniBook. In addition to the eye-tracking, an Early Grade Reading Assessment (EGRA) was administered to every child, right after the eye-tracking. Generally, reading achievement in Amthala and Ganka schools was comparable across grades but Mordu's reading scores were less than half.

Sample finding(s)

Grade 3, mean Total Reading Scores: Amthala = 71.5; Mordu = 25.6; Ganka = 94.9
Grade 4, mean Total Reading Scores: Amthala = 148.7; Mordu = 17.4; Ganka = 123.5
(See Figure 1).

The presence of SLS increased the eye-fixations in the SLS band for over 90% of the children, including weak readers. Engagement with SLS was high in Amthala school, where the e-Library programme had been the most active. In Mordu and Ganka schools, eye-fixation on the SLS band, for the same AniBooks, was around half that of Amthala's. That just means that AniBooks invited automatic reading in all three schools, just more so in Amthala, probably because of greater familiarity with the AniBooks and the consequent practice, if not habit formation, of reading along to SLS.

Sample finding(s)

Grade 3 in Amthala registered an average 34.6 more Fixations Per Minute (Δ FPM) in the SLS band when watching the AniBook titled 'What Did You See?' (low reading difficulty).

'What Did You See?' 3rd Grade: Δ FPM^{Amthala} = 34.6; Δ FPM^{Mordu} = 18.1; Δ FPM^{Ganka} = 17.1
 'What Did You See?' 5rd Grade: Δ FPM^{Amthala} = 87.7; Δ FPM^{Mordu} = 40.6; Δ FPM^{Ganka} = 30.3
 (See Figures 2-4).

The reading difficulty level of the AniBook matters. AniBooks with a low and medium level of reading difficulty were more appropriate for the schools in our study. They invited more engagement with the text. The AniBook that was relatively harder to read along with, had far fewer eye-fixations on the SLS band.

Sample finding(s)

Grade 3, reading difficulty of AniBook:

| | | | |
|--------|---|---------------------------------------|--------------------------------------|
| Low | Δ FPM ^{Amthala} = 34.6; | Δ FPM ^{Mordu} = 18.1; | Δ FPM ^{Ganka} = 17.1 |
| Medium | Δ FPM ^{Amthala} = 19.2; | Δ FPM ^{Mordu} = 11.2; | Δ FPM ^{Ganka} = 12.9 |
| High | Δ FPM ^{Amthala} = 14.2; | Δ FPM ^{Mordu} = 2.4; | Δ FPM ^{Ganka} = 6.0 |

(See Figures 2-4).

An intervention that substantially improved the already high engagement with SLS in Amthala, was not having the narration but just the SLS with background music. However, this was not the case in Mordu, where the e-Library intervention was weaker and children had less prior exposure and read along practice with AniBooks.

Sample finding(s)

Δ FPM here refers to the difference in FPM in the subtitle band between a regular AniBook and one without narration. Representative findings for Grade 3 in Amthala and Mordu, for AniBooks with low, medium and high level of reading difficulty are:

| | | |
|--------|---|--------------------------------------|
| Low | Δ FPM ^{Amthala} = 11.8; | Δ FPM ^{Mordu} = -2.9 |
| Medium | Δ FPM ^{Amthala} = 26.2; | Δ FPM ^{Mordu} = -2.2 |
| High | Δ FPM ^{Amthala} = 15.5; | Δ FPM ^{Mordu} = 1.1 |

(See Figure 8; Tables 16-18).

In Amthala, the number of eye-fixations on the SLS band was comparable for familiar versus unfamiliar stories. In Mordu, familiar AniBooks generally invited more reading.

Sample finding(s)

Unfamiliar AniBooks were only shown to Grade 4 in Amthala and Mordu. FPM for AniBooks with low, medium and high level of reading difficulty:

| | |
|--------|--|
| Low | FPM, Amthala ^{Familiar} = 53.5; FPM, Amthala ^{Unfamiliar} = 45.6 |
| Medium | FPM, Amthala ^{Familiar} = 46.0; FPM, Amthala ^{Unfamiliar} = 44.1 |
| High | FPM, Amthala ^{Familiar} = 27.4; FPM, Amthala ^{Unfamiliar} = 42.4 |

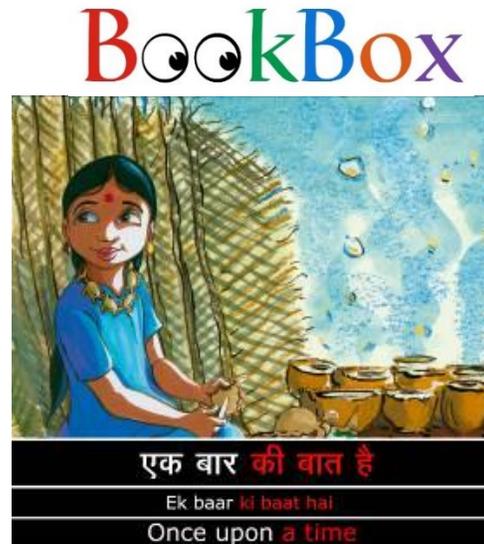
(See Figures 9-10).

In Amthala, girls tended to read along more with SLS than boys, a pattern that was not found in the other two schools. This was primarily due to the girls there being better readers. The number of eye-fixations on the SLS band was generally correlated to reading ability, especially story/paragraph reading ability.

AniBooks cause reading engagement, but do they lead to improved reading? This study was not designed to answer that question. However, a separate study in Delhi schools found strong evidence of improved reading from regular AniBook viewing.

Introduction: AniBooks ([back to contents](#))

Same Language Subtitling (SLS) is the idea of subtitling audio-visual content in the “same” language as the audio. ‘AniBooks’ are animated stories where the narration appears as SLS, with every word highlighted in perfect timing with the audio. AniBooks were innovated by [BookBox](#), a social enterprise and an off shoot of PlanetRead’s work, with the goal of massively scaling up children’s reading in India, in all Indian languages.¹



AniBooks have enormous potential. On [YouTube](#) globally, lifetime views are at they are currently clocking around 60,000 views/day: 75% on mobiles, 16% on computers, 6.4% on tablets and 2% on smart TVs (the remaining unknown). In India, specifically, AniBooks are currently getting 35,000/views/day: 91% on mobiles and only 4.4% on computers, 2.5% on tablets and 0.6% on smart TVs (the remaining unknown).

A successful children’s printed book title in India sells 5,000 copies. Such small print runs, in a severely limited number of languages, are a drop in the ocean of 357 million children in the 0-14 age group that groups involved in promoting children’s reading, aim to reach. In India, at 35,000 views/day, and growing, in a manner of speaking, AniBooks already register a quantum of reading equivalent to 7 successful children’s titles every day.²

A strong testament to the popularity of AniBooks is that globally they have acquired 65 million lifetime views on YouTube, with over 276,000 subscribers and in India, 29 million views and 90,000 subscribers.

SLS is what turns AniBooks into a reading experience. SLS is simply the idea of subtitling audio-visual content in the “same” language as the audio, or word for word, what you hear is what you read. It is a scientifically proven innovation developed at the Indian Institute of Management, Ahmedabad (IIM-A) and implemented in many Indian languages on TV, on film songs, by both, IIM-A and PlanetRead Trust. SLS is known to cause inescapable and automatic reading engagement on song-based TV programming.³ While SLS can also be expected to cause automatic reading along with AniBooks, among good readers, whether it actually does among weak-readers or early-literates, how much, remain open questions. We address these research questions with the help of eye-tracking in three government schools in Abu Road, Sirohi District, Rajasthan, where the Centre for microFinance (CmF) has been running an e-Library programme. The schools serve children in Amthala, Mordu, and Ganka villages.

¹ https://www.huffingtonpost.com/brij-kothari/bookbox-scaling-childrens_b_9424106.html

² Of course, a printed children’s book is read multiple times, so still, the quantum of reading from AniBooks is already more than at least 1 successful children’s title every day.

³ https://www.huffingtonpost.com/entry/what-caused-maharashtras-leap-in-reading_us_589d1277e4b0e172783a9a8f

E-Library Programme ([back to contents](#))

As part of the Nurturing Early Literacy Project, co-funded by USAID and Tata Trusts, CmF has been implementing the e-Library pilot programme in 10 schools in Abu Road. Prior to our study, for around a year all the students in these 10 schools (except Grade 1) had access to tablets, for one hour a week, loaded with a variety of children’s books, games and activities, as plain ePubs, AniBooks and apps.

All tablet usage was tracked by an app, in the background. For some time in the beginning, children had unrestricted access to the tabs, during their session. CmF’s analysis of the tracking data found that, left to themselves, children tended to pull up the “videos” (i.e., AniBooks) 75% of the time. The “books” or e-Pubs were pulled up 25% of the time. From a pedagogic point of view, this could be a problem in a reading intervention, if the AniBooks did not actually contribute to reading.

According to CmF, AniBooks were found to be popular with children. However, it was unclear to them if, and to what extent, children in the e-Library schools are actually engaging in reading along with the SLS while watching the AniBooks. If they were reading along, how could one enhance their reading engagement further?

CmF suggested three of the 10 schools for the study, or one each from where the e-Library programme had been assessed in internal reviews, as enjoying a relatively high (Amthala) and low (Mordu and Ganka) level of success.

This report analyzes the eye-tracking data from these three schools, which are located in the district of Sirohi, Rajasthan.



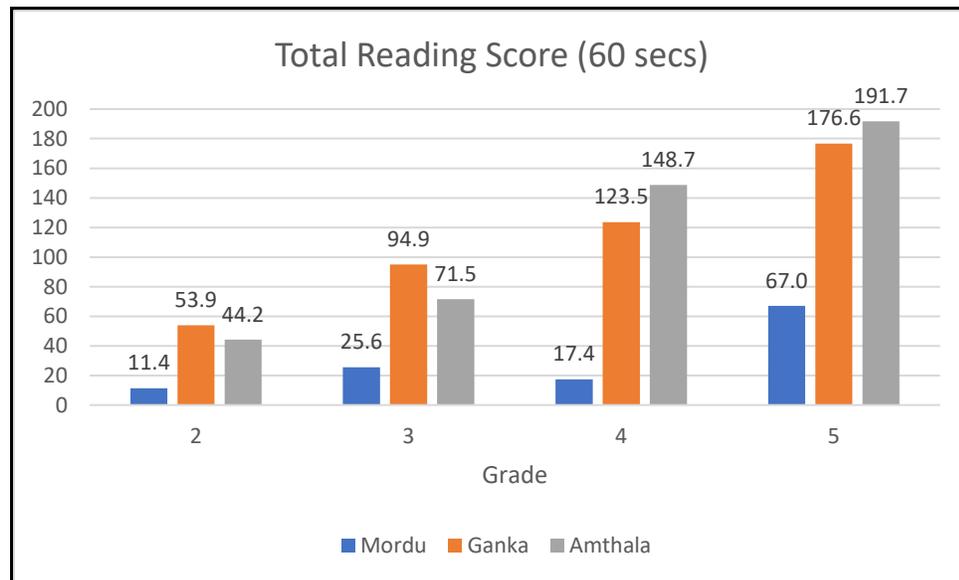
Reading performance: Amthala, Ganka and Mordu ([back to contents](#))

Amthala’s reading performance, as measured by the Total Reading Score (in 60 seconds), was comparable to Ganka’s, for all grades (Table 1, Figure 1). Ganka did better in Grades 2 and 3 and Amthala did better in Grades 4 and 5. However, we had far fewer students in our study from Ganka (40) than from Amthala (100). It is interesting to note that although Amthala had slightly lower outcomes in reading in Grades 2-3, Amthala caught up and surpassed Ganka in Grades 4-5, implying that something positive is happening in Amthala. Mordu’s reading performance was around three times lower in every grade.

Table 1: Total Reading Score by Grade in Amthala, Ganka and Mordu

| Grade | Amthala | | | Ganka | | | Mordu | | |
|-------|---------|--------------------------------|----------------|-------|--------------------------------|----------------|-------|--------------------------------|----------------|
| | N | Total Reading Score in 60 secs | Std. Deviation | N | Total Reading Score in 60 secs | Std. Deviation | N | Total Reading Score in 60 secs | Std. Deviation |
| 2 | 33 | 44.2 | 65.8 | 10 | 53.9 | 62.8 | 11 | 11.4 | 23.6 |
| 3 | 26 | 71.5 | 70.7 | 10 | 94.9 | 86.1 | 26 | 25.6 | 44.7 |
| 4 | 20 | 148.7 | 90.8 | 10 | 123.5 | 105.0 | 14 | 17.4 | 24.6 |
| 5 | 21 | 191.7 | 59.2 | 10 | 176.6 | 77.5 | 25 | 67.0 | 80.2 |
| Total | 100 | 103.2 | 92.0 | 40 | 112.2 | 92.7 | 76 | 35.6 | 58.4 |

Figure 1: Mordu, Ganka and Amthala Schools, Reading Performance



Methodology ([back to contents](#))

Location

The eye-tracking in Amthala, Ganka and Mordu government schools was done one student at a time, in a dedicated classroom on the school premises. In Amthala, the classroom for the study was located in a corner of the school, with no adjacent classrooms. This allowed for minimal disturbance from school assemblies and activities and ensured good quality data. In Mordu and Ganka too, we set up the eye-tracking in a separate room.

Local researchers and training

Two local women and a man, who were generally comfortable with computers, were hired and trained to conduct the eye-tracking sessions. They were first trained in Khadat, a nearby e-Library school which was not selected for the present study. To gain further training and familiarity with eye-tracking, the three field researches conducted a few trial eye-tracking sessions in the first school, Amthala, with seven children.

Besides familiarity with the actual setting, these trial sessions helped streamline the calibration process and sorted out several practical challenges that came up. For instance, there was erratic power supply so we installed an Uninterrupted Power Supply (UPS). For good calibration we had to ensure that the child's eyes, irrespective of his/her height, were always at the appropriate level and the student was positioned within the eye-tracker's horizontal range. This was simply accomplished with a bunch of cushions to control for height and chalk marks on the ground to position precisely the legs of the plastic chair. There were frequent interruptions during a session, so one field researcher was stationed at the entrance, outside, who would then also conduct the reading test, after the eye-tracking session was completed.

Eye-tracking process

Students were called one by one into the study room. They were first seated in front of a computer monitor, with the eye-tracker located unobtrusively on the table. None of the children were conscious that their eyes were being tracked. For calibration, they were asked to follow a dot that appeared and disappeared at different points on the screen. After the calibration was completed and confirmed, the researcher simply played the AniBooks for that particular session in an uninterrupted sequence, while monitoring the eye-tracking throughout, sitting across the table from the subject. The monitoring was done on a separate screen, not visible to the subject, that had a constant indication of whether both the eyes were being tracked properly while also showing a dynamic heat map of where on the AniBook video, the student was actually fixating, i.e., looking.

The only two people present in the study room, during the eye-tracking, were the student and one field researcher. In the initial rounds, we found that the student often looked away at anyone entering or exiting the room. After the eye-tracking session was completed, the student stepped out of the room, back into the school yard, where the second research conducted the reading test. Every student's best reading performance was also captured on cell phone video, as a qualitative measure of the student's reading ability.

Videos shown

Amthala

Three different eye-tracking sessions were conducted in Amthala (Table 2). In Session 1 (videos 1-6), all the students in Grades 2-5 were shown three AniBooks in the order mentioned in Table 2. The student first saw three different videos at low, medium and high level of reading difficulty, respectively, without SLS and then saw the same three AniBooks, with SLS.⁴ Session 1 was designed to answer the question whether the students read along with the AniBook's SLS or not, how much, and how that might change with the reading difficulty of the AniBook itself.

After completing Session 1 with all the students in Grades 2-5, we conducted Session 2 with Grades 2 and 3 only, but not with Grades 4 and 5. The goal with Session 2 was to explore ways to enhance the reading engagement with AniBooks. What if the AniBook had SLS, background music, but no story narration? That way, the student would HAVE to read along to follow the story. Would that then enhance the student's reading engagement with SLS? If it did, the teacher could then, sometimes, simply show the no-narration-AniBook to the whole class and have the students read the story together, aloud. This could be done individually, in small groups, or with the whole class. Since the goal was to find ways to enhance reading along with alternative strategies, we chose to explore this with weaker readers in Grades 2 and 3, and in the interest of time, not with Grades 4 and 5.

Through the e-Library programme, Amthala students had already seen the Sessions 1 & 2 AniBooks, numerous times. In conducting Session 3, we wanted to know whether there was any clear difference in reading engagement between familiar and unfamiliar AniBooks. To answer this question, we eye-tracked only Grade 4 children in Amthala, by showing them four unfamiliar AniBooks: two were at low, one at medium and one at high level of reading difficulty, as also indicated by the number of words per minute of SLS, in Table 2.

Table 2: AniBooks shown and eye-tracked, in three separate sessions

| Video | AniBooks | SLS | Narration | Story Duration (s) | SLS Duration in Story (s) | Reading Difficulty | Number of Words per Min |
|-------------------------------------|-------------------|-----|-----------|--------------------|---------------------------|--------------------|-------------------------|
| Session 1: Familiar AniBooks | | | | | | | |
| 1. | What did you see? | No | Yes | 137.6 | 112.9 | L | 81.3 |
| 2. | Gajapati Kulapati | No | Yes | 341.0 | 335.2 | M | 81.8 |
| 3. | School Topper | No | Yes | 295.3 | 292.0 | H | 111.4 |
| 4. | What did you see? | Yes | Yes | | | | |
| 5. | Gajapati Kulapati | Yes | Yes | | | | |
| 6. | School Topper | Yes | Yes | | | | |

⁴ Even though the words/minute for videos 1 and 2 are practically the same, the words in video 1 are much simpler and repetitive, hence, the reading difficulty is stated as low for video 1 and medium for video 2.

| Session 2: Familiar AniBooks, No Narration | | | | | | | |
|---|------------------------|-----|-----|-------|-------|---|------|
| 7. | What did you see? | Yes | No | | | | |
| 8. | Gajapati Kulapati | Yes | No | | | | |
| 9. | School Topper | Yes | No | | | | |
| Session 3: Unfamiliar AniBooks | | | | | | | |
| 10. | The Elephant King | No | Yes | 62.0 | 44.8 | L | 45.5 |
| 11. | The Moon and the Stars | No | Yes | 63.0 | 55.4 | L | 49.8 |
| 12. | Good Night Tinku | No | Yes | 370.6 | 359.4 | M | 89.3 |
| 13. | No Smiles Today | No | Yes | 215.6 | 207.0 | H | 98.6 |
| | | | | | | | |
| 14. | The Elephant King | Yes | Yes | | | | |
| 15. | The Moon and the Stars | Yes | Yes | | | | |
| 16. | Good Night Tinku | Yes | Yes | | | | |
| 17. | No Smiles Today | Yes | Yes | | | | |

Mordu and Ganka

In Mordu and Ganka, the e-Library programme was not as active as in Amthala. In Mordu we conducted Sessions 1-3, exactly like we did in Amthala (Table 3 presents the number of students eye-tracked in each session and grade). In Ganka, we conducted Session 1, but not Sessions 2 & 3. Given that Sessions 2 & 3 were exploratory in nature, we felt that between Amthala and one other school with low e-Library school, we could get at the “narration vs. no-narration” and “familiar vs. unfamiliar” differences without the need for an additional school. In total, 211 students were eye-tracked for Session 1, 72 for Session 2 and 25 for Session 3.

Table 3: AniBook sessions eye-tracked in Amthala, Mordu and Ganka

| | Grade 2 | Grade 3 | Grade 4 | Grade 5 | Total |
|-----------------------|---------|---------|---------|---------|-------|
| <i>Amthala</i> | | | | | |
| Session 1 | 32 | 25 | 20 | 21 | 98 |
| Session 2 | 24 | 21 | 0 | 0 | 45 |
| Session 3 | 0 | 0 | 15 | 0 | 15 |
| <i>Mordu</i> | | | | | |
| Session 1 | 11 | 24 | 13 | 25 | 73 |
| Session 2 | 9 | 18 | 0 | 0 | 27 |
| Session 3 | 0 | 0 | 10 | 0 | 10 |

| | | | | | |
|---------------------|----|----|----|----|----|
| <i>Ganka</i> | | | | | |
| Session 1 | 10 | 10 | 10 | 10 | 40 |
| Session 2 | 0 | 0 | 0 | 0 | 0 |
| Session 3 | 0 | 0 | 0 | 0 | 0 |

Analytical approach: Area of Interest (AOI) and fixations in the SLS band

The Area of Interest (AOI) is defined in our study as the subtitle band at the bottom of the screen where all SLS is shown. Session 1, therefore allows for a comparison of how the same student saw the exact same animated story, with and without SLS.

A Gazepoint eye-tracker was used at 120 Hz, i.e., it recorded 120 gazepoints/second, where exactly the viewer was looking on the screen. The software converted those gazepoints into fixations. A fixation is a clustering of gazepoints in time and space and serves as a marker of eyes actually locked on an object or point on the screen. When we read, our eyes saccade (or move) from one fixation to another. Since our AOI, or SLS band, had nothing but text in it, fixations there can only be interpreted as an attempt to read or at least engage with the text.

The eye-tracker gave us the number of fixations in the AOI and is a proxy measure for reading engagement. Thus, a comparison of fixations in the AOI for the AniBook with and without SLS, gives us an accurate measure of reading engagement due to SLS.

Fixations Per Minute (FPM)

The eye-tracker gave us the total number of fixations in AOI (SLS band) for the entire video (# Fix). The difference in number of fixations for the AniBooks with and without SLS is the number of fixations that can be credited to the presence of SLS and is represented as Δ # Fix.

Since the total duration of the SLS in every AniBook was different (see Table 2), to be able to compare reading interaction across different AniBooks and conditions, we calculated:

Fixations Per Minute (FPM) of SLS = (Total number of fixations for the AniBook) *div* (SLS duration in the AniBook in seconds) *multiplied* (60)

Δ FPM = (FPM of AniBook with SLS) *minus* (FPM of same AniBook without SLS)

Δ FPM is a key metric in our analysis and represents the change in FPM directly resulting from the presence of SLS. Δ FPM allows a comparison across AniBooks and categories, and therefore, an important unit of analysis for reading engagement with SLS.

Findings ([back to contents](#))

The two main research questions of this study are:

Set 1

Do children who watch AniBooks, simultaneously engage in reading? How much unprompted reading engagement takes place while watching AniBooks? What are the factors that determine the quantum of reading engagement, such as, a child’s reading ability or the reading difficulty level of the AniBook text?

Set 2

What are some ways of enhancing the quality and quantity of reading engagement with AniBooks? SLS is known to cause at least some automatic and inescapable reading, but what can we do to nudge viewers to engage in more engagement with the on-screen text?

Session 1: Eye-tracking of familiar AniBooks, with and without SLS

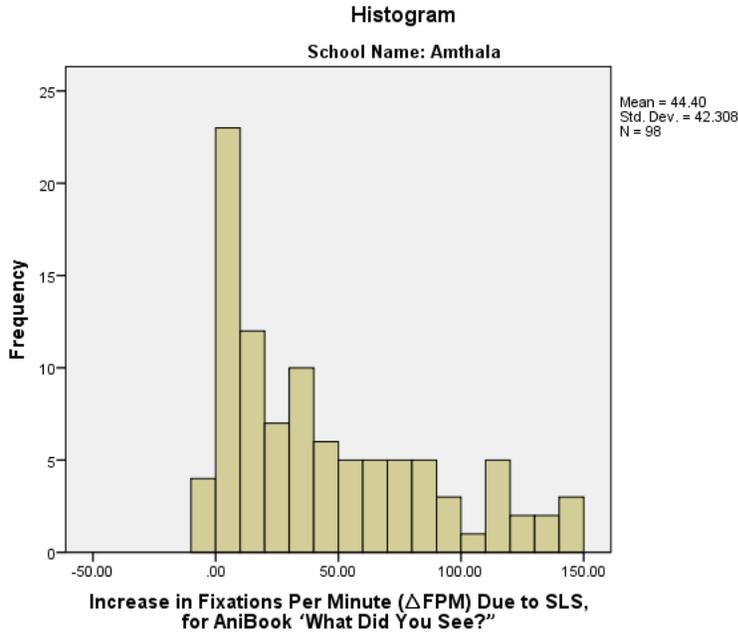
Amthala

In Amthala, the number of fixations in AOI increased substantially with SLS, for every grade. In Grade 2, SLS resulted in 33.9 more mean number of fixations and in Grade 5, 165 more fixations, for AniBook “What did you see?” (Table 4). Generally, higher grades had higher engagement with SLS and this pattern held true for all three AniBooks in Session 1 (see Δ # Fix in Tables 4-6).

Table 4: Amthala, AniBook: What did you see?

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
|-------|----------------|---------------|-----------------|----------------|--------------|
| 2 | Mean | 4.1 | 38.0 | 33.9 | 18.0 |
| | N | 32 | 32 | 32 | 32 |
| | Std. Deviation | 6.6 | 34.3 | 35.3 | 18.7 |
| 3 | Mean | 5.9 | 71.0 | 65.0 | 34.6 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 7.5 | 59.4 | 59.3 | 31.5 |
| 4 | Mean | 5.3 | 105.9 | 100.7 | 53.5 |
| | N | 20 | 20 | 20 | 20 |
| | Std. Deviation | 3.4 | 79.9 | 79.8 | 42.4 |
| 5 | Mean | 7.4 | 172.4 | 165.0 | 87.7 |
| | N | 21 | 21 | 21 | 21 |
| | Std. Deviation | 7.0 | 84.2 | 83.1 | 44.2 |
| Total | Mean | 5.5 | 89.1 | 83.6 | 44.4 |
| | N | 98 | 98 | 98 | 98 |
| | Std. Deviation | 6.5 | 80.4 | 79.6 | 42.3 |

The Δ FPM means for AniBook ‘What Did You See?’ were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 94) = 19.05, p = 0.000$].

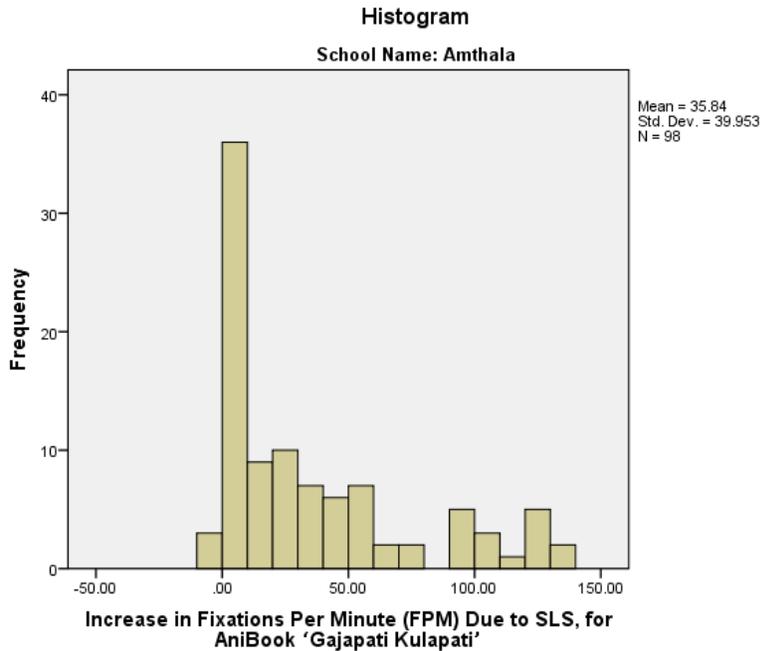


The percentage of students in Amthala, Grades 2-5 who engaged in at least some reading (Δ FPM > 0), due to SLS, when watching ‘What Did You See?’ was 93.9%.

Table 5: Amthala, AniBook: Gajapati Kulapati

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
|--------------|----------------|---------------|-----------------|----------------|--------------|
| 2 | Mean | 15.2 | 80.4 | 65.3 | 11.7 |
| | N | 32 | 32 | 32 | 32 |
| | Std. Deviation | 26.0 | 75.8 | 76.5 | 13.7 |
| 3 | Mean | 16.1 | 123.2 | 107.0 | 19.2 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 15.4 | 113.4 | 114.2 | 20.4 |
| 4 | Mean | 21.8 | 278.6 | 256.9 | 46.0 |
| | N | 20 | 20 | 20 | 20 |
| | Std. Deviation | 33.4 | 208.2 | 217.4 | 38.9 |
| 5 | Mean | 13.1 | 476.0 | 463.0 | 82.9 |
| | N | 21 | 21 | 21 | 21 |
| | Std. Deviation | 12.0 | 236.0 | 237.3 | 42.5 |
| Total | Mean | 16.3 | 216.6 | 200.2 | 35.8 |
| | N | 98 | 98 | 98 | 98 |
| | Std. Deviation | 23.1 | 220.7 | 223.2 | 40.0 |

The Δ FPM means for AniBook ‘Gajapati Kulapati’ were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 94) = 28.78, p = 0.000$].

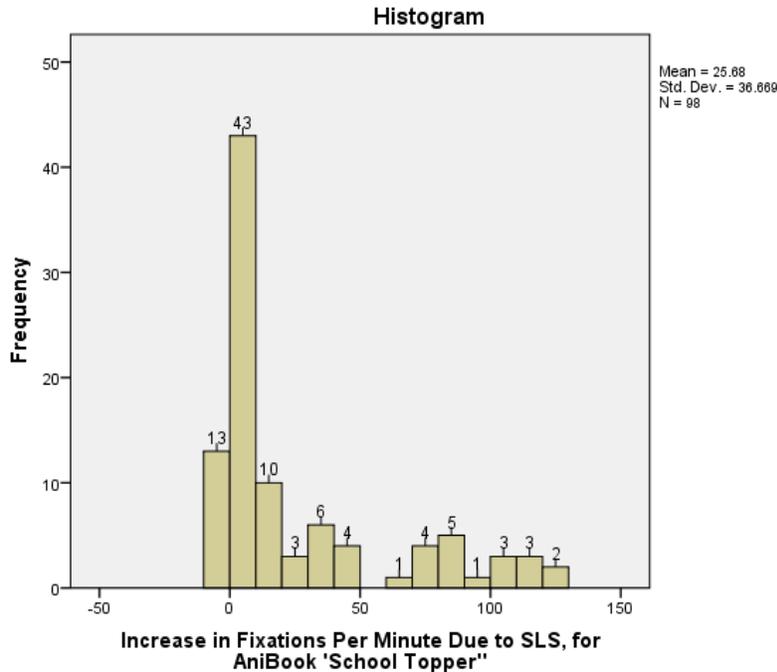


The percentage of students in Amthala, Grades 2-5 who engaged in at least some reading ($\Delta\text{FPM} > 0$), due to SLS, when watching 'Gajapati Kulapati' was 96.9 %.

Table 6: Amthala, AniBook: School Topper

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
|--------------|----------------|---------------|-----------------|----------------|--------------------|
| 2 | Mean | 8.1 | 31.5 | 23.4 | 4.8 |
| | N | 32 | 32 | 32 | 32 |
| | Std. Deviation | 16.6 | 27.6 | 29.0 | 6.0 |
| 3 | Mean | 12.9 | 82.1 | 69.2 | 14.2 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 17.4 | 126.9 | 126.0 | 25.9 |
| 4 | Mean | 14.0 | 147.5 | 133.5 | 27.4 |
| | N | 20 | 20 | 20 | 20 |
| | Std. Deviation | 22.5 | 164.7 | 169.4 | 34.8 |
| 5 | Mean | 8.6 | 346.6 | 338.0 | 69.5 |
| | N | 21 | 21 | 21 | 21 |
| | Std. Deviation | 8.7 | 194.4 | 196.8 | 40.4 |
| Total | Mean | 10.6 | 135.6 | 125.0 | 25.7 |
| | N | 98 | 98 | 98 | 98 |
| | Std. Deviation | 16.9 | 177.0 | 178.5 | 36.7 |

The ΔFPM means for AniBook 'School Topper' were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 94) = 24.73, p = 0.000$].

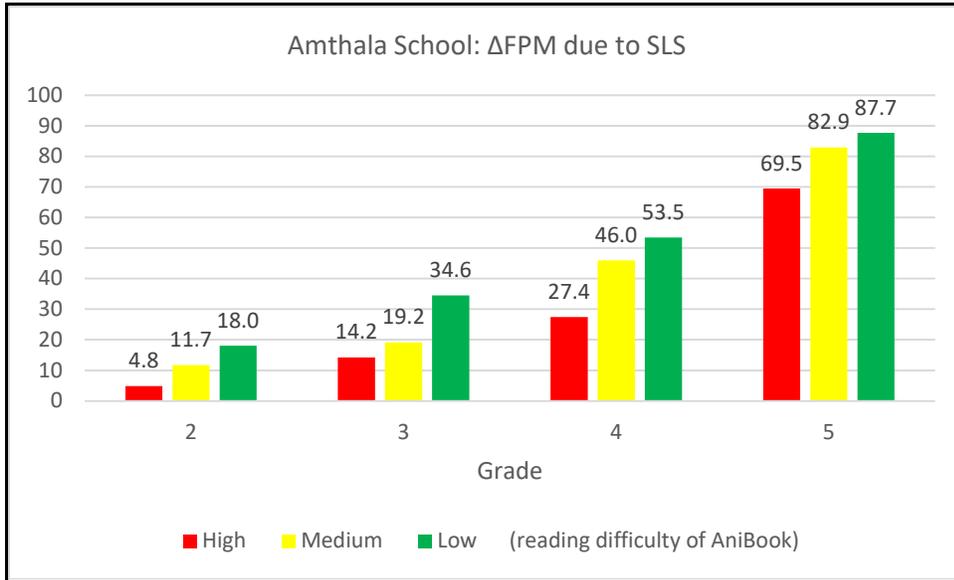


Percentage of students in Amthala, Grades 2-5 who engaged in at least some reading ($\Delta\text{FPM} > 0$), due to SLS, when watching 'School Topper': 84.7% ($\Delta\text{FPM} > 0$).

Figure 2 captures the findings of Tables 4-6. For all 3 AniBooks in Session 1, the two clear findings are:

- 1) For every AniBook, SLS increased the engagement with SLS, noticeably and substantially, and more so in a higher grade. The mean difference in ΔFPM , in the SLS vs. the no-SLS condition, for all grades, was statistically significant.
- 2) The lower the reading difficulty of the AniBook, the higher was the engagement with SLS, and this was found across Grades 2-5. 'What did you see?' (L) had many more fixations per SLS-minute than 'Gajapati Kulapati' (M) and that in turn had many more fixations per minute than 'School Topper' (H).

Figure 2: Amthala, Eye-fixations per SLS-minute, due to SLS



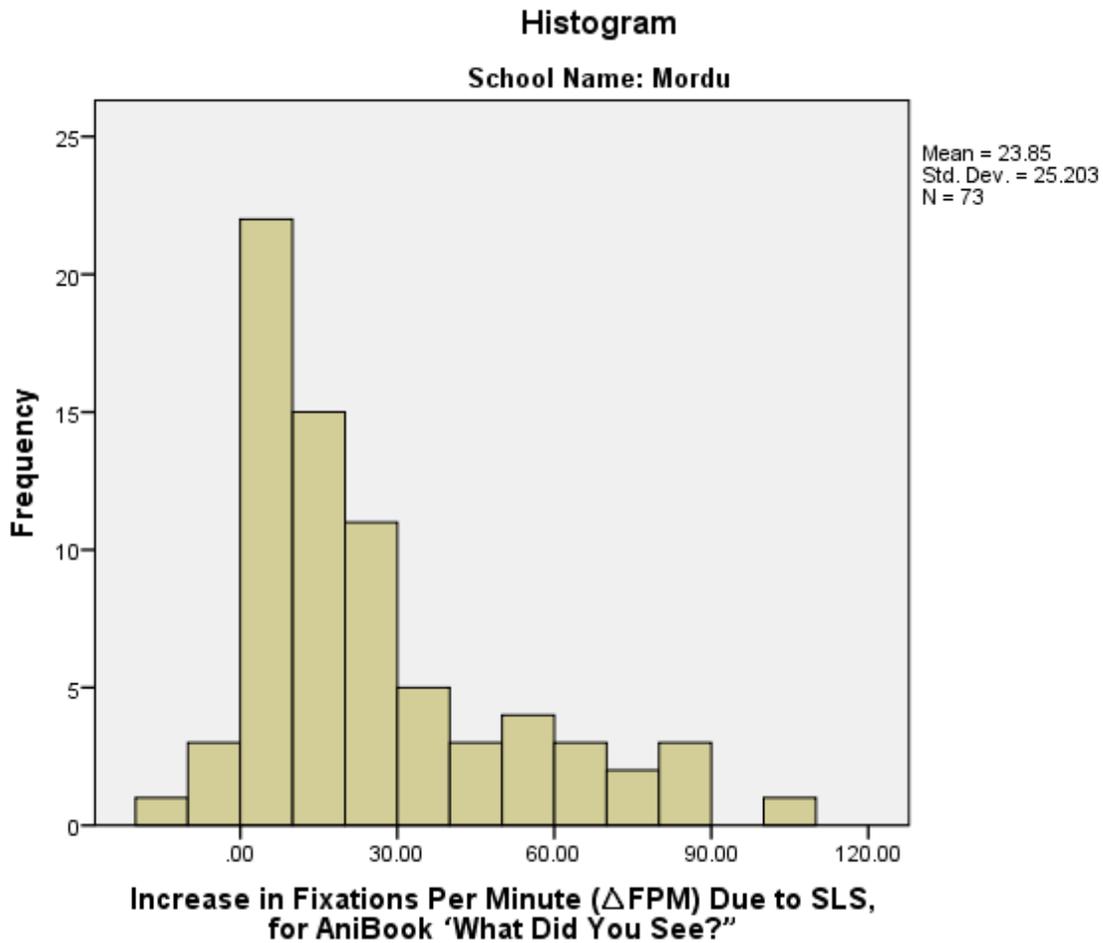
Mordu

In Mordu school also, the mean number of fixations due to SLS, generally increased with grade (Table 7). However, the linear relationship between $\Delta \# \text{Fix}$ and grade did not hold up entirely. As expected, $\Delta \# \text{Fix}$ was highest for Grade 5 (76.5), but then, the second highest was Grade 3 (34.1), then Grade 4 (28.0) and finally Grade 2 (16.5). The mean $\Delta \# \text{Fix}$ for all students was 44.9, nearly half of Amthala’s (83.6). This is not surprising, given Amthala children’s considerably better reading achievement in all grades.

Table 7: Mordu, AniBook: What did you see?

| Grade | | # Fix, No SLS | # Fix, With SLS | $\Delta \# \text{Fix}$ | ΔFPM |
|-------|----------------|---------------|-----------------|------------------------|---------------------|
| 2 | Mean | 7.3 | 23.8 | 16.5 | 8.8 |
| | N | 11 | 11 | 11 | 11 |
| | Std. Deviation | 9.8 | 19.5 | 25.7 | 13.6 |
| 3 | Mean | 3.1 | 37.2 | 34.1 | 18.1 |
| | N | 24 | 24 | 24 | 24 |
| | Std. Deviation | 2.9 | 37.8 | 36.8 | 19.6 |
| 4 | Mean | 5.2 | 33.2 | 28.0 | 14.9 |
| | N | 13 | 13 | 13 | 13 |
| | Std. Deviation | 3.7 | 30.0 | 30.5 | 16.2 |
| 5 | Mean | 6.2 | 82.6 | 76.5 | 40.6 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 6.2 | 54.5 | 55.0 | 29.3 |
| Total | Mean | 5.1 | 50.0 | 44.9 | 23.8 |
| | N | 73 | 73 | 73 | 73 |
| | Std. Deviation | 5.8 | 47.2 | 47.4 | 25.2 |

The Δ FPM means for AniBook ‘What Did You See?’ were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 69) = 7.62, p = 0.000$].



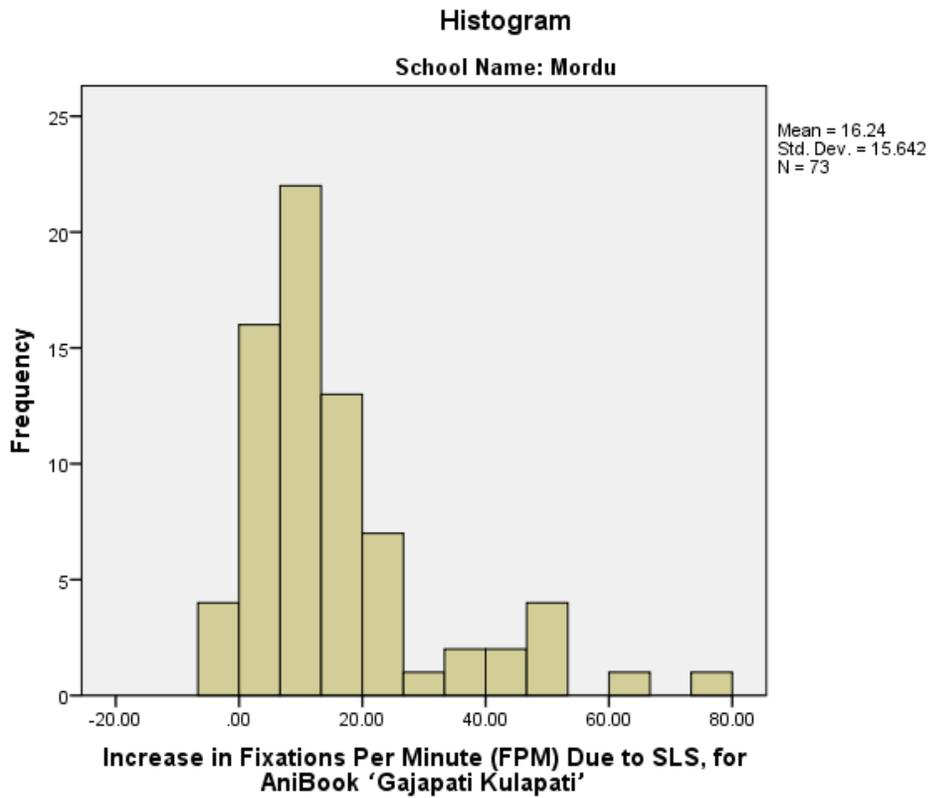
The percentage of students in Mordu, Grades 2-5 who engaged in at least some reading (Δ FPM > 0), due to SLS, when watching ‘What Did You See?’: 90.4%. In Amthala it was 93.9%. The mean Δ FPM across all grades in Mordu, for ‘What Did You See?’ was 23.8, as compared to 44.4, nearly double, in Amthala.

For AniBook ‘Gajapati Kulapati’ in Mordu, Δ FPM for Grades 2-4 was low, in the 10-12 range (Table 8). This is explained by the fact that we had found very little difference in reading ability across Grades 2-4 in Mordu. Grade 5’s reading was better and it is reflected in higher Δ FPM (25.6); Amthala’s was 82.9.

Table 8: Mordu, AniBook: Gajapati Kulapati

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
|-------|----------------|---------------|-----------------|----------------|--------------|
| 2 | Mean | 22.2 | 90.5 | 68.4 | 12.2 |
| | N | 11 | 11 | 11 | 11 |
| | Std. Deviation | 13.8 | 42.3 | 44.2 | 7.9 |
| 3 | Mean | 20.1 | 82.7 | 62.6 | 11.2 |
| | N | 24 | 24 | 24 | 24 |
| | Std. Deviation | 16.8 | 83.4 | 81.9 | 14.7 |
| 4 | Mean | 27.2 | 88.0 | 60.8 | 10.9 |
| | N | 13 | 13 | 13 | 13 |
| | Std. Deviation | 24.0 | 40.5 | 34.4 | 6.2 |
| 5 | Mean | 21.5 | 164.6 | 143.1 | 25.6 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 15.2 | 103.5 | 103.5 | 18.5 |
| Total | Mean | 22.2 | 112.9 | 90.7 | 16.2 |
| | N | 73 | 73 | 73 | 73 |
| | Std. Deviation | 17.2 | 88.0 | 87.4 | 15.6 |

The Δ FPM means for AniBook ‘Gajapati Kulapati’ were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 69) = 5.41, p = 0.002$].



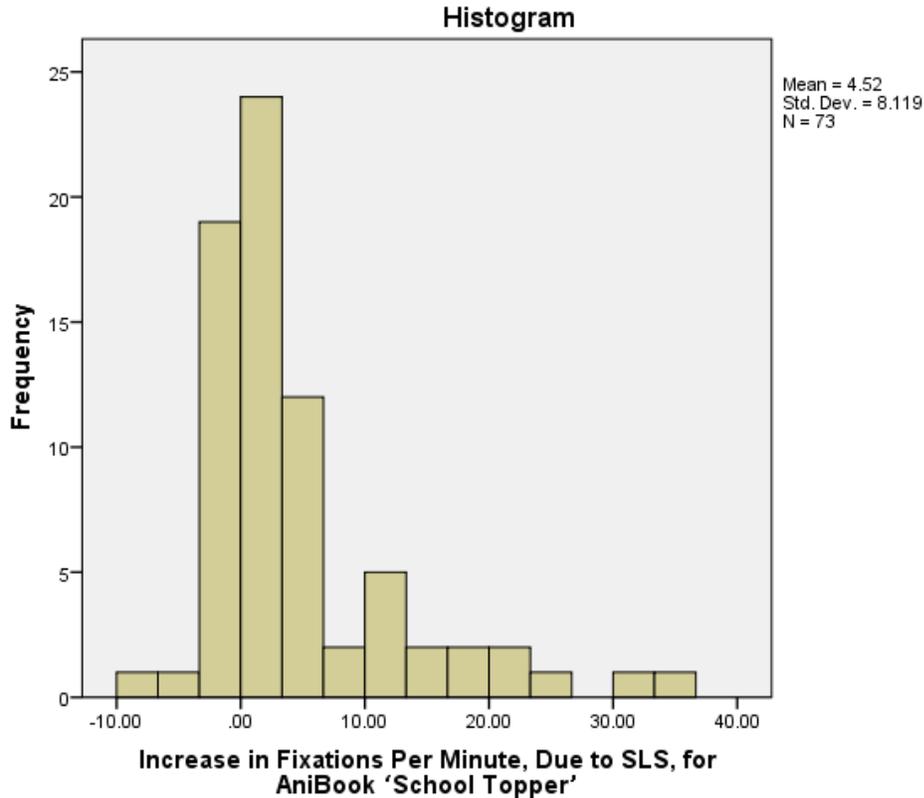
The percentage of students in Mordu, Grades 2-5 who engaged in at least some reading ($\Delta\text{FPM} > 0$), due to SLS, when watching ‘Gajapati Kulapati’: 94.5 %. In Amthala it was 96.9% for the same AniBook. The mean ΔFPM for all grades in Mordu, for ‘Gajapati Kulapat,’ was 16.2. In Amthala it was more than double that, 35.8.

‘School Topper’ was too difficult to read along with for Mordu children in all grades. The mean ΔFPM for this AniBook in Mordu, across grades, was only 4.5 (Table 9) as compared to 25.7 in Amthala. In Mordu too, children engaged more with SLS when the AniBook’s reading difficulty was lower.

Table 9: Mordu, AniBook: School Topper

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
|-------|----------------|---------------|-----------------|----------------|--------------------|
| 2 | Mean | 11.6 | 20.3 | 8.6 | 1.8 |
| | N | 11 | 11 | 11 | 11 |
| | Std. Deviation | 10.8 | 20.7 | 26.7 | 5.5 |
| 3 | Mean | 11.7 | 23.5 | 11.8 | 2.4 |
| | N | 24 | 24 | 24 | 24 |
| | Std. Deviation | 11.8 | 28.4 | 28.6 | 5.9 |
| 4 | Mean | 14.6 | 18.0 | 3.4 | 0.7 |
| | N | 13 | 13 | 13 | 13 |
| | Std. Deviation | 15.0 | 22.0 | 21.6 | 4.4 |
| 5 | Mean | 8.7 | 56.0 | 47.4 | 9.7 |
| | N | 25 | 25 | 25 | 25 |
| | Std. Deviation | 8.1 | 50.0 | 48.2 | 9.9 |
| Total | Mean | 11.2 | 33.2 | 22.0 | 4.5 |
| | N | 73 | 73 | 73 | 73 |
| | Std. Deviation | 11.1 | 38.9 | 39.5 | 8.1 |

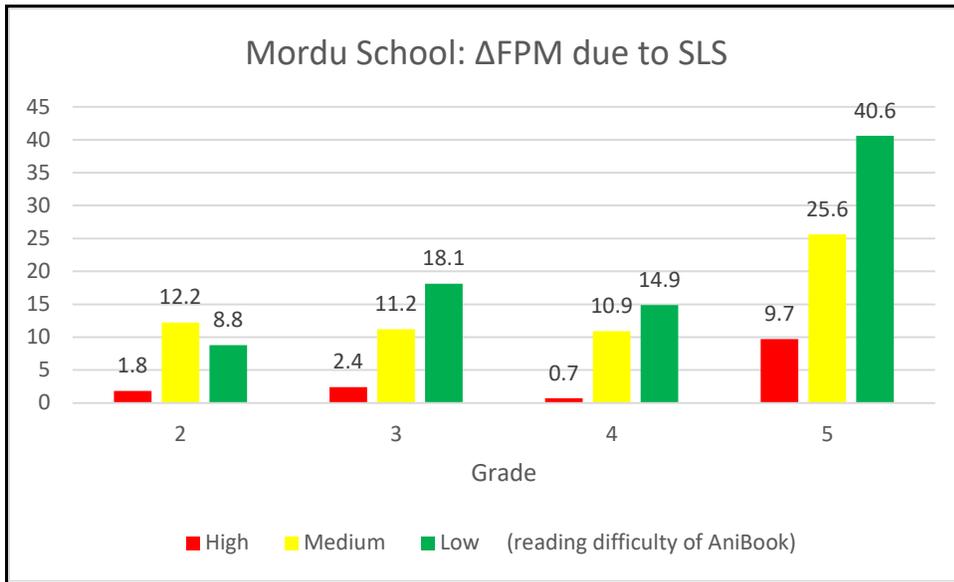
The ΔFPM means for AniBook ‘School Topper’ were significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 69) = 6.60, p = 0.001$].



The percentage of students in Mordu, Grades 2-5 who engaged in at least some reading ($\Delta\text{FPM} > 0$), due to SLS, when watching 'School Topper': 68.5% ($\Delta\text{FPM} > 0$), as compared to 84.7% in Amthala.

The findings of Tables 7-9 are represented in Figure 3. Except in Grade 2, ΔFPM was higher for AniBooks that were easier to read along with. Although ΔFPM tended to be higher with higher grades, the pattern was not as clear as that in Amthala. For instance, ΔFPM was similar for Grades 2-4 but much higher for Grade 5. For any grade or AniBook, ΔFPM in Mordu was much lower than Amthala's.

Figure 3: Mordu, Eye-fixations per SLS-minute, due to SLS



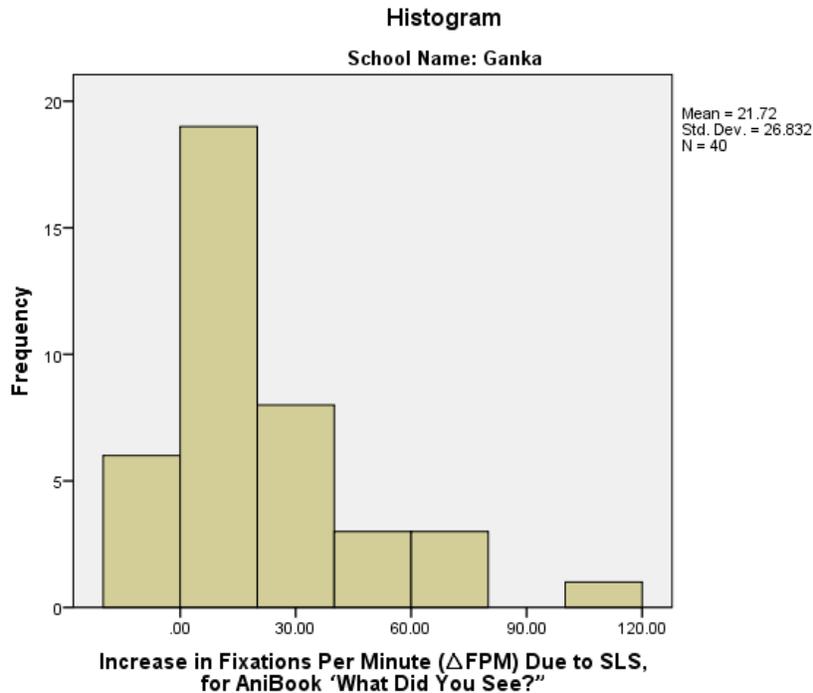
Ganka

For ‘What did you see?’ in Ganka, as expected, ΔFPM increased with the grade, for Grades 2-4 but Grades 4 & 5 were comparable at 32.4 and 30.3 respectively (Table 10). Ganka’s reading achievement in all grades was comparable to Amthala’s. Although Ganka children engaged quite a bit with SLS, Amthala’s was considerably more.

Table 10: Ganka, AniBook: What did you see?

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
|-------|----------------|---------------|-----------------|---------|------|
| 2 | Mean | 6.9 | 20.3 | 13.4 | 7.1 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 9.0 | 17.8 | 19.4 | 10.3 |
| 3 | Mean | 4.9 | 37.1 | 32.2 | 17.1 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 6.9 | 36.4 | 39.9 | 21.2 |
| 4 | Mean | 6.0 | 66.9 | 60.9 | 32.4 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 7.6 | 69.6 | 68.9 | 36.6 |
| 5 | Mean | 7.4 | 64.4 | 57.0 | 30.3 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 14.7 | 45.6 | 51.8 | 27.5 |
| Total | Mean | 6.3 | 47.2 | 40.9 | 21.7 |
| | N | 40 | 40 | 40 | 40 |
| | Std. Deviation | 9.7 | 48.6 | 50.5 | 26.8 |

The ΔFPM means for AniBook ‘What Did You See?’ were not significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 36) = 2.12, p = 0.115$].



The percentage of students in Ganka, Grades 2-5 who engaged in at least some reading (Δ FPM > 0), due to SLS, when watching ‘What Did You See?’: 85.0%. This is considerably lower than than Amthala’s 93.9% for the same AniBook.

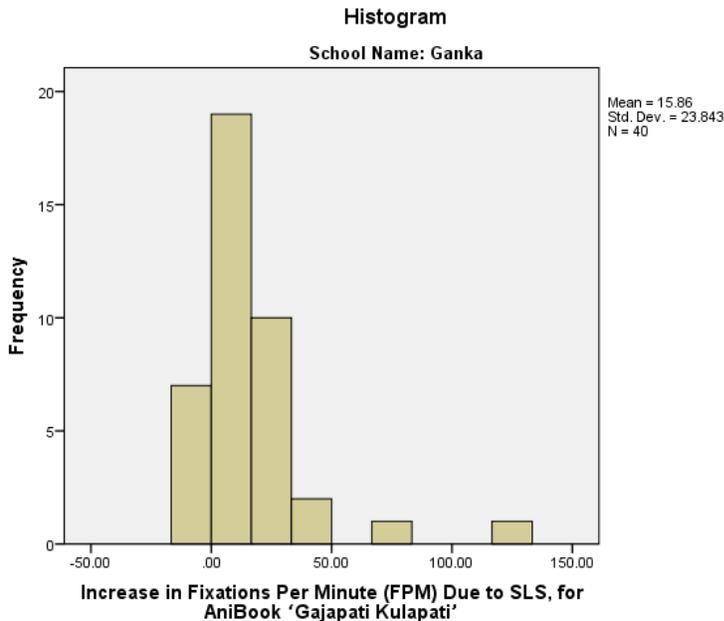
For ‘Gajapati Kulapati’ too, Δ FPM increased with grade, for Grades 2-4, however, it dipped slightly for Grade 5 (Table 11). The mean Δ FPM across grades was 15.9, comparable to Mordu’s 16.2 but much lower than Amthala’s 35.8.

Table 11: Ganka, AniBook: Gajapati Kulapati

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
|--------------|----------------|---------------|-----------------|----------------|--------------|
| 2 | Mean | 21.9 | 43.8 | 21.9 | 3.9 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 30.0 | 40.1 | 50.7 | 9.1 |
| 3 | Mean | 26.4 | 98.6 | 72.2 | 12.9 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 27.5 | 91.1 | 79.2 | 14.2 |
| 4 | Mean | 33.5 | 171.5 | 138.0 | 24.7 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 41.4 | 201.4 | 218.5 | 39.1 |
| 5 | Mean | 25.0 | 147.3 | 122.3 | 21.9 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 41.0 | 100.1 | 105.3 | 18.9 |
| Total | Mean | 26.7 | 115.3 | 88.6 | 15.9 |
| | N | 40 | 40 | 40 | 40 |
| | Std. Deviation | 34.4 | 128.1 | 133.2 | 23.8 |

The Δ FPM means for AniBook ‘Gajapati Kulapati’ were not significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 36) = 1.63, p = 0.199$].

The percentage of students in Ganka, Grades 2-5 who engaged in at least some reading (Δ FPM > 0), due to SLS, when watching ‘Gajapati Kulapati’: 82.5%. This is much lower than Mordu’s 94.5 % and Amthala’s 96.9%



Mean Δ FPM in Ganka for ‘School Topper’ was 9.5 (Table 12) and not that different from Mordu’s 4.5, but much lower than Amthala’s 25.7.

Table 12: Ganka, AniBook: School Topper

| Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
|-------|----------------|---------------|-----------------|----------------|--------------|
| 2 | Mean | 7.9 | 24.0 | 16.1 | 3.3 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 11.0 | 47.0 | 48.4 | 9.9 |
| 3 | Mean | 14.7 | 44.1 | 29.4 | 6.0 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 14.8 | 50.9 | 40.7 | 8.4 |
| 4 | Mean | 44.2 | 96.7 | 52.5 | 10.8 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 75.2 | 188.4 | 220.1 | 45.2 |
| 5 | Mean | 12.5 | 100.1 | 87.6 | 18.0 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 20.5 | 121.9 | 126.2 | 25.9 |
| Total | Mean | 19.8 | 66.2 | 46.4 | 9.5 |
| | N | 40 | 40 | 40 | 40 |
| | Std. Deviation | 41.1 | 117.6 | 128.6 | 26.4 |

The Δ FPM means for AniBook ‘School Topper’ were not significantly different at the $p < 0.05$ level for Grades 2-5 [$F(3, 36) = 0.57, p = 0.636$].

Percentage of students in Ganka, Grades 2-5 who engaged in at least some reading (Δ FPM > 0), due to SLS, when watching ‘School Topper’: 77.5% (Δ FPM > 0). In Mordu it was 68.5% and in Anthala, 84.7%.

The findings of Tables 10-12 are represented in Figure 4. Δ FPM in Ganka was higher for AniBooks that were easier to read along with. Δ FPM was higher with higher grades.

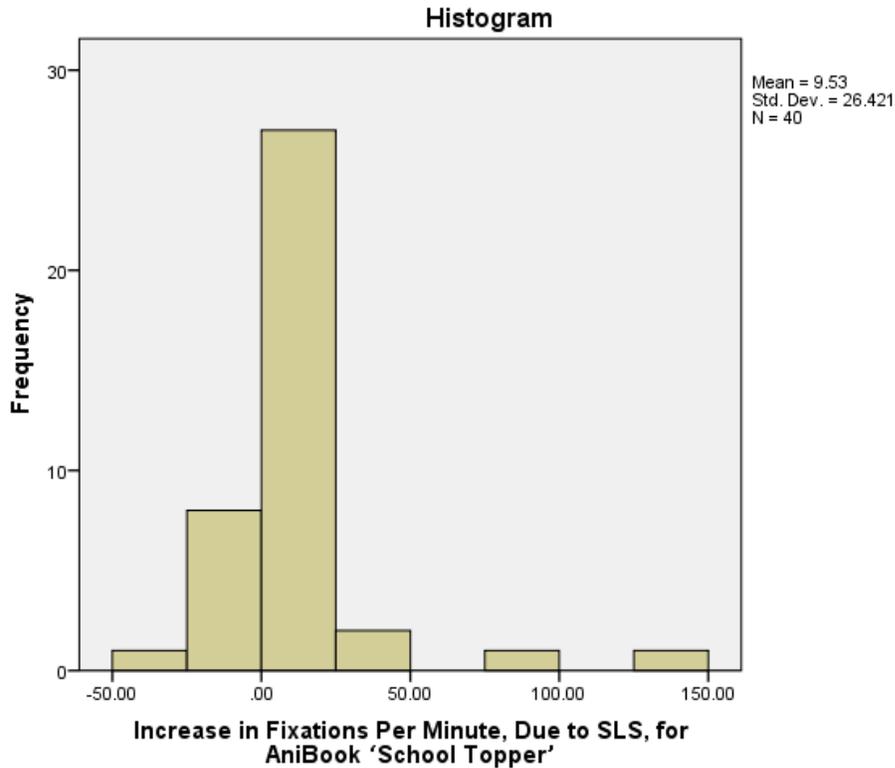
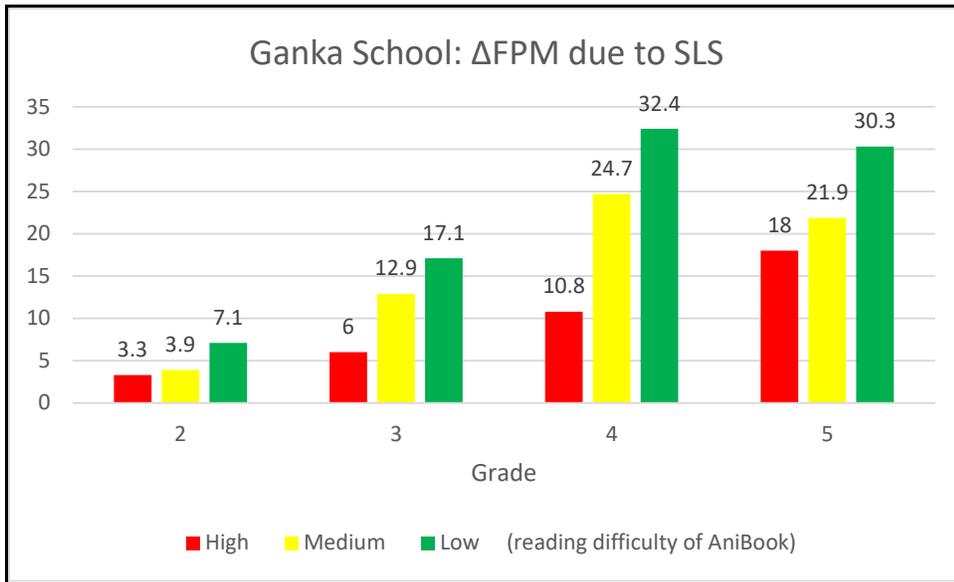


Figure 4: Ganka, Eye-fixations per SLS-minute, due to SLS



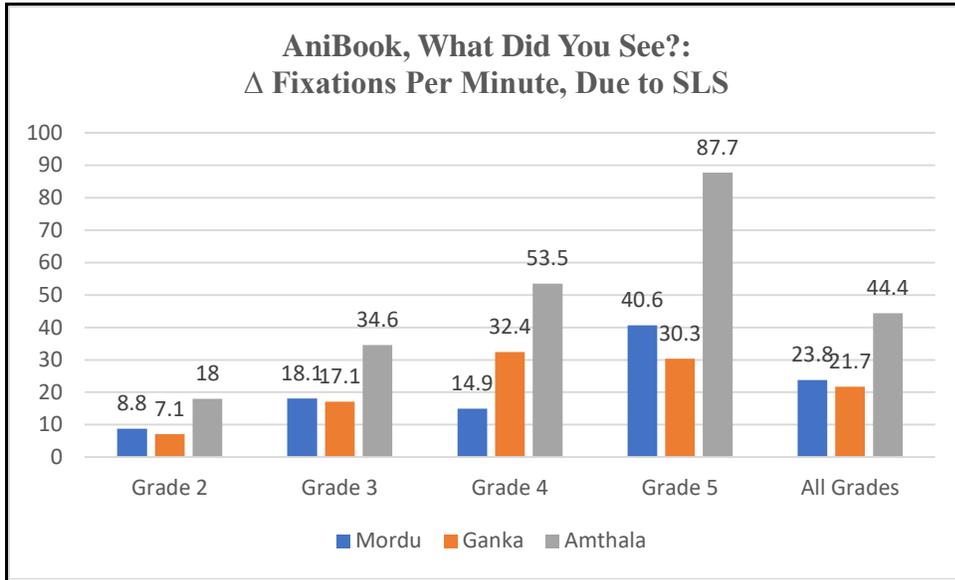
Schools compared

The change in fixations per minute due to SLS (Δ FPM) for ‘What Did You See?’ is presented in Figure 5, for all three schools, by grade. Overall, SLS caused around double the fixations per minute on the subtitle band in Amthala (44.4) than Mordu (23.8) and Ganka (21.7). This may be attributed to the high level of e-Library intervention in Amthala where children not only got more familiar with the AniBooks, they also got better at reading along due to practice.

As we saw earlier, Amthala’s reading performance in Grades 2 and 3 was slightly poorer than Ganka’s in the same Grades, but, Amthala surpassed Ganka in Grades 4 and 5. Even though Amthala and Ganka were comparable in reading, overall, Amthala children engaged with SLS substantially more. Surprisingly, Mordu and Ganka children’s engagement with SLS, as measured by Δ FPM, was similar, despite the fact that Mordu’s reading achievement was much lower than Ganka’s. This implies that while reading levels help children read along with AniBooks, children also become better at reading along, and do more of it, simply because of exposure and practice, which children got a lot more in Amthala than in Mordu or Ganka.

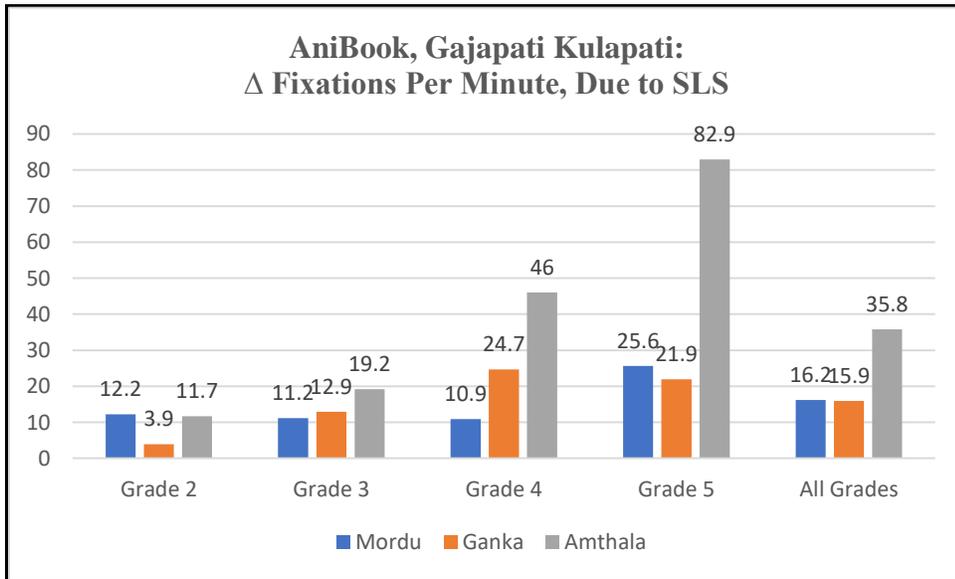
In all three schools, and in all grades, Δ FPM was inversely correlated to the reading difficulty level of the AniBook. We found ‘What Did You See?’ and ‘Gajapati Kulapati’ to be at the appropriate reading level for the children in all three schools. ‘School Topper’ was too difficult for most children, except, in Amthala’s Grades 4 and 5.

Figure 5: All schools, Δ FPM for AniBook ‘What Did You See?’ due to SLS



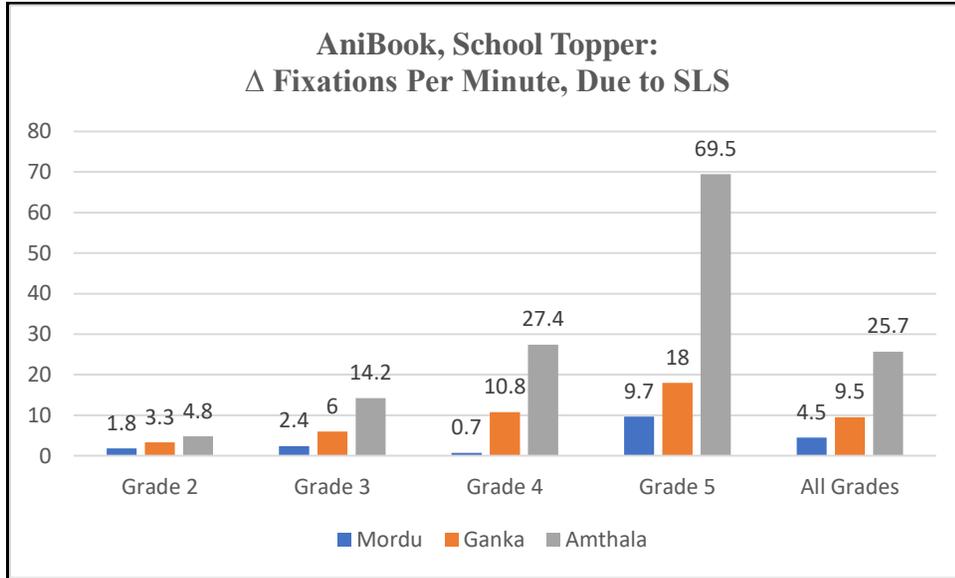
For ‘Gajapati Kulapati’, children in Amthala engaged far more with SLS, in Grades 3-5 than Mordu and Ganka, and this engagement only increased with every grade (Figure 6).

Figures 6: All schools, Δ FPM for AniBook ‘Gajapati Kulapati’ due to SLS



‘School Topper’ caused reading engagement meaningfully, only in Amthala and to some extent Grades 4-5 in Ganka and Grade 5 in Mordu (Figure 7). One possibility, which we didn’t explore, is to allow AniBook playback at slower speeds, in the viewer’s control.

Figures 7: All schools, ΔFPM for AniBook ‘School Topper’ due to SLS



Session 2: Eye-tracking of AniBooks with no narration

Amthala

The fixations per SLS-minute went up when there was no narration but only SLS and background music, from 18 to 34.3, an increase of 16.3 FPM for Grade 2 and from 34.6 to 46.4 for Grade 3, an increase of 11.8 FPM (Table 13). Overall, not having the narration increased FPM from 25.3 to 39.9, a gain of 14.6 FPM. One could argue that the absence of narration increased reading engagement in Amthala by 57.7%, for ‘What Did You See?’

Table 13: Amthala, AniBook: What Did You See?

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|-------|----------------|----------------|----------|--------------|----------|------------------------------|
| Grade | | Δ # Fix | ΔFPM (A) | Δ # Fix | ΔFPM (B) | ΔFPM (B)- ΔFPM (A) |
| 2 | Mean | 33.9 | 18.0 | 64.5 | 34.3 | 16.3 |
| | N | 32 | 32 | 24 | 24 | |
| | Std. Deviation | 35.3 | 18.7 | 54.3 | 28.9 | |
| 3 | Mean | 65.0 | 34.6 | 87.3 | 46.4 | 11.8 |
| | N | 25 | 25 | 21 | 21 | |
| | Std. Deviation | 59.3 | 31.5 | 60.0 | 31.9 | |
| Total | Mean | | 25.3 | | 39.9 | 14.6 |
| | N | | 57 | | 45 | |
| | Std. Deviation | | 26.3 | | 30.6 | |

For ‘Gajapati Kulapati’ too the fixations went up with no narration, for both Grades 2 and 3 (Table 14). For Grade 2, Δ FPM increased from 11.7 to 24.3 when the narration was dropped, i.e., 12.6 additional FPMs. The corresponding additional FPM for Grade 3, due to no narration, was 26.2, and overall for Grades 2-3, it was 19.1. The absence of narration increased fixations on the SLS band by a remarkable 127%.

Table 14: Amthala, AniBook: Gajapati, Kulapati

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|--------------|----------------|----------------|------------------|----------------|------------------|------------------------------------|
| Grade | | Δ # Fix | Δ FPM (A) | Δ # Fix | Δ FPM (B) | Δ FPM (B)- Δ FPM (A) |
| 2 | Mean | 65.3 | 11.7 | 135.7 | 24.3 | 12.6 |
| | N | 32 | 32 | 24 | 24 | |
| | Std. Deviation | 76.5 | 13.7 | 161.3 | 28.9 | |
| 3 | Mean | 107.0 | 19.2 | 253.4 | 45.4 | 26.2 |
| | N | 25 | 25 | 21 | 21 | |
| | Std. Deviation | 114.2 | 20.5 | 214.6 | 38.4 | |
| Total | Mean | 83.6 | 15.0 | 190.6 | 34.1 | 19.1 |
| | N | 57 | 57 | 45 | 45 | |
| | Std. Deviation | 96.3 | 17.2 | 195.1 | 34.9 | |

In the case of School Topper that has by far the highest level of reading difficulty, no narration nevertheless caused more fixations in the SLS band, but the shift was relatively smaller than for the low and medium level AniBooks (Table 15). Overall there were an additional 9.9 FPM in ‘School Topper’ as compared to 14.6 for ‘What Did You See?’ and 19.1 for ‘Gajapati Kulapati’. Still, even for ‘School Topper’ the non-narrated version of the AniBook got an additional 111.2% FPM.

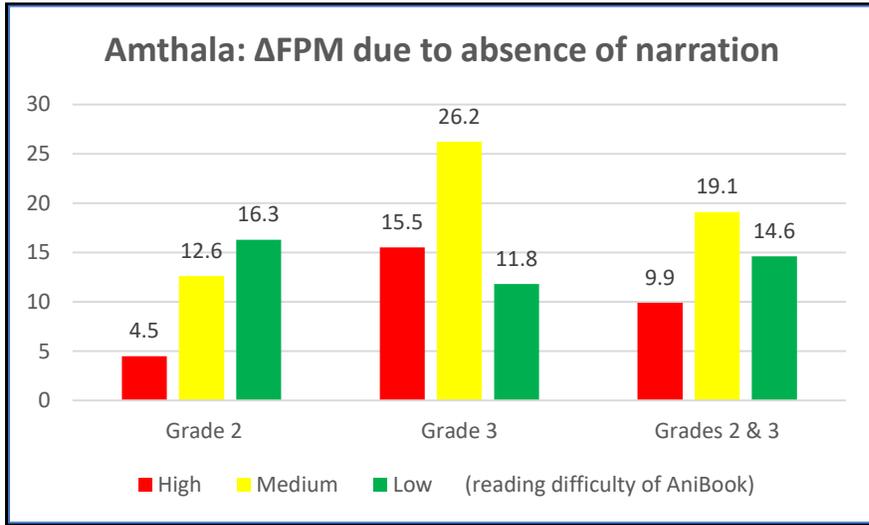
Table 15: Amthala, AniBook: School Topper

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|--------------|----------------|----------------|------------------|----------------|------------------|------------------------------------|
| Grade | | Δ # Fix | Δ FPM (A) | Δ # Fix | Δ FPM (B) | Δ FPM (B)- Δ FPM (A) |
| 2 | Mean | 23.4 | 4.8 | 45.2 | 9.3 | 4.5 |
| | N | 32 | 32 | 24 | 24 | |
| | Std. Deviation | 29.0 | 6.0 | 48.1 | 9.9 | |
| 3 | Mean | 69.2 | 14.2 | 144.5 | 29.7 | 15.5 |
| | N | 25 | 25 | 21 | 21 | |
| | Std. Deviation | 126.0 | 25.9 | 164.3 | 33.8 | |
| Total | Mean | 43.5 | 8.9 | 91.5 | 18.8 | 9.9 |
| | N | 57 | 57 | 45 | 45 | |
| | Std. Deviation | 88.3 | 18.1 | 126.5 | 26.0 | |

Figure 8 captures the impact of no narration on increased fixations per minute in the SLS band. The no narration approach works best in Grade 2 with an AniBook that requires a low level of reading ability. The medium reading level AniBook, however, worked best in the no narration scenario, with Grade 3 and also worked well with Grade 2. The high reading level AniBook also drew more fixations without the narration, but, worked less effectively.

For schools like Amthala, the no narration approach can be an effective complementary strategy for increasing reading engagement with AniBooks. While we haven't explored the benefits of group, class or generally collective reading along with AniBooks, based on these individual eye-tracking findings, we feel that several game-like activities could be built around no-narration AniBooks, after familiarity with regular AniBooks (with narration) is established.

Figure 8: Increase in fixations per minute



Mordu

The no narration approach did not work in Mordu which had, both, a low level of reading achievement and much less familiarity with the AniBooks (Tables 16-18). With or without narration, the reading engagement with SLS was very comparable, with the no-narration condition causing a small loss in fixations, for ‘What Did You See?’ and ‘Gajapati Kulapati’ and a small gain for ‘School Topper.’

Table 16: Mordu, AniBook: What Did You See?

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|--------------|----------------|----------------|----------|--------------|----------|------------------------------|
| Grade | | Δ # Fix | ΔFPM (A) | Δ # Fix | ΔFPM (B) | ΔFPM (B)- ΔFPM (A) |
| 2 | Mean | 16.5 | 8.8 | 17.8 | 9.4 | 0.7 |
| | N | 11 | 11 | 9 | 9 | |
| | Std. Deviation | 25.7 | 13.6 | 17.1 | 9.1 | |
| 3 | Mean | 34.1 | 18.1 | 28.6 | 15.2 | -2.9 |
| | N | 24 | 24 | 18 | 18 | |
| | Std. Deviation | 36.8 | 19.6 | 26.6 | 14.1 | |
| Total | Mean | 28.6 | 15.2 | 25.0 | 13.3 | -1.9 |
| | N | 35 | 35 | 27 | 27 | |
| | Std. Deviation | 34.3 | 18.2 | 24.1 | 12.8 | |

Table 17: Mordu, AniBook: Gajapati, Kulapati

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|-------|----------------|----------------|------------------|----------------|------------------|------------------------------------|
| Grade | | Δ # Fix | Δ FPM (A) | Δ # Fix | Δ FPM (B) | Δ FPM (B)- Δ FPM (A) |
| 2 | Mean | 68.4 | 12.2 | 24.1 | 4.3 | -7.9 |
| | N | 11 | 11 | 9 | 9 | |
| | Std. Deviation | 44.2 | 7.9 | 33.3 | 6.0 | |
| 3 | Mean | 62.6 | 11.2 | 50.1 | 9.0 | -2.2 |
| | N | 24 | 24 | 18 | 18 | |
| | Std. Deviation | 81.9 | 14.7 | 54.8 | 9.8 | |
| Total | Mean | 64.4 | 11.5 | 41.4 | 7.4 | -4.1 |
| | N | 35 | 35 | 27 | 27 | |
| | Std. Deviation | 71.6 | 12.8 | 49.6 | 8.9 | |

Table 18: Mordu, AniBook: School Topper

| | | With Narration | | No Narration | | Gain from No Narration (FPM) |
|-------|----------------|----------------|------------------|----------------|------------------|------------------------------------|
| Grade | | Δ # Fix | Δ FPM (A) | Δ # Fix | Δ FPM (B) | Δ FPM (B)- Δ FPM (A) |
| 2 | Mean | 8.6 | 1.8 | 5.9 | 1.2 | -0.6 |
| | N | 11 | 11 | 9 | 9 | |
| | Std. Deviation | 26.7 | 5.5 | 21.2 | 4.4 | |
| 3 | Mean | 11.8 | 2.4 | 16.9 | 3.5 | 1.1 |
| | N | 24 | 24 | 18 | 18 | |
| | Std. Deviation | 28.6 | 5.9 | 26.7 | 5.5 | |
| Total | Mean | 10.8 | 2.2 | 13.3 | 2.7 | 0.5 |
| | N | 35 | 35 | 27 | 27 | |
| | Std. Deviation | 27.7 | 5.7 | 25.1 | 5.2 | |

Session 3: Eye-tracking of unfamiliar AniBooks

The number of fixations per SLS-minute for all 4 unfamiliar AniBooks – two at low level of reading difficulty, one at medium and one at high – is presented in Table 19.

Table 19: Amthala, unfamiliar AniBooks, Grade 4

| AniBook: The Elephant King (L) | | | | | |
|---------------------------------------|----------------|----------------------|------------------------|----------------------------------|-------------------------------|
| Amthala Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
| 4 | Mean | 5.8 | 34.5 | 28.7 | 38.4 |
| | N | 15 | 15 | 15 | 15 |
| | Std. Deviation | 10.0 | 29.5 | 31.8 | 42.6 |

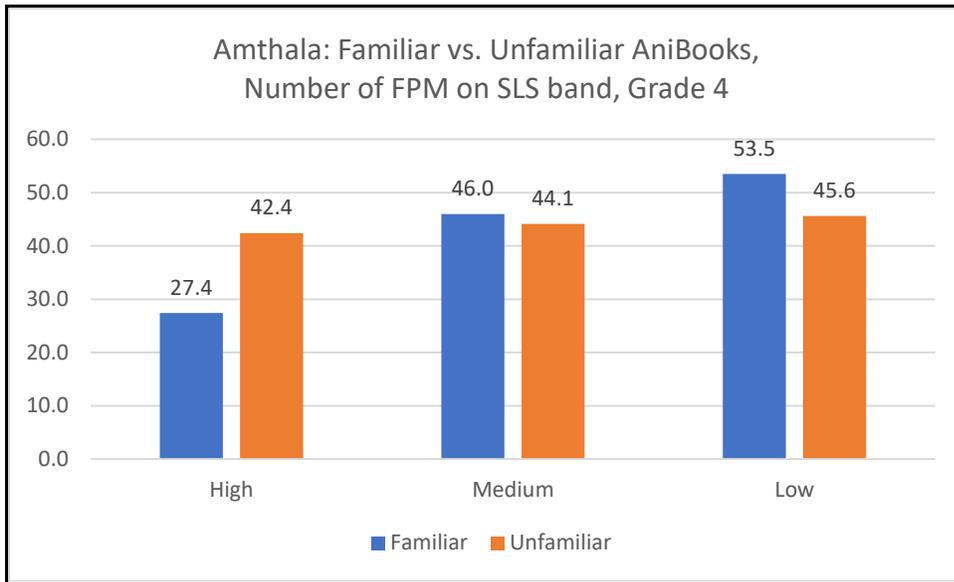
| AniBook: The Moon and the Stars (L) | | | | | |
|--|----------------|----------------------|------------------------|----------------------------------|-------------------------------|
| Amthala Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
| 4 | Mean | 2.7 | 51.5 | 48.8 | 52.9 |
| | N | 15 | 15 | 15 | 15 |
| | Std. Deviation | 5.0 | 39.7 | 41.4 | 44.8 |

| AniBook: Goodnight Tinku (M) | | | | | |
|-------------------------------------|----------------|----------------------|------------------------|----------------------------------|-------------------------------|
| Amthala Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
| 4 | Mean | 23.5 | 287.7 | 264.2 | 44.1 |
| | N | 15 | 15 | 15 | 15 |
| | Std. Deviation | 30.2 | 239.9 | 245.6 | 41.0 |

| AniBook: No Smiles Today (H) | | | | | |
|-------------------------------------|----------------|----------------------|------------------------|----------------------------------|-------------------------------|
| Amthala Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | ΔFPM |
| 4 | Mean | 13.1 | 159.4 | 146.3 | 42.4 |
| | N | 15 | 15 | 15 | 15 |
| | Std. Deviation | 19.5 | 137.7 | 141.4 | 41.0 |

We compared Δ FPM in familiar and unfamiliar AniBooks (Figure 9). Since there were two unfamiliar AniBooks at low level of reading difficulty, we averaged their Δ FPM. It is clear that in Amthala, unfamiliar AniBooks invited comparable SLS engagement (or reading) as familiar ones, at low and medium level of reading difficulty. At high level of reading difficulty, children engaged more with SLS when the AniBook was unfamiliar.

Figure 9: Amthala, fixations per SLS-minute for familiar and unfamiliar AniBooks



Mordu

In Mordu, the familiar AniBooks caused more reading engagement for medium and high reading difficulty (Table 20, Figure 10). The unfamiliar AniBook did better at low level of difficulty.

Table 20: Mordu, unfamiliar AniBooks, shown only to Grade 4

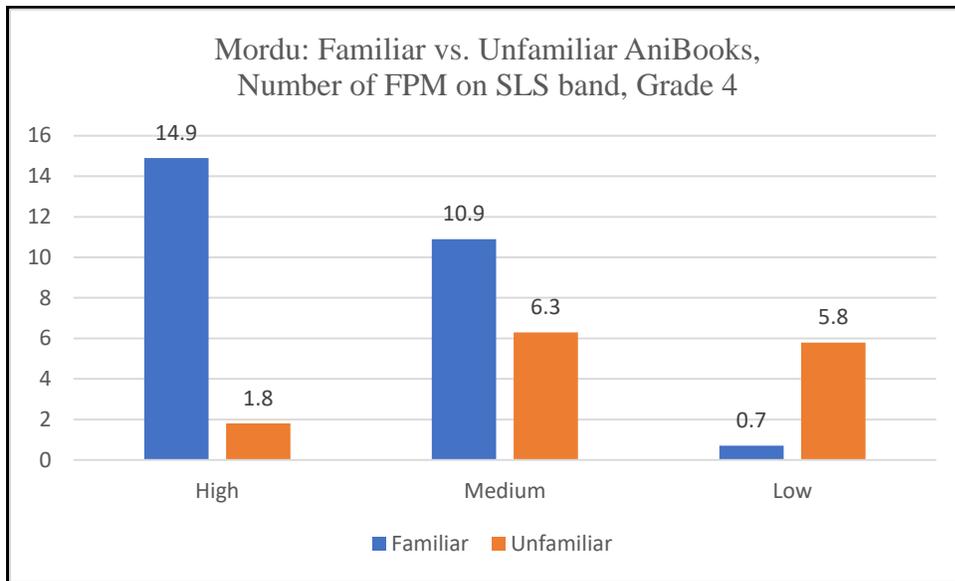
| AniBook: The Elephant King (L) | | | | | |
|--------------------------------|----------------|---------------|-----------------|----------------|--------------|
| Mordu Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
| 4 | Mean | 1.0 | 5.8 | 4.8 | 6.4 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 1.2 | 8.0 | 8.1 | 10.9 |

| AniBook: The Moon and the Stars (L) | | | | | |
|-------------------------------------|----------------|---------------|-----------------|----------------|--------------|
| Mordu Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
| 4 | Mean | 1.7 | 6.5 | 4.8 | 5.2 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 1.3 | 6.2 | 5.5 | 6.0 |

| AniBook: Goodnight Tinku (M) | | | | | |
|------------------------------|----------------|---------------|-----------------|----------------|--------------|
| Mordu Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
| 4 | Mean | 13.0 | 50.5 | 37.5 | 6.3 |
| | N | 10 | 10 | 10 | 10 |
| | Std. Deviation | 9.8 | 47.3 | 43.4 | 7.2 |

| AniBook: No Smiles Today (H) | | | | | |
|------------------------------|----------------|---------------|-----------------|----------------|--------------|
| Mordu Grade | | # Fix, No SLS | # Fix, With SLS | Δ # Fix | Δ FPM |
| 4 | Mean | 6.4 | 12.5 | 6.1 | 1.8 |
| | N | 10 | 10.0 | 10 | 10 |
| | Std. Deviation | 4.1 | 12.1 | 11.3 | 3.3 |

Figure 10: Mordu, fixations per SLS-minute for familiar and unfamiliar AniBooks



Based on findings from Amthala and Mordu (unfamiliar AniBooks were not shown in Ganka), familiar AniBooks do seem to invite slightly more reading than unfamiliar AniBooks, but the difference is marginal.

Reading ability's correlation with fixations on SLS

What is the correlation of reading ability and fixations? Intuitively, better reading ability is expected to result in a greater number of fixations per minute on the SLS band. To explore that question we calculated the following:

Fixation:

- a) $\Delta\text{FPM_FAM} = \Delta\text{FPM_Familiar AniBooks} = \text{Average of the increase in FPM due to SLS, of all 3 AniBooks in Session 1} = \text{Average} (\Delta\text{FPM_What Did You See?} + \Delta\text{FPM_Gajapati Kulapati} + \Delta\text{FPM_School Topper})$
- b) $\Delta\text{FPM_NN} = \Delta\text{FPM_Familiar AniBooks, No Narration} = \text{Average of the increase in FPM due to SLS but no narration, of all 3 AniBooks in Session 2.}$
- c) $\Delta\text{FPM_UNFAM} = \Delta\text{FPM_Unfamiliar AniBooks} = \text{Average of the increase in FPM due to SLS, of all 4 AniBooks in Session 3} = \text{Average} (\Delta\text{FPM_The Elephant King} + \Delta\text{FPM_The Moon and the Stars} + \Delta\text{FPM_Good Night Tinku} + \Delta\text{FPM_No Smiles Today})$

Reading ability:

- d) $\text{RS_1_60} = \text{Reading_Score_1_60} = \text{Syllables/letters read correctly in 60 seconds (max 52)}$
- e) $\text{RS_2_60} = \text{Reading_Score_2_60} = \text{Simple 2-syllable words read correctly in 60 seconds (max 50)}$
- f) $\text{RS_3_60} = \text{Reading_Score_3_60} = \text{Nonsense 2-syllable words read correctly in 60 seconds (max 50)}$
- g) $\text{RS_4_60} = \text{Reading_Score_4_60} = \text{Four simple sentences read correctly in 60 seconds; total 19 words (max 19)}$
- h) $\text{RS_5_60} = \text{Reading_Score_5_60} = \text{Para/Story read correctly in 60 seconds; total 65 words (max 65)}$
- i) $\text{RS_Total_60} = \text{Reading_Score_Total_60} = \text{RS_1_60} + \text{RS_2_60} + \text{RS_3_60} + \text{RS_4_60} + \text{RS_5_60 (max 236)}$

The correlations of the fixation and reading ability variables a-i above, are presented in Tables 21a, Tables 21b and Tables 21c, for Amthala, Mordu, and Ganka, respectively. The noteworthy statistically significant correlations are presented below ($p < 0.05$):

Amthala

- 1) $\Delta\text{FPM_FAM}$ & $\Delta\text{FPM_NN}$: Students drawn to reading along with SLS are also more likely to be reading along with SLS when the narration is absent (0.715; $p = .000$).
- 2) $\Delta\text{FPM_FAM}$ & $\Delta\text{FPM_UNFAM}$: Those who read along with SLS when watching familiar stories are more likely to also read along with unfamiliar stories (0.653; $p = .008$).
- 3) $\Delta\text{FPM_FAM}$ is quite strongly correlated to all reading scores, especially the para/story reading score RS_5_60 (0.644; $p = .000$).
- 4) $\Delta\text{FPM_NN}$ is also strongly correlated to all reading scores, especially the para/story reading score RS_5_60 (0.537; $p = .000$) and RS_Total_60 (0.580; $p = .000$).
- 5) Interestingly, $\Delta\text{FPM_UNFAM}$ did not have a statistically significant correlation with any of the reading scores. The sample size was small because unfamiliar stories were only shown to 15 Grade 4 children.

Mordu:

- 1) $\Delta\text{FPM_FAM}$ & $\Delta\text{FPM_NN}$: Students drawn to reading along with SLS are also more likely to be reading along with SLS when the narration is absent (0.592; $p=.001$). The correlation for Mordu is weaker than that for Amthala.
- 2) $\Delta\text{FPM_FAM}$ & $\Delta\text{FPM_UNFAM}$: Contrary to what we found in Amthala, there was no correlation between reading along with SLS when watching familiar stories and reading along with SLS when watching unfamiliar stories.
- 3) $\Delta\text{FPM_FAM}$ is correlated to all reading scores and it is strongest with the total reading score and the para/story reading score; RS_Total_60 (0.532; $p=.000$) and RS_5_60 (0.499; $p=0.000$). Both these correlations are considerably weaker than Amthala's.
- 4) $\Delta\text{FPM_NN}$ is also correlated to most reading scores, especially the para/story reading scores, RS_4_60 (0.612; $p=.001$) and RS_5_60 (0.612; $p=.001$). It is not correlated to the letter/syllable reading score, RS_1_60 .
- 5) Like in Amthala, in Mordu also $\Delta\text{FPM_UNFAM}$ did not have a statistically significant correlation with any of the reading scores. The sample size was small because unfamiliar stories were only shown to 10 Grade 4 children.

Ganka

- 1) $\Delta\text{FPM_FAM}$ is weakly correlated only to three of the reading scores: RS_Total_60 (0.323; $p=.042$), RS_2_60 (0.0.346; $p=0.029$), and RS_5_60 (0.338; $p=0.033$). These correlations are much weaker than Amthala's and even Mordu's.

Table 21a: Amthala, correlations between reading and fixations on SLS

| | | ΔFPM_FAM (1) | ΔFPM_NN (2) | ΔFPM_UNFAM (3) | RS_Total_60 (4) | RS_1_60 (5) | RS_2_60 (6) | RS_3_60 (7) | RS_4_60 (8) | RS_5_60 (9) |
|--------------------|--------------|-----------------|----------------|-------------------|--------------------|----------------|----------------|----------------|----------------|----------------|
| ΔFPM_FAM (1) | Correlation | 1 | .715** | .653** | .639** | .583** | .631** | .578** | .554** | .644** |
| | Significance | | .000 | .008 | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 98 | 45 | 15 | 98 | 98 | 98 | 98 | 98 | 98 |
| ΔFPM_NN (2) | Correlation | | 1 | .b | .580** | .549** | .565** | .509** | .544** | .537** |
| | Significance | | | | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | | 45 | 0 | 45 | 45 | 45 | 45 | 45 | 45 |
| ΔFPM_UNFAM (3) | Correlation | | | 1 | .384 | .285 | .360 | .339 | .447 | .402 |
| | Significance | | | | .158 | .304 | .187 | .216 | .095 | .138 |
| | N | | | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| RS_Total_60 (4) | Correlation | | | | 1 | .893** | .985** | .955** | .914** | .973** |
| | Significance | | | | | .000 | .000 | .000 | .000 | .000 |
| | N | | | | 101 | 101 | 101 | 101 | 101 | 101 |
| RS_1_60 (5) | Correlation | | | | | 1 | .837** | .790** | .774** | .809** |
| | Significance | | | | | | .000 | .000 | .000 | .000 |
| | N | | | | | 101 | 101 | 101 | 101 | 101 |
| RS_2_60 (6) | Correlation | | | | | | 1 | .953** | .900** | .961** |
| | Significance | | | | | | | .000 | .000 | .000 |
| | N | | | | | | 101 | 101 | 101 | 101 |
| RS_3_60 (7) | Correlation | | | | | | | 1 | .860** | .914** |
| | Significance | | | | | | | | .000 | .000 |
| | N | | | | | | | 101 | 101 | 101 |
| RS_4_60 (8) | Correlation | | | | | | | | 1 | .876** |
| | Significance | | | | | | | | | .000 |
| | N | | | | | | | | 101 | 101 |
| RS_5_60 (9) | Correlation | | | | | | | | | 1 |
| | Significance | | | | | | | | | |
| | N | | | | | | | | | 101 |

** . Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Table 21b: Mordu, correlations between reading and fixations on SLS

| | | Δ FPM_FAM (1) | Δ FPM_NN (2) | Δ FPM_UNFAM (3) | RS_Total_60 (4) | RS_1_60 (5) | RS_2_60 (6) | RS_3_60 (7) | RS_4_60 (8) | RS_5_60 (9) |
|---------------------------|--------------|-------------------------|------------------------|---------------------------|--------------------|----------------|----------------|----------------|----------------|----------------|
| Δ FPM_FAM (1) | Correlation | 1 | .592** | .421 | .532** | .431** | .481** | .461** | .472** | .499** |
| | Significance | | .001 | .299 | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 73 | 27 | 8 | 73 | 73 | 73 | 73 | 73 | 73 |
| Δ FPM_NN (2) | Correlation | | 1 | . ^b | .477* | .242 | .400* | .442* | .612** | .612** |
| | Significance | | | | .012 | .225 | .039 | .021 | .001 | .001 |
| | N | | 27 | 0 | 27 | 27 | 27 | 27 | 27 | 27 |
| Δ FPM_UNFAM (3) | Correlation | | | 1 | .152 | .073 | .214 | .267 | . ^b | . ^b |
| | Significance | | | | .696 | .852 | .580 | .487 | 0.000 | 0.000 |
| | N | | | 10 | 9 | 9 | 9 | 9 | 9 | 9 |
| RS_Total_60 (4) | Correlation | | | | 1 | .757** | .954** | .931** | .908** | .905** |
| | Significance | | | | | .000 | .000 | .000 | .000 | .000 |
| | N | | | | 76 | 76 | 76 | 76 | 76 | 76 |
| RS_1_60 (5) | Correlation | | | | | 1 | .641** | .491** | .439** | .433** |
| | Significance | | | | | | .000 | .000 | .000 | .000 |
| | N | | | | | 76 | 76 | 76 | 76 | 76 |
| RS_2_60 (6) | Correlation | | | | | | 1 | .916** | .874** | .867** |
| | Significance | | | | | | | .000 | .000 | .000 |
| | N | | | | | | 76 | 76 | 76 | 76 |
| RS_3_60 (7) | Correlation | | | | | | | 1 | .966** | .960** |
| | Significance | | | | | | | | .000 | .000 |
| | N | | | | | | | 76 | 76 | 76 |
| RS_4_60 (8) | Correlation | | | | | | | | 1 | .993** |
| | Significance | | | | | | | | | .000 |
| | N | | | | | | | | 76 | 76 |
| RS_5_60 (9) | Correlation | | | | | | | | | 1 |
| | Significance | | | | | | | | | |
| | N | | | | | | | | | 76 |

** Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Table 21c: Ganka, correlations between reading and fixations on SLS

| | | Δ FPM_FAM (1) | Δ FPM_NN (2) | Δ FPM_UNFAM (3) | RS_Total_60 (4) | RS_1_60 (5) | RS_2_60 (6) | RS_3_60 (7) | RS_4_60 (8) | RS_5_60 (9) |
|---------------------------|--------------|-------------------------|------------------------|---------------------------|--------------------|----------------|----------------|----------------|----------------|----------------|
| Δ FPM_FAM (1) | Correlation | 1 | . ^a | . ^a | .323* | .196 | .346* | .281 | .294 | .338* |
| | Significance | | | | .042 | .226 | .029 | .079 | .066 | .033 |
| | N | 40 | 0 | 0 | 40 | 40 | 40 | 40 | 40 | 40 |
| Δ FPM_NN (2) | Correlation | | . ^a | . ^a | . ^a | . ^a | . ^a | . ^a | . ^a | . ^a |
| | Significance | | | | | | | | | |
| | N | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Δ FPM_UNFAM (3) | Correlation | | | . ^a | . ^a | . ^a | . ^a | . ^a | . ^a | . ^a |
| | Significance | | | | | | | | | |
| | N | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| RS_Total_60 (4) | Correlation | | | | 1 | .730** | .970** | .951** | .954** | .975** |
| | Significance | | | | | .000 | .000 | .000 | .000 | .000 |
| | N | | | | 40 | 40 | 40 | 40 | 40 | 40 |
| RS_1_60 (5) | Correlation | | | | | 1 | .639** | .556** | .579** | .604** |
| | Significance | | | | | | .000 | .000 | .000 | .000 |
| | N | | | | | 40 | 40 | 40 | 40 | 40 |
| RS_2_60 (6) | Correlation | | | | | | 1 | .943** | .906** | .940** |
| | Significance | | | | | | | .000 | .000 | .000 |
| | N | | | | | | 40 | 40 | 40 | 40 |
| RS_3_60 (7) | Correlation | | | | | | | 1 | .915** | .933** |
| | Significance | | | | | | | | .000 | .000 |
| | N | | | | | | | 40 | 40 | 40 |
| RS_4_60 (8) | Correlation | | | | | | | | 1 | .984** |
| | Significance | | | | | | | | | .000 |
| | N | | | | | | | | 40 | 40 |
| RS_5_60 (9) | Correlation | | | | | | | | | 1 |
| | Significance | | | | | | | | | |
| | N | | | | | | | | | 40 |

** . Correlation is significant at the 0.01 level (2-tailed).

b. Cannot be computed because at least one of the variables is constant.

Gender Differences

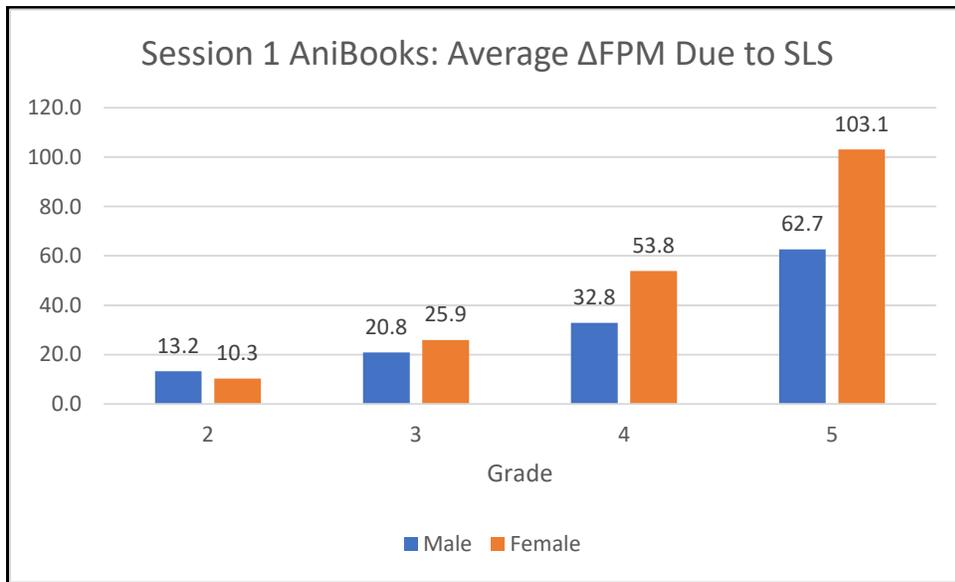
Amthala

In Grade 2, Session 1, the boys recorded a slightly higher Δ FPM than the girls, or 13.2 and 10.3, respectively. However, the girls reversed this in Grades 3-5, as presented in Table 22 and Figure 11. By Grade 5 girls' Δ FPM was considerably higher at 103.1 while for boys it was 62.7.

Table 22: Amthala, Session 1 AniBooks, average Δ FPM due to SLS

| Grade | Male | Female |
|-------|------|--------|
| 2 | 13.2 | 10.3 |
| 3 | 20.8 | 25.9 |
| 4 | 32.8 | 53.8 |
| 5 | 62.7 | 103.1 |

Figure 11: Amthala, Session 1 AniBooks, average Δ FPM due to SLS



The Δ FPM means for all the AniBooks in Session 1 were significantly different at the $p < 0.05$ level for Grades 2-5, for boys [$F(3, 48) = 6.80, p = 0.001$] and girls [$F(3, 42) = 31.47, p = 0.000$].

Girls' greater fixation due to SLS, in Grades 3-5 seems more a function of better mean reading scores in Amthala (Table 23).

Table 23: Amthala, Total reading score by sex

| | Total Reading Score in 60 Seconds (RS_Total_60) | |
|-------|---|--------|
| Grade | Male | Female |
| 2 | 62.4 | 29.2 |
| 3 | 51.6 | 103.5 |
| 4 | 128.0 | 174.0 |
| 5 | 180.5 | 206.6 |

Mordu

In Mordu, girls and boys engaged with SLS, comparably in Grades 2-3 but boys fixated slightly more on the SLS band in Grades 4-5 (Table 24 and Figure 12). Boys' reading scores were much lower than girls' in Grades 2-3, comparable in Grade 4, but much higher in Grade 5 (Table 25). This implies that weak readers too engage with SLS and this engagement is automatic, not just determined by ability to read.

Table 24: Mordu, Session 1 AniBooks, average Δ FPM due to SLS

| Grade | Male | Female |
|-------|------|--------|
| 2 | 7.4 | 7.6 |
| 3 | 9.3 | 12.1 |
| 4 | 10.9 | 7.1 |
| 5 | 30.6 | 22.9 |

Figure 12: Mordu, Session 1 AniBooks, average Δ FPM due to SLS

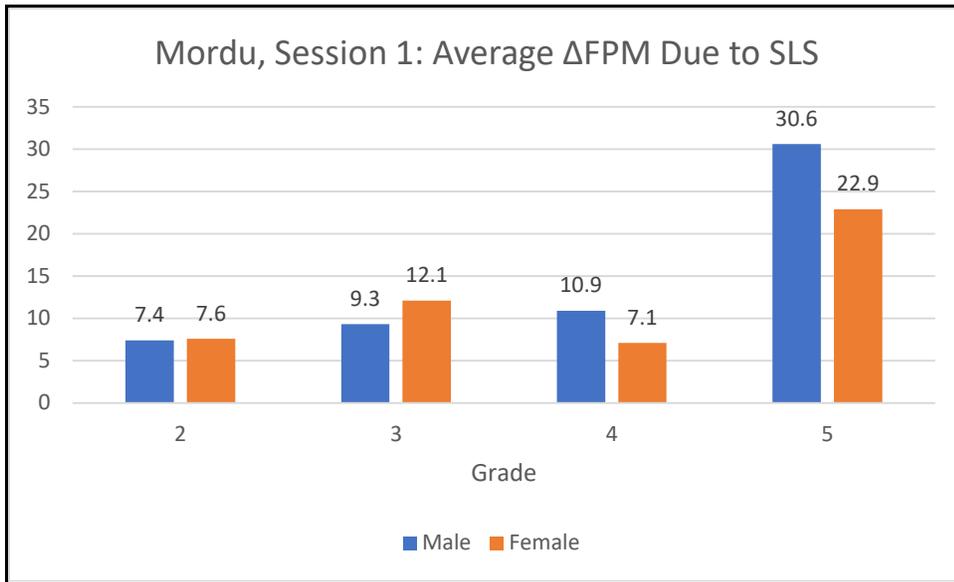


Table 25: Mordu, Total reading score by sex

| Grade | Total Reading Score in 60 Seconds (RS_Total_60) | |
|-------|---|--------|
| | Male | Female |
| 2 | 1.4 | 23.6 |
| 3 | 9.7 | 44.8 |
| 4 | 14.5 | 22.3 |
| 5 | 124.6 | 39.9 |

Ganka

In Ganka, the girls tried to read along much more with SLS in Grades 3-5 (Table 26 and Figure 13). Boys tried to read along more in Grade 2. These findings can be explained by girls' much better reading achievement in Grades 3-5 and slightly lower reading achievement in Grade 2.

Table 26: Ganka, Session 1 AniBooks, average Δ FPM due to SLS

| Grade | Male | Female |
|-------|------|--------|
| 2 | 8.9 | 3.0 |
| 3 | 1.4 | 16.6 |
| 4 | 12.7 | 32.6 |
| 5 | 20.2 | 25.5 |

Figure 13: Ganka, Session 1 AniBooks, average Δ FPM due to SLS

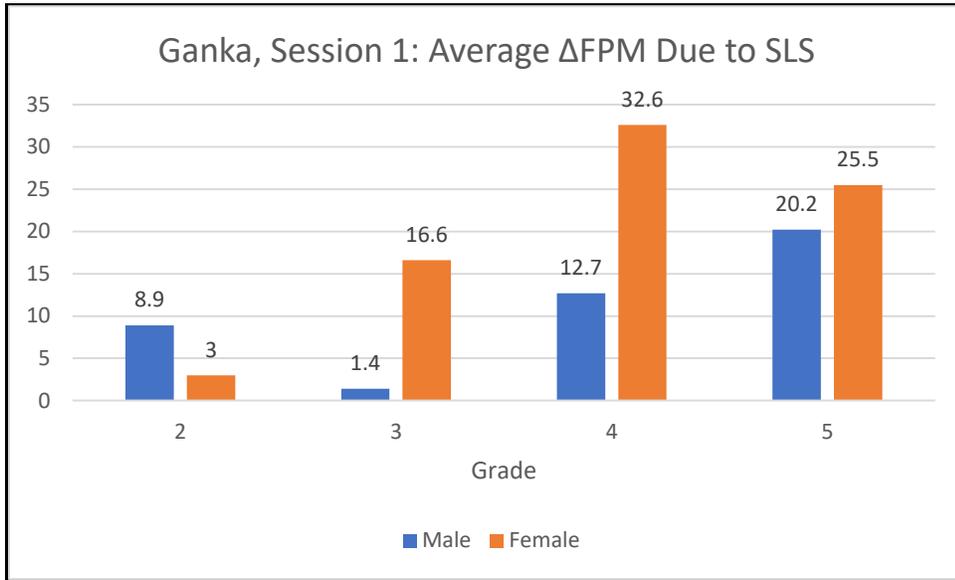


Table 27: Ganka, Total reading score by sex

| Grade | Total Reading Score in 60 Seconds (RS_Total_60) | |
|-------|---|--------|
| | Male | Female |
| 2 | 31.7 | 63.4 |
| 3 | 73.3 | 104.1 |
| 4 | 50.6 | 196.4 |
| 5 | 128.3 | 208.8 |

Conclusion ([back to contents](#))

Eye-tracking provided strong evidence that when watching AniBooks, school children automatically engage with SLS. Across all schools and grades, 93.8% school children tried to read along with SLS.

Amthala, where the e-Library programme was best implemented, eye-fixation on the SLS band was more than double of Mordu and Ganka. We attribute this to greater exposure to the AniBooks, the practice of reading along with SLS, and the resulting habit formation. Amthala and Ganka were comparable in reading performance, still, Amthala children engaged with SLS at double the rate. It was surprising that Mordu and Ganka children's fixations on the SLS band were very comparable, despite the fact that Ganka children had far better reading skills. This supports the importance of habit formation – more AniBook and SLS exposure, leads to more reading along.

There was very little difference in reading along with familiar versus unfamiliar AniBooks. For both, the amount of reading along is largely determined by one's prior habituation with SLS and reading ability.

Prior exposure to the AniBooks resulted in more reading along to SLS when there was no narration, like in Amthala. But in schools where the e-Library programme was weak, like in Mordu and Ganka, the eye-fixation rates were similar for familiar and unfamiliar AniBooks.

Interestingly, girls read along with SLS more than boys, only in Amthala. However, this pattern did not hold up in Mordu and Ganka.

The e-Library programme in Amthala caused children to read along with SLS at double the rate of Mordu and Ganka. While our eye-tracking study did not look at any resulting reading skill improvement from regular SLS exposure, we know that Amthala children did get substantial reading practice through AniBook viewing.

However, in a recent study in 10 schools of Delhi serving low-income students (5 control and 5 treatment schools), we did find strong evidence that regular exposure to AniBooks does in fact result in improved reading skills. The present study provides evidence that AniBook exposure causes even weak-reading children to engage with SLS and the Delhi study shows that this exposure leads to improved reading over time.

Although there might be an inclination to see AniBooks as “videos” for entertainment and not “books” for reading, the present study found that they are both, in other words, entertaining story-videos that get children to read.⁵

⁵ Based on our interactions and observations in Amthala: The e-Library coordinator in Abu Road saw the high viewing of AniBooks, when students were given unfettered access, as something to be rectified, built on the assumption that AniBooks are for entertainment but not reading. ePubs were actively encouraged and children discouraged from watching the AniBooks, during their weekly tablet session. Success of the e-Library programme was construed as the quantum of ePub usage relative to other content, such as, AniBooks/videos and/or games.

Appendix A: Photos and Videos [\(back to contents\)](#)



Children and Eye Tracking Coordinators at Amthala, Rajasthan



Interaction with school children at Amthala, Rajasthan



Interaction with school children at Amthala, Rajasthan



Eye tracking device



Eye tracking session in progress



Computer set up with eye tracking device



Girl watching story with eye tracking device

Videos



| | |
|--------------------|---|
| Name | Rakesh Kumar |
| Class | 3 |
| Mother Tongue | Marwari |
| Age | 8 |
| School | Amthala Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/x5zYfjnsecl |



| | |
|--------------------|---|
| Name | Mohan Kumar |
| Class | 4 |
| Mother Tongue | Marwari |
| Age | 10 |
| School | Amthala Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/G5WLIisUAlk |



| | |
|--------------------|---|
| Name | Seema Kumai |
| Class | 5 |
| Mother Tongue | Marwari |
| Age | 10 |
| School | Amthala Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/CshnlXiq8FE |



| | |
|--------------------|---|
| Name | Sami Kumari |
| Class | 3 |
| Mother Tongue | Marwari |
| Age | 8 |
| School | Mordu Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/1QuJKet4SPw |



| | |
|--------------------|---|
| Name | Somi kumari |
| Class | 5 |
| Mother Tongue | Marwari |
| Age | 11 |
| School | Mordu Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/LjFGKk-JQKw |



| | |
|--------------------|---|
| Name | Pappu |
| Class | 4 |
| Mother Tongue | Marwari |
| Age | 11 |
| School | Ganka Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/7fzc9lfA3F8 |



| | |
|--------------------|---|
| Name | Lalit kumar |
| Class | 5 |
| Mother Tongue | Marwari |
| Age | 12 |
| School | Ganka Govt School, Rajasthan |
| Eye tracking video | https://youtu.be/CG4ViMGPfak |

Appendix B: School Data ([back to contents](#))

| Section | Information | School 1 | School 2 | School 3 |
|---------|-------------------------------------|--------------|---------------|------------------------------|
| General | State: | Rajasthan | Rajasthan | Rajasthan |
| General | District: | Sirohi | Sirohi | Sirohi |
| General | Block: | Abu Road | Abu Road | Abu Road |
| General | Name of the village: | Amthala | Mordu | Ganka |
| General | Name of the school: | Amthala | Mordu | Govt Secondary School, Ganka |
| General | Arrival time in school | 9.30 AM | 9.20 AM | 9.50 AM |
| General | School from which Std to which Std? | 1 to 4/5 | 1 to 6/7/8 | 1 to 10 |
| General | Name (Resp. info) | Dharma Ram | Khem Chand | Vandana Agarwal |
| General | Designation | Teacher | Teacher | HM |
| General | Phone number | 9511541567 | 9414841880 | No info. |
| General | Date of the survey | 22/03/2018 | 21/03/2018 | 28/03/2018 |
| General | Day of the survey | Thursday | Wednesday | Wednesday |
| General | Surveyors' names | Payal Bansal | Usha Audichya | Usha Audichya |
| Sec 1 | Child Enrollment Std 1 | 26 | 33 | 63 |
| Sec 1 | Child Enrollment Std 2 | 35 | 19 | 39 |
| Sec 1 | Child Enrollment Std 3 | 28 | 45 | 52 |
| Sec 1 | Child Enrollment Std 4 | 21 | 24 | 55 |
| Sec 1 | Child Enrollment Std 5 | 21 | 27 | 56 |
| Sec 1 | Child Enrollment Std 6 | No info. | 26 | 42 |
| Sec 1 | Child Enrollment Std 7 | No info. | 27 | 35 |
| Sec 1 | Child Enrollment Std 8 | No info. | 25 | 20 |
| Sec 1 | Child Attend today Std 1 | 17 | 13 | 14 |
| Sec 1 | Child Attend today Std 2 | 23 | 3 | 14 |
| Sec 1 | Child Attend today Std 3 | 23 | 20 | 16 |
| Sec 1 | Child Attend today Std 4 | 15 | 8 | 24 |
| Sec 1 | Child Attend today Std 5 | 21 | 17 | 17 |
| Sec 1 | Child Attend today Std 6 | No info. | 15 | 28 |
| Sec 1 | Child Attend today Std 7 | No info. | 14 | 13 |
| Sec 1 | Child Attend today Std 8 | No info. | No info. | Exam |
| Sec 2 | Medium of Instruction Lang 1 | Hindi | Hindi | Hindi |
| Sec 2 | Medium of Instruction Lang 2 | No info. | No info. | No info. |
| Sec 2 | Medium of Instruction Lang 3 | No info. | No info. | No info. |
| Sec 3 | HM (Appointed) | No info. | 1 | 1 |
| Sec 3 | Reg Govt Teacher (Appointed) | 4 | 8 | 15 |
| Sec 3 | Para Teachers (Appointed) | 1 | 1 | No info. |
| Sec 3 | HM (Present) | No info. | Yes | Yes |
| Sec 3 | Reg Govt Teacher (Present) | 4 | 8 | No info. |
| Sec 3 | Para Teachers (Present) | 1 | 1 | No info. |

| | | | | |
|-------|--|-------|----------|-------|
| Sec 4 | Std 2 Are the children of this Std. sitting with children from any other standard? | Yes | Yes | No |
| Sec 4 | Std 2 Is there a blackboard in this class? | Yes | Yes | Yes |
| Sec 4 | Std 2 If yes, could you easily write on the blackboard? | Yes | Yes | Yes |
| Sec 4 | Std 2 Apart from textbooks, did you see any other TLM (e.g. other books, charts on the wall, board games etc.) in the room. | Yes | Yes | Yes |
| Sec 4 | Std 2 Classroom seated where? | Class | Class | Class |
| Sec 4 | Std 4 Are the children of this Std. sitting with children from any other standard? | Yes | Yes | No |
| Sec 4 | Std 4 Is there a blackboard in this class? | Yes | Yes | Yes |
| Sec 4 | Std 4 If yes, could you easily write on the blackboard? | Yes | Yes | Yes |
| Sec 4 | Std 4 Apart from textbooks, did you see any other TLM (e.g. other books, charts on the wall, board games etc.) in the room. | Yes | No | Yes |
| Sec 4 | Std 4 Classroom seated where? | Class | Verandah | Class |
| Sec 5 | Was the mid day meal served in the school today? (Ask) | Yes | Yes | Yes |
| Sec 5 | Is there a kitchen/shed for cooking mid-day meal? (Observe) | Yes | No | Yes |
| Sec 5 | Did you see food being cooked in the school? (Observe) | Yes | Yes | Yes |
| Sec 5 | Did you see any evidence of the meal being served to the children today (look for evidence like dirty utensils or meal brought from outside etc.)? (Observe) | No | No | No |
| Sec 6 | Total number of pucca rooms in the school excluding toilets (count yourself and write) | 9 | 10 | 10 |
| Sec 6 | Total number of rooms being used for teaching today (count yourself and write] | 5 | 6 | 9 |
| Sec 6 | Did you see an office/store/office-cum store? | Yes | Yes | Yes |
| Sec 6 | Did you see a playground? | Yes | Yes | Yes |
| Sec 6 | Did you see library books in the school? | No | Yes | Yes |
| Sec 6 | If yes, did you see library books being used/read by children? | No | Yes | Yes |
| Sec 6 | Did you see a hand pump/tap? | Yes | Yes | Yes |

| | | | | |
|-------|--|----------|----------|----------|
| Sec 6 | If there is a hand pump/tap, could you use it to drink water? | No | Yes | Yes |
| Sec 6 | If there is no hand pump/tap or it is not usable, did you see drinking water available? | Yes | No info. | Yes |
| Sec 6 | Did you see a complete boundary wall or fencing? | Yes | Yes | Yes |
| Sec 6 | Is there electricity connection in the school? (Look for wires & fitting) | Yes | Yes | Yes |
| Sec 6 | If yes, was there electricity in the school today? (Observe/ask) | Yes | Yes | Yes |
| Sec 6 | Did you see computers to be used by children in the school? | No | No | Yes |
| Sec 6 | If yes, did you see children using computers? | No | No | No |
| Sec 7 | Is there a girl's toilet? | Yes | Yes | Yes |
| Sec 7 | Girl's toilet. Was it locked? | No | No | No |
| Sec 7 | Girl's toilet. If unlocked, was it in a usable condition? | Yes | Yes | Yes |
| Sec 7 | Is there a boy's toilet? | Yes | Yes | Yes |
| Sec 7 | Boy's toilet. Was it locked? | No | No | No |
| Sec 7 | Boy's toilet. If unlocked, was it in a usable condition? | Yes | Yes | Yes |
| Sec 7 | Is there a teacher's toilet? | Yes | Yes | Yes |
| Sec 7 | Teacher's toilet. Was it locked? | No | No | No |
| Sec 7 | Teacher's toilet. If unlocked, was it in a usable condition? | Yes | Yes | Yes |
| Sec 7 | Is there a common toilet? | No info. | No info. | No info. |
| Sec 7 | Common toilet. Was it locked? | No info. | No info. | No info. |
| Sec 7 | Common toilet. If unlocked, was it in a usable condition? | No info. | No info. | No info. |
| Sec 8 | Have you heard about Continuous and Comprehensive Evaluation/CCE? (Ask) | Yes | Yes | Yes |
| Sec 8 | How many teachers in this school have received a Continuous and Comprehensive Evaluation manual? (Ask) | All | All | All |
| Sec 8 | If manual or format was received, ask the respondent to show it. Could you see a Continuous and Comprehensive Evaluation manual or format in the school? (Ask and observe) | Yes | Yes | Yes |

| | | | | |
|----------|---|-----------------|------------|------------|
| Sec 9 | Currently is there a School Management Committee [SMC] for this school? (ask) | No | Yes | Yes |
| Sec 9 | If yes, then when was the last meeting of the School Management Committee [SMC] held? (Ask) | No info. | 16/01/2018 | 15/02/2018 |
| Sec 10 | Was a school Development Plan (SDP) made of your school in 2015-16? (Ask) (Do not include DISE format as SDP) | No | Yes | No |
| Sec 10 | If School Development Plan (SDP) was made, ask the respondent to show it. | No | Yes | No |
| Sec 10 | Could you see the school Development Plan yourself (Ask and observe) | No | Yes | No |
| Sec 11 | Who gave the information about grants? | Regular Teacher | HM | HM |
| Sec 12 A | Apr 2017 to Mar 2018 Did you get the (SMG) grant? | No | No | Yes |
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 A | Apr 2017 to Mar 2018 Did you get the (SDG) grant? | No | No | Yes |
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 A | Apr 2017 to Mar 2018 Did you get the (TLM) grant? | Yes | Yes | Yes |
| Sec 12 A | If yes, did you spend the full amount? | Yes | Yes | No info. |
| Sec 12 A | Apr 2017 to Mar 2018 New Classroom Grant | No | No | Yes |
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 A | Apr 2017 to Date of Survey Did you get the (SMG) grant? | No info. | No info. | No info. |
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 A | Apr 2017 to Date of Survey. Did you get the (SDG) grant? | No info. | No info. | No info. |
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 A | Apr 2017 to Date of Survey. Did you get the (TLM) grant? | No info. | No info. | No info. |

| | | | | |
|----------|---|----------|----------|----------|
| Sec 12 A | If yes, did you spend the full amount? | No info. | No info. | No info. |
| Sec 12 B | Construction of new classroom(s) | No | No | Yes |
| Sec 12 B | White wash/plastering | No info. | No info. | No info. |
| Sec 12 B | Repair of drinking water facility | No | No | Yes |
| Sec 12 B | Repair of toilet | No info. | No info. | No info. |
| Sec 12 B | Purchase of sitting mats/Tat Patti | No | No info. | Yes |
| Sec 12 B | Purchase of charts, globes or other teaching material | No info. | Yes | No info. |
| General | Departure time from school | 4.20 PM | 4.00 PM | 4.00 PM |