Qualitative Study Summary

Study Title: *BuddyBooks Acceptability and Appropriateness Study*

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1. Introduction

Under a National Science Foundation grant, ObjectiveEd created the literacy improvement system entitled BuddyBooks.

BuddyBooks combines the findings of diverse peer-reviewed research studies for building literacy skills into a cutting-edge AI-based EdTech product. BuddyBooks provides individualized instruction to struggling readers, resulting in improved oral reading fluency, accuracy, and duration.

This study aimed to determine the acceptability and appropriateness of BuddyBooks to improve a student's oral reading skills through qualitative surveys completed by students and teachers who used BuddyBooks over 5 weeks. This data, collected by the BuddyBooks software, tracked each student's oral fluency, accuracy, and reading duration.

The need for BuddyBooks was driven by the literacy crisis in America. Biennial testing by Urban Institute's National Assessment of Educational Progress consistently shows that two-thirds of U.S. children are unable to read with proficiency (NAEP, 2023).

A seminal review and meta-analysis found a moderate association between poor reading and self-concept domains of academia, mathematics, behavior, and physical appearance (McArthur et al., 2020). Additionally, children who lack phonological processing develop negative self-perceptions and are at moderate risk for experiencing anxiety compared to typical readers (Chapman & Turner, 2003; Francis et al., 2019).

BuddyBooks is designed to help students who struggle with reading to improve their reading skills and develop a joy of reading. This study focuses on 4th and 5th-grade students one or more years behind grade-level reading.

2. Researcher Positionality

As the author of this paper, Dr. Sofia Jimenez brings a background in educational technology, learning research, and a deep commitment to supporting students' language and literacy development. Broadly, she is interested in how to improve children's learning, particularly active or self-motivated learning in both formal and informal educational settings. Dr. Jimenez was a Senior Education Researcher at Noggin (Nickelodeon) where she created and led interventions that target early math and literacy through digital media. This experience has shaped her belief in the potential of technology to enhance student learning and provide additional support for skill-building outside of the classroom.

Her positionality as an advocate for digital learning tools may influence her interpretation of the data. She acknowledges that her enthusiasm for educational technology could introduce bias, particularly in interpreting positive feedback or underestimating challenges faced by teachers. To mitigate this, she has employed strategies such as peer debriefing, where colleagues and program developers review and validate the findings, and triangulation, using multiple data sources to confirm the results - in this case, educator and student testimonials along with product data. This approach aims to ensure a balanced and accurate representation of teachers' experiences and perspectives on the possibility of Buddy Books to support reading skills development and practice.

3. Study Context

This qualitative study was conducted in summer 2024, with feedback collected from educators implementing the intervention in a summer school program at the Edna Runner Tutorial Center in Jupiter, Florida. The tutorial center provides an after-school program, spring break, and summer break camp services for 125 children in grades K-8. The Center aims to provide educational support and increase students' grade point average and self-esteem. For the past 30 years, the Center has been successful in empowering children to overcome the circumstances of poverty. Children must attend

classes at least 3 times per week. Summer classes run from 8:00 AM to 5:00 PM between June 5 and August 2.

4. Research Questions

Primary Questions:

1. Will students using BuddyBooks in an intensive summer intervention show improved reading fluency, accuracy, and duration?
2. What do teachers think about the effectiveness of the intervention in improving oral reading fluency, accuracy, and duration?
3. Will students using BuddyBooks report an improvement in their confidence and enjoyment of reading?

Hypothesis:

1. If implemented to fidelity, students who use BuddyBooks will show improved reading fluency, accuracy, and duration as measured by BuddyBooks' continuous data collection system.
2. If implemented to fidelity, teachers will observe that for struggling readers, oral reading fluency, accuracy, and duration increase.
3. If implemented to fidelity, students will report improved confidence in oral reading and enjoyment of books.

Secondary Questions:

1. Will any improvement in reading fluency, accuracy, and duration align with teachers' and students' reports of student reading?
2. How will students use Buddy Books?
3. Will students find the program too easy or difficult?
4. Will students find the stories engaging?

5. Methods

Participants:

Participants included the Executive Director of the summer school program, two teachers, and 26 students (16 male and 10 female) in 4th and 5th grade who attend the summer school program at least 3 days per week. Based on recent public school testing, the teachers and Executive Director select students based on their reading skills being below grade level.
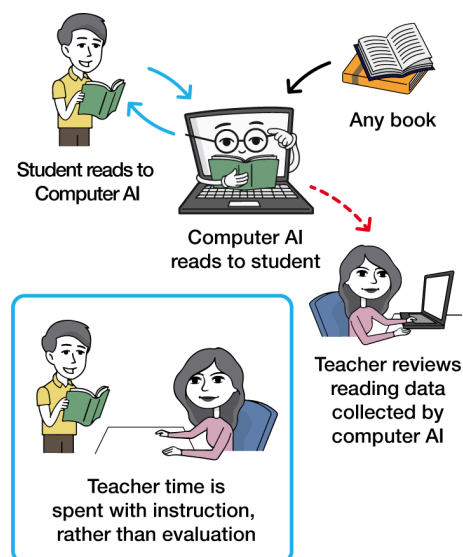
Data Collection:

For qualitative feedback, data is collected by an online survey for teachers and directors and a separate survey for students. The intervention tool continuously collects reading progress analysis data for each reading session. The intervention tool, BuddyBooks, is a web-based application that records each student's reading activity (i.e., number of pages and books read), reading duration, fluency, and accuracy of the student's oral reading.

Materials:

BuddyBooks Intervention Tool

Using almost any book, the student and computer co-read, which keeps the student engaged in the story. Since the student is reading every other sentence, it decreases their cognitive load. That means some students can read stories at their interest level instead of their reading skill level, which they might think is too immature. At the same time, BuddyBooks continuously analyzes how well the students are reading, helps them where they struggle, and shows the teacher, in a web dashboard, where they need additional support.

Any book

Student reads to Computer AI

Computer AI reads to student

Teacher reviews reading data collected by computer AI

Teacher time is spent with instruction, rather than evaluation

On the computer's turn, the screen shows the sentence, highlighting each word as it is spoken to the student.

> So he kept a good distance away from the flames, and only came near to cover Dorothy with dry leaves when she lay down to sleep.
>
> These kept her very snug and warm, and she slept soundly until morning.
>
> **When it was daylight, the girl bathed her face in a little rippling brook, and soon after they all started toward the Emerald City.**
>
> This was to be an eventful day for the travelers.

When it's the student's turn, the sentence is bolded, and the student orally reads their sentence.

> **Your Turn**
>
> When it was daylight, the girl bathed her face in a little rippling brook, and soon after they all started toward the Emerald City.
>
> **This was to be an eventful day for the travelers.**
>
> They had hardly been walking an hour when they saw before them a great ditch that crossed the road and divided the forest as far as they could see on either side.

Students: For using the intervention, each student is provided with a noise-cancellation headset/microphone and Chromebook with an Internet connection. Each student is assigned a BuddyBooks username and password.

Teachers: The teacher and director have a Chromebook with access to the Teacher Dashboard. The Teacher Dashboard (Appendix A) presents detailed information based on data collected during each student's reading sessions, including oral reading duration, fluency, and accuracy.

Books: Prior to the intervention, 5 groups of books were selected, one for each reading level. Students will be assigned to a book group based on their reading level. See Appendix B.

Post-Intervention Surveys: For the teacher's survey, questions focus on teachers' experiences with program implementation and its effectiveness. For the student survey, questions focus on the student's engagement and ease of use as seen in Appendix C.

Interviews: After completion of the surveys, the project coordinator conducted unstructured interviews individually with the teachers and students.

Procedure:

Determine baseline reading level:

Prior to the 5-week intervention, the baseline reading level of each student is determined. Each student orally read up to 4 paragraphs, from easiest to hardest. One paragraph was created for each of the four reading levels, from 1 to 4. Students were assigned a reading level based on their successful reading of that grade's paragraph. Students who could not successfully read the Level 1 paragraph were assigned to Level 0. Reading levels and student groups are shown in Appendix B.

On the first day, each student was given the Chromebook, headset, username, and password to access BuddyBooks and was shown how to participate in the co-reading activity with the computer. The teacher worked with each student until she felt the student fully understood how to use BuddyBooks.

Daily Activity:

Students were required to read using BuddyBooks for 30 minutes for 3 days per week during the 5-week summer camp. Reading sessions were scheduled at the same time every day.

Post-Intervention:

Students and teachers were requested to complete an online SurveyMonkey survey.

6. Analysis:

Question 1: Will students using BuddyBooks in an intensive summer intervention show improved reading fluency, accuracy, and duration?

To answer this question, we compared student reading metrics from week 1 to week 5

Using BuddyBooks' continuous data collection system, the following metrics were recorded:

- ○ Fluency is measured by correct words per minute
- ○ Accuracy is measured by comparing the words in a sentence spoken by the student to the sentence in the text.
- ○ Daily Reading time is measured by the amount of time the student spends actively participating in the co-reading activity. When the student stopped participating, the session was marked finished for the day.

These metrics were visualized and examined for patterns.

Question 2: What do teachers think about the effectiveness of the intervention in improving oral reading fluency, accuracy, and duration?

This question was addressed by having teachers complete surveys and discuss their experiences.

The Director and two teachers completed Teacher Surveys (Appendix C), and the project coordinator completed an informal interview individually with the Director and one teacher for 15 minutes each. We identified relevant quotes from the interviews that addressed this research question.

Question 3: Will students using BuddyBooks report an improvement in their confidence and enjoyment of reading?

We used student surveys and unstructured student interview responses to address this question.

All students (n = 24) completed Student Surveys ([Appendix C](#)), and the project coordinator completed unstructured interviews individually with each of the 12 students for up to 10 minutes. We compiled survey responses and identified quotes from the interviews that addressed this research question by doing a thematic analysis.

Validation

Triangulation was used to compare teacher feedback with student feedback and the metrics provided by the continuous data collection system from BuddyBooks.

7. Results

Primary Question 1: Will students using Buddy Books in an intensive summer intervention show improved reading fluency, accuracy, and duration?

As students read using the BuddyBooks "reader" app, BuddyBooks collected data on the student's oral reading fluency, accuracy, and duration.

Students improved fluency: As shown in the fluency chart below, the Mid (blue) and Low (red) groups improved their fluency by about 10 Correct Words per Minute (See Figure 1).
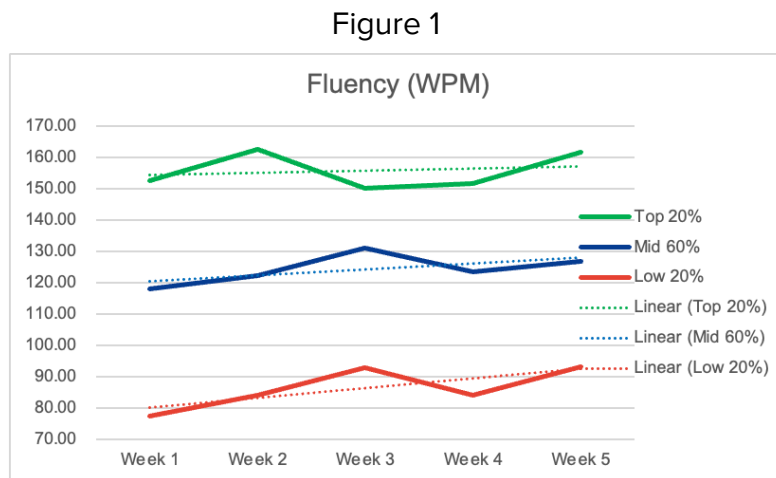
Figure 1

Students improved reading accuracy: Similarly, as shown in the accuracy chart below, the Mid (blue) and Low (red) groups improved their accuracy by about 10% (See Figure 2).

Figure 2
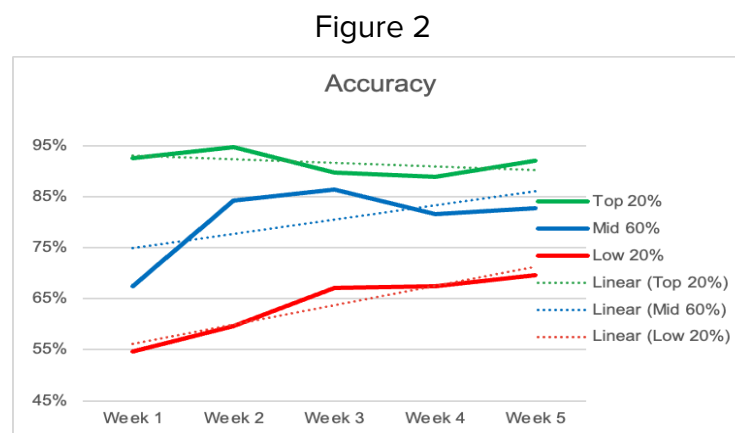
Students read for about 30 minutes per day: Except for the first week, all students read for at least 20 minutes per reading session. After the first week, reading duration varied from 24 minutes to 39 minutes. Minimum reading time showed an upward trend (See Figure 3).

Figure 3

Student reading time across weeks
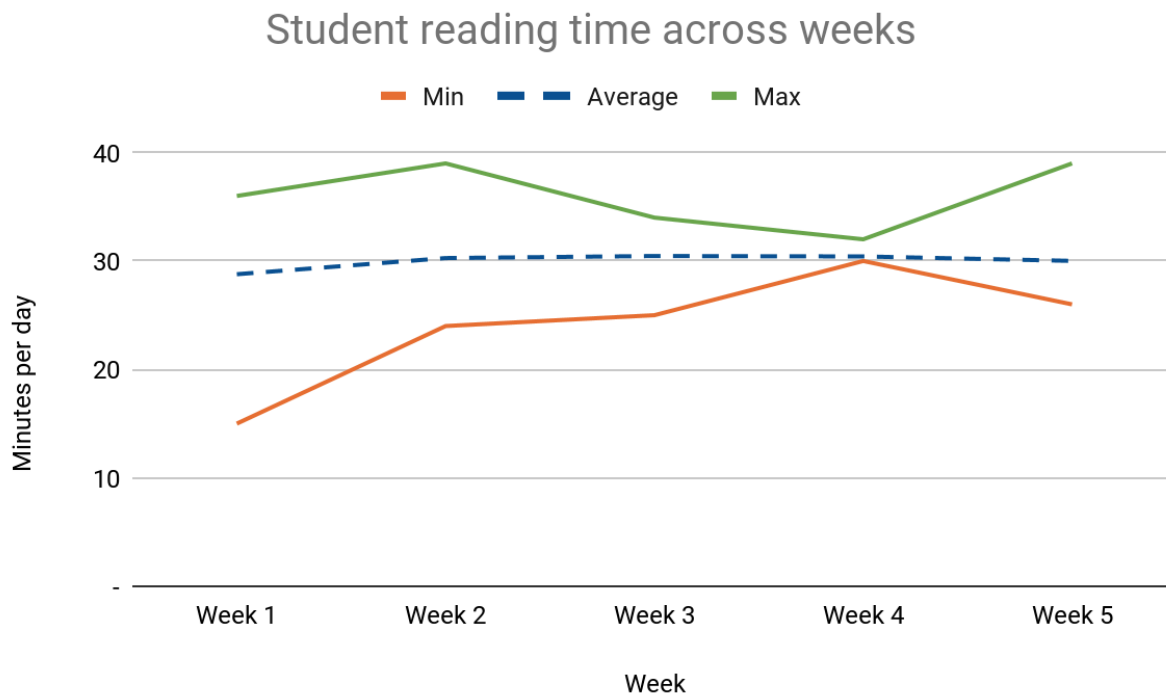
Primary Question 2: What do teachers think about the effectiveness of the intervention in improving oral reading fluency, accuracy, and duration?

Based on the survey the Director and two teachers completed, they had mixed opinions on how easy it was to set up. However, they reported that 90-100% of students selected to use it were able to do so in the first week.

Educators reported that students varied in their engagement with BuddyBooks. 2 of 3 educators said that students were "very much" engaged in the books they were reading. 2 of 3 educators said they "somewhat" enjoyed using BuddyBooks. They reported that some students were distracted by the ability to change their background color and font color. They also reported, "The students see it as more work, but in the end will make them stronger readers."

Ultimately, and most importantly, all stated that with BuddyBooks, every student improved their reading skills "very much," and all said that they would "very much" recommend the program to other teachers or directors.

Travis Conway, Executive Director, Edna Runner Tutorial Center
He requested to continue using BuddyBooks with the 4th and 5th-grade students in the fall as part of the after-school program.

"Buddy Books was incorporated at the beginning of the summer, and I've seen a tremendous change with the 4th and 5th graders with them wanting to read on an online program. Once we had an opportunity to go with BuddyBooks, you definitely see the kids are trying to do and reading and actually are being engaged in the lesson.

From what I've seen and what the data shows, BuddyBooks is working for our students."

Mira Aguirre, Assistant Teacher
"I like the aspect of how it teaches you how to pronounce the word and how to enunciate. It helps the kids to know exactly what they are trying to say. I like that our students have a particular dedicated

time for BuddyBooks, so they try their hardest to get to the next level.
Some of the key elements were that the students would sit down, take the time to learn
how to pronounce words, and learn how to read a little more efficiently."

Primary Question 3: Will students using BuddyBooks report an improvement in their confidence and enjoyment of reading?

54% (13/24) of students reported that with BuddyBooks, they improved their reading skills "very much."

The following student comments are indicative of improved confidence and enjoyment of reading:

- *"Because in the school year, I wasn't really a good reader at that time, but now once I started doing BuddyBooks, I feel like it helped me a lot."*
- *"I had trouble, like, like, reading the lines I got confused with. BuddyBooks was helping me with the pronouncing it correctly and just almost everything."*
- *"I like the stories about the BuddyBooks because it's like I feel like it's helping me become a better reader. I have ADHD. It's a little harder for me."*
- *"I probably would (recommend BuddyBooks to my friends) because I know I have some friends that sometimes come to me saying they wish their reading was a little bit better."*

Secondary Question 1: Will any improvement in reading fluency, accuracy, and duration align with teachers' and students' reports of student reading?

The data show an increase in fluency and accuracy for the bottom two groups (red and blue lines), consistent with the teachers' and students' reports. 100% of teachers and 57% of students reported that BuddyBooks helped improve students' reading skills "very much." This was not observed for the top group (the best readers). Not surprisingly, after a few weeks, several students said their books were becoming too easy and wanted a more challenging book.

In response, two students from Level 3 and two from Level 4 were moved up one level. Hence, the data from the earlier weeks had much easier books than the later weeks.

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As all students had to read for 30 minutes before switching to a different task during the day, there reading duration was consistent.

Secondary Question 2: How will students use Buddy Books?

Many students "gamed" the system during the first week when they discovered they could skip ahead. Instead of orally reading their sentence and pressing the ENTER key, they could avoid reading and press the ENTER key.

In addition to tracking fluency and accuracy data, BuddyBooks tracks **Skip Rate** percentage. Skip Rate indicates how often a student skips over reading their sentence. The Skip Rate for the first two days for many students was over 75%.

To solve this problem, the teacher explained to the students that they were required to read their sentences orally and that the teacher knew when they were not doing so. By the third day, Skip Rate dropped to under 8% and remained very low throughout the study. Teachers monitored the Skip Rate every day.

By the end of the session survey, even students acknowledged that the skip feature should be fixed.

Secondary Question 3: Will students find the program too easy or difficult?

Based on the survey completed by all students, 50% of students reported that BuddyBooks was "hard or very hard" to use during the first week. By the fifth week, 87.5% of students indicated it was "easy or very easy" (See Figure 4).
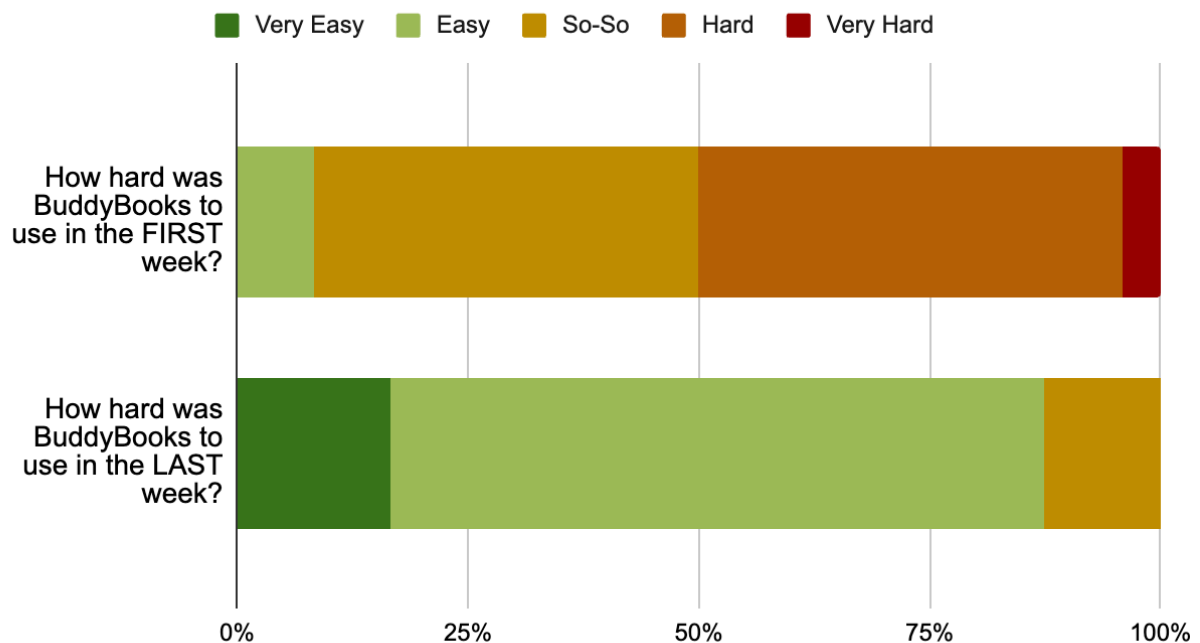
Example quote:

- *"With Buddy Books, it's been helping me a lot. BuddyBooks is hard at first, and then you start progressing, and then you learn how to read fluidly."*

Figure 4

Students' report on the level of difficulty using BuddyBooks n = 24

Legend: ■ Very Easy ■ Easy ■ So-So ■ Hard ■ Very Hard

How hard was BuddyBooks to use in the FIRST week?

How hard was BuddyBooks to use in the LAST week?

0%   25%   50%   75%   100%

Secondary Question 4: Will students find the stories engaging?

Based on the survey completed by all students, 63% reported that they "somewhat or very much" enjoyed the books they read and the reading experience with the BuddyBooks platform (See Figure 5). Educators reported that students were only "somewhat" enjoying BuddyBooks. Still, they also reported that about a third of the students wanted to read more than their allotted BuddyBooks time, suggesting they were engaged in the stories. A few students said they would not recommend BuddyBooks to a friend (See Figure 6).

- *"I enjoy BuddyBooks because it helps me learn new words and new books that I never read before."*
- *"Before I read, I was kinda bad at reading. I would recommend BuddyBooks because they can help people read, get better at reading. I like the books - Dragon in the Bag, I think, Nephew's Magician, Babysitter Club."*
- *"Before, I didn't really read the books in class. Now, it was like interesting books that I saw, so I started to read them."*

Figure 5

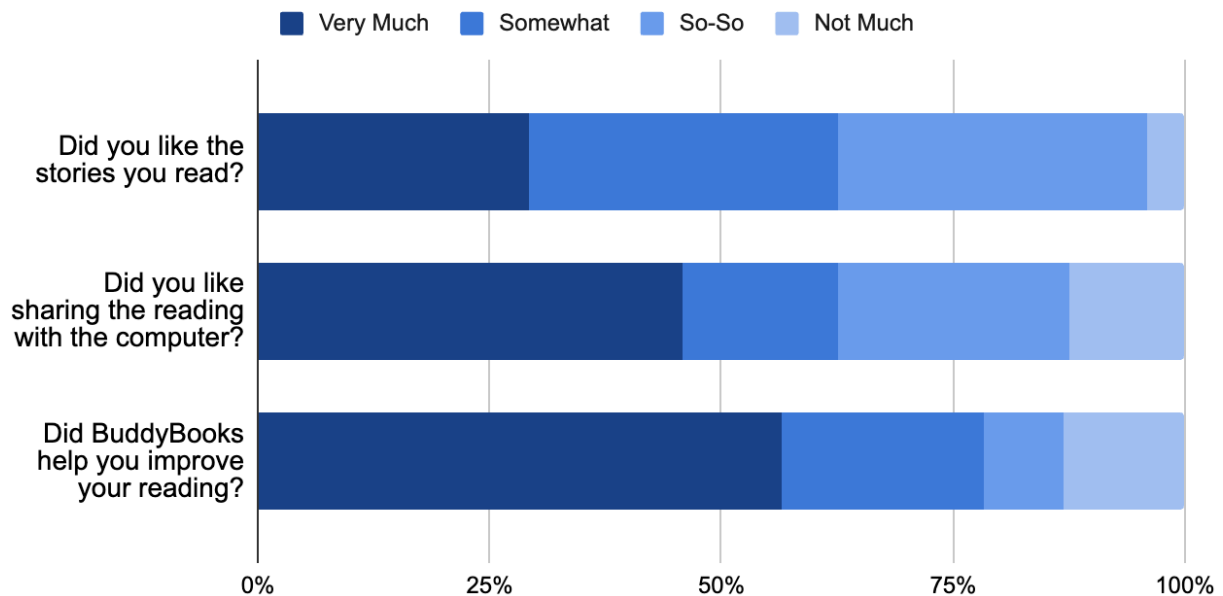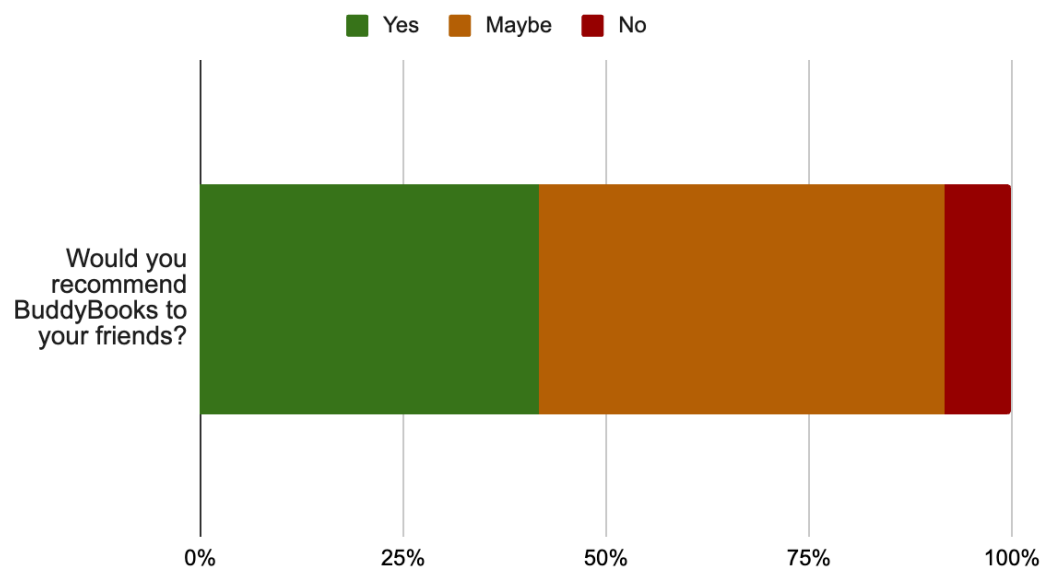## Students' report on their BuddyBooks experience n = 24

■ Very Much   ■ Somewhat   ■ So-So   ■ Not Much

Figure 6

Students' likelihood of recommending BuddyBooks n = 24

■ Yes   ■ Maybe   ■ No

Key Findings:

1. The data indicated the students' fluency, accuracy, and reading duration improved between Week 1 and Week 5 with BuddyBooks. For some students, Reading Skills improved by 1 Grade Level: As shown in the above Fluency Chart (Figure 1), the Top (green) group experienced lower improvements in fluency and accuracy. These students requested more challenging books, so we moved these students to a higher grade level book selection, as mentioned above. Hence, the book they read in Week 1 was easier than the book they read in Week 5.

2. The teachers and the director reported that BuddyBooks was relatively easy to set up, that students mostly enjoyed using BuddyBooks, that some wanted to read more, and that students' reading skills improved.

3. Students indicated they enjoyed reading with BuddyBooks, became more confident in their reading skills, and some would recommend it to their friends who struggle to read, as seen in Figure 6. Survey details are provided in Appendix C.

8. Conclusion

This study concludes that the BuddyBooks intervention has a positive impact on oral reading skills, resulting in improved fluency and accuracy. Teachers found the tool valuable for helping students become stronger readers. Students were engaged in their reading, and many wanted to read longer than the allocated reading duration. The pilot study helped developers determine which improvements needed to be made, but ultimately found that BuddyBooks was a useful tool for students who had reading delays.

9. Reference Page

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McArthur, G. M., Filardi, N., Francis, D. A., Boyes, M. E., & Badcock, N. A. (2020). Self-concept in poor readers: a systematic review and meta-analysis. *PeerJ*, *8*, e8772. https://doi.org/10.7717/peerj.8772

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Appendix A - Teacher Dashboard Screenshots

The Teacher Dashboard displays summary information for all students and detailed information for each student, such as:

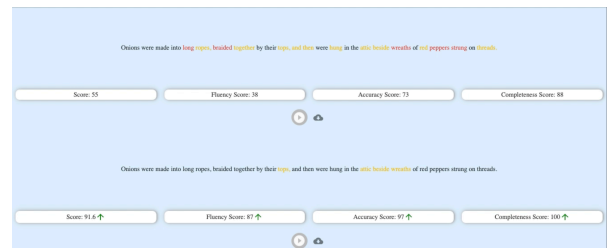|	
Last 7 days for all students Shows student name, the book they are currently reading, percent completion, reading duration for the past week and accuracy.	
Reading time for a student over the past month Green: Student read for the full assigned duration. Yellow: Student read, but not for the assigned duration. Red: Student did not read that day.	
Accuracy and Fluency For the student, shows total accuracy per day, and fluency (measured in correct words/minute) for each day. As you move the mouse across the data points on the chart, you can see details such as the date, fluency and book.	

| **Listen to a student's oral reading**

The teacher can see the before & after results of the micro-intervention, and view the fluency, accuracy and completion scores as well as listen to the student's oral reading (before & after). | Onions were made into long ropes, braided together by their tops, and then were hung in the attic beside wreaths of red peppers strung on threads.

Score: 55   Fluency Score: 38   Accuracy Score: 73   Completeness Score: 88

Onions were made into long ropes, braided together by their tops, and then were hung in the attic beside wreaths of red peppers strung on threads.

Score: 91.6 ↑   Fluency Score: 87 ↑   Accuracy Score: 97 ↑   Completeness Score: 100 ↑ |

Appendix B - Reading Levels and Books

BuddyBooks provides three configurations for individualized instruction:

- **Echo mode:** the computer speaks a sentence, highlighting each word as it speaks, and the student orally reads the same sentence. This configuration helps very early readers.
- **Sentence mode:** the computer speaks a sentence, highlighting each word as it speaks, and the student orally reads the next sentence.
- **Paragraph mode:** the computer speaks a paragraph, highlighting each line as it speaks, and the student orally reads the next paragraph.

The teachers performed base-level testing prior to starting the intervention. The reading level of the participants is shown below:

Level & Book Group	Reading Grade	Configuration / Level	Number of students
0	K-1st	Echo Mode	1
1	1st-2nd	Sentence mode (I Can Read Level 1)	1
2	2nd-3rd	Sentence mode (I Can Read Level 2)	14
3	4th-5th	Paragraph mode (I Can Read Level 3)	7
4	6th-7th	Paragraph mode (I Can Read Level 4)	3
5	7th-8th	Paragraph mode (I Can Read Level 5)	0

Based on the reading level each student was assigned, they could select from any of these books:

Level & Book Group	Books available for students during the 5 weeks
0	Nate the Great; Swim, Mo, Swim!; The Berenstain Bears - The Big Honey Hunt; Biscuit and the Little Pup; An Elephant And Piggie Biggie!; The Bear Detectives; Mia and the Too Big Tutu; One Fish, Two Fish, Red Fish, Blue Fish
1	Junie B. Jones Smells Something Fishy; Junie B. Jones Has a Monster Under Her Bed; Cam Jansen and the Summer Camp Mysteries; Frog and Toad Are Friends; Amelia Bedelia Helps Out; The One in the Middle Is the Green Kangaroo; Pete the Cat: Super Pete
2	Goosebumps: Night of the Living Dummy; Otherwise Known as Sheila the Great; Dogs Don't Tell Jokes; How to Be Cool in the Third Grade; A to Z Mysteries: The Missing Mummy; Cam Jansen: Mystery of the U.F.O.; The Stories Julian Tells; Hello, Ninja. Hello, Stage Fright!; The Girl With a Mind for Math
3	Spelling Pen in Elf Land; The Magician's Nephew; Tuesdays At The Castle; The Red Pyramid; All American Girl; Best Babysitters Ever
4	Anne of Green Gables; The Hobbit; The Detective s Club: The Case of the Missing Mascot; Who Was Martin Luther King, Jr.?; Who Was George Washington Carver?; Washed Up! ; The Grim Grotto; White Fang
5	The End; When You Grow Up To Vote; The Boy Who Harnessed The Wind; Who Was Booker T. Washington?; Across Five Aprils; The Raven; Anne Frank: The Diary of a Young Girl; Dr. Jekyll and Mr. Hyde; 1984

After a few weeks, several of the students said their books were becoming too easy, and wanted a more challenging book. Two students from Level 3 and two students from Level 4 were moved up one level.

# Students	Week 1	Week 5
2	Level 4	Level 5
2	Level 3	Level 4

Appendix C - Teacher and Student Surveys and Results

Teacher Survey:

Question
How hard was it for your organization to set up BuddyBooks for your students?
In the first week, what percent of the children who were selected to use BuddyBooks, were able to use it?
By the fifth week, what percent of the children who were selected to use BuddyBooks, were able to use it?
On average, how engaged were students in the book(s) they were reading?
On average, how much did students enjoy using BuddyBooks?
What percent of students wanted to read more than their allotted BuddyBooks time?
Did students improve their reading skills with BuddyBooks?
Would you recommend BuddyBooks to other teachers or directors?

Student Survey:

Question
Did you like the stories you read?
Did you like sharing the reading with the computer?
How hard was BuddyBooks to use in the FIRST week?
How hard was BuddyBooks to use in the LAST week?
Did BuddyBooks help you improve your reading?
Would you recommend BuddyBooks to your friends?