Motivating Struggling Readers to Mentally "Show Up" with Wonder Stories

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ABSTRACT

In the United States, a student in the 20th percentile reads books for 0.7 minutes per day, while a student in the 98th percentile reads 65 minutes per day (Cunningham & Stanovich, 1998). For the last four years, with 300 children from Title 1 schools and the Boys & Girls Club, we researched how to create digital texts that better cognitively engage struggling readers using psychophysiological sensors, eye tracking, and co-creation.

This research led to the creation of Wonder Stories. Wonder Stories' texts motivate students to critically think by immersing students in frequent, story-based questions. As a response to children's low motivations during COVID-19, we added a social competition to Wonder Stories – answering questions correctly gave points in a trivia-like game.

When struggling readers were given Wonder Stories, students mentally showed up: their participation increased, readers were more cognitively engaged with the material, and students were critically thinking about the text more often. This study suggests that interactive, question-based reading shows great promise to increasing children's participation and engagement in middle-grade reading.

I. CHALLENGE

It requires extensive practice to become skilled at an activity (Allington, 2009, 2014), putting struggling readers at a disadvantage with their lack of reading hours. According to the National Reading Panel, "Literally hundreds of correlational studies find that the best readers read the most and the poor readers read the least. These correlational studies suggest that the more children read, the better their fluency, vocabulary, and comprehension" (2000, p.12). Correspondingly, another strong predictor of reading scores is a child's engagement with reading. Reading engagement is more influential than gender, income, or ethnicity (Cox & Guthrie, 2001).

The Boys & Girls Club of Metro Denver faced the challenge that many of their students were not reading at all when they came back to the club in the middle of COVID-19. After more than six months of not being in school, the students were actively resisting reading activities.

A. Defining "showing up"

When a student shows up to reading, they have a will to learn (Covington, 1998). Students are excited and curious to start reading. The student is open to difficult challenges. A student who shows up cognitively engages with the task set before them.

A student who does not "show up" chooses not to participate if given the option. When asked to do a task, they will actively resist, do nothing, or participate minimally. In our reading setting, participating minimally often meant skipping texts and answering questions without thinking.

B. Students were not mentally showing up to read

For the last four years, Dr. Elliott Hedman has been a researcher in residence at the Boys & Girls Club of Metro Denver. There, 19.5% of students are African American and 64.5% of students are Hispanic (Omni Institute, 2015). Most of these students attend Title 1 schools and are one to two grade levels below reading.

With COVID-19, the Denver Public Schools closed down, but the Boys & Girls Club was considered essential and opened in August 2020. In addition to the research Dr. Hedman was doing, he was invited to be the new literacy teacher for the opened club.

While many teachers were struggling to motivate kids to physically show up to Zoom meetings, the Boys & Girls Club had a different problem – students were not mentally showing up in the classroom.

"Reading sucks." Those were the first words second-grade student Emanuel told Dr. Hedman as he came back to the Vickers Boys & Girls Club.

When Dr. Hedman pulled up the first reading assignment, third-grade student Adonis actively pushed against participation. He told the class he did not want to read. Others echoed Adonis's attitude. The social worker came in to help settle things down.

On that same day, Dr. Hedman worked with the fifth- and sixth-grade students. When he told the students they

were going to read, their eyes drifted back to their cell phones and computer games, ignoring him. Only one fifth-grade student read with him that first day back.

While students were physically back in the Boys & Girls Club, they were not ready to engage with reading and actively resisted reading any text.

C. Students were removed from a culture of daily reading

Many students had likely not read a book all year. They may not have books at home (Luo et al., 2020) and spent less than 1 minute per day reading (Cunningham & Stanovich, 1998).

D. Book donatitions did not change the reading culture

While at the club, Dr. Hedman brought over 100 of his own middle-grade books, with popular titles such as *Diary of a Wimpy Kid* and *Dog Man*. Throughout the course of the year, none of those books were read; all stayed in the storage bin.

The Boys & Girls Club also received a large donation of hundreds of new books with diverse main characters during COVID-19. Those books sat on the pool table unread as well. The high school students received a collection of the first book in the Harry Potter series, which never left the plastic wrapping. Access to physical books by itself did not solve the "showing up" problem, as reading was not motivating.

E. Addressing the "showing up" problem

While there is literature on the importance of motivation, research on how to motivate students in reading is still lacking (Guthrie, 2004). Providing texts students are interested in (Cox & Guthrie, 2001) and providing students choice (Worthy & McKool, 1996) are two main strategies for engaging readers. Top digital reading tools today emphasize the abundance of literature students can choose from: Epic's front page announces it has 40,000 books, myON has 6,000. With this many books, students are given an abundance of choice and books within their interests. Yet, like Harry Potter in plastic wrap, for many students, having access to books of interest is not enough to motivate them to "show up" and become engaged readers.

Our research and co-creation went beyond choice and topic. How could we redesign the actual experience of reading to motivate children?

In the last six months, we worked with 50 students, most of them behind in reading, not wanting to show up. This lack of motivation was likely due, in part, to students not having exposure to physical book reading for more than six months. When schools once again open in person, we believe other teachers will experience our same challenge of students not wanting to "show up" to reading.

II. Methods

Over the last four years, we have conducted research with over 300 kids at the Boys & Girls Club of Metro Denver and Title 1 schools, exploring how to make digital reading a more engaging experience. For this year, with reduced class sizes due to COVID-19, we worked with a smaller set of 50 students.

We asked participating students to read digital prototypes. We observed children's behaviors with both screen recording and digital eye tracking (Tobii Technology AB, Sweden). In some cases (before COVID-19), we asked readers to wear psychophysiological sensors to monitor their emotional engagement (see Hedman, 2014).

After each session, we interviewed children about their reading experience and how the experience could be improved.

We used a design-based research method to improve students' motivation (Cobb et al., 2003). Based on student feedback, we would make improvements to the reading app and show students the updated version the following week. Through the four years, this reading prototype has been iterated on over 60 times, and we are still iterating on it.

With COVID-19, our research methodology was modified. Since Dr. Hedman was teaching reading to the Boys & Girls Club, interviews were done in class and observations were made live. Iterations were still done to the product, but changes were made primarily to help children better "show up" to their reading lessons.

A. Description of intervention

Below is a description of the most recent reading intervention we used during most of COVID-19.

Wonder Stories are short stories that are approximately 300 words in length. Each page has one to three sentences. Stories are presented as mysteries with "big problems." The major difference between typical stories and Wonder Stories is that there are many questions interspersed throughout the text, typically around seven questions in a 300-word story. These questions are critical to the plot and require deduction and inferential thinking. For example, "Dr. Llama can't see anything because she is _____ (too far away)" or "To help Glomper, Dr. Llama brings back _____ (binoculars)."
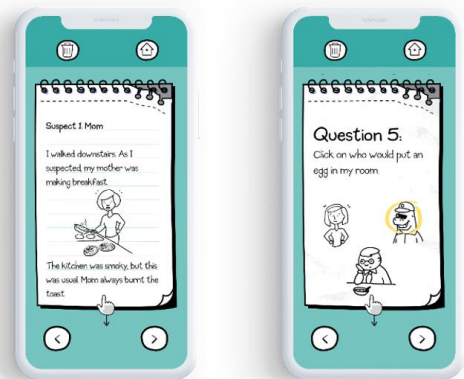

Fig. 1: *Example of Wonder Story format*

Partway through our research during COVID-19, we noticed that some children were resistant to reading even with interactive text. We created new prototypes to add in social motivators to Wonder Stories.

For our early prototypes, we integrated Wonder Stories with Kahoot! In Kahoot!, when children answer questions correctly, they receive points and are ranked against one another. We tied Kahoot! points to each question as children read.

You can download and view our Wonder Stories app at www.wonderstories.app.

You can see an example of the Kahoot! and Wonder Story prototype here:

https://create.kahoot.it/share/glomper-goes-to-the-dentist/3c213a63-8766-4d95-becb-2a4e8756c950

You can access all of our Kahoot! prototypes by looking for the username "WonderStory" in Kahoot!

Throughout the year, students read 60 different Wonder Stories. Kindergarten to third-grade students read as a group, taking turns reading off of the projector. The fourth-grade students alternated reading as a group and individually, and the sixth- and seventh-graders read individually. Reading material was at a second- to fourth-grade reading level.

Depending on the homeroom teacher, some classes offered a prize for the first- and second-place students. The fifth- and sixth-grade students' performance was tied to Classcraft rewards.

III. RESULTS

A. Increased academic participation

Within three weeks, all students were reading Wonder Stories daily, without protest (except for two, which we will discuss later). Some students began asking the teacher in the hallway, "When are we going to play Wonder Stories again?" Other students asked to read another story after the 30-minute reading period was over. Students would already be logged into Kahoot! ready to play before Dr. Hedman arrived at the classroom. On three separate occasions, parents came to pick up students and the students asked their parents to wait so they could finish Wonder Stories.

Wonder Stories worked particularly well for children who struggled with reading in school. As the fifth-grade student Davies said in class, "I don't know what it is, but normally during school I just drift off. But with Wonder Stories, it is really easy for me to pay attention."

With Wonder Stories, we started with students who hated reading and created a way to encourage students to mentally show up and participate.

B. Increased academic engagement

In addition to observing children participating, we observed an increased level of academic engagement as well. Typically during reading questions, observed students do not put effort into their tasks. During the Accelerated Reading STAR test that students are required to take each semester, we observed most students randomly selecting answers and skipping reading – the test had no meaning for them, and they did not "show up."

The competition feature added importance to each question in Wonder Stories. Consequentially, students cared about comprehension and answering correctly. Students asked the teacher or one another for "hints" on questions. When students answered questions correctly, there was often a verbal celebration or a fist pump. Sometimes students would restart the reading assignment once they answered a few questions wrong.

One particularly struggling fifth-grade student, Kaseem, asked if he could read with the teacher or the top student to make sure he got every question right.

When a correct answer felt wrong, students would point it out and argue with the teacher why they felt it was correct: "There is no way you can put a costume on a fish!"

In addition, Wonder Stories made it easier to help students. Dr. Hedman would tell struggling students, "Let me read with you. I want to make sure you get the next question right."

Similarly, some struggling readers were in the habit of skipping past all of the text, a behavior we have observed many times with eye tracking. We were able to tell these fast readers, "If you skip past the text, it is going to be really hard to get the question right," making the conversation more positive and helpful.

Students not only participated in reading but were cognitively engaged with the texts they were reading, working hard to comprehend the text.

C. Increased comprehension and critical thinking skills

The goal of teaching reading is not only to help children with phonics and fluency but build their higher-level skill of comprehension as well (Oakhill & Cain, 2007). Wonder Stories includes a comprehension question about every 40 words. Children are asked to make a model of what they read and make an inference based off of that model. This inference-making is regarded as a high-level skill (Kintsch, 1994) that often is not developed until third grade (Paris & Lindauer, 1976; Paris, Lindauer, & Cox, 1977). But with Wonder Stories, inferential questions are part of the process for all grades. The ability to make inferences is a strong predictor of overall reading comprehension across multiple studies (Cain & Oakhill, 1999; Cain, Oakhill, & Elbro, 2003; Cain, Oakhill, & Lemmon, 2004).

The kindergarten to third-grade students often scored as well or better on the comprehension questions than their older peers, suggesting that young children were able to work on higher-level comprehension skills within the Wonder Stories setting.

Book Title	Average Reading Score		
	K - 3rd	4th	5th - 6th
Slippery Soccer Field	80%	83%	72%
The Birthday Surprise	85%	84%	84%
Toothpaste Cookies	83%	85%	82%
The Shoe House	81%	82%	75%

Table 1: *Students' comprehension scores on select stories*

With inquiry-based reading, children across grades were applying critical thinking skills and showing high levels of comprehension.

D. Questions motivate

During our early prototypes and testing, children often drifted off during the reading sessions. However, when questions occurred, readers would become much more engaged and attentive. As an example, here is the psychophysiological data of a third-grade English language learner at the Boys & Girls Club reading *Doctor Dolittle*.
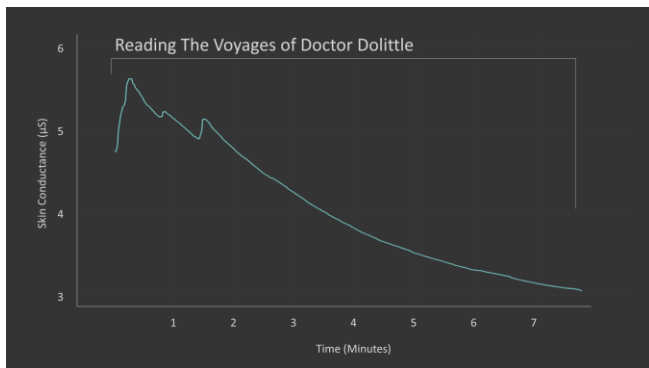

Fig. 2: *Skin conductance of a third-grade reader*

The above graph shows the student's skin conductance, a marker of psychophysiological arousal. When the graph spikes up (like at the beginning), those are moments where the student is likely engaging. When there are no spikes in skin conductance, these are moments where the reader is likely disengaging from the text.

In this example, the student drifted off while reading *Doctor Dolittle* for less than eight minutes. When the researchers ended the session, they noted a big glob of drool on the front page.

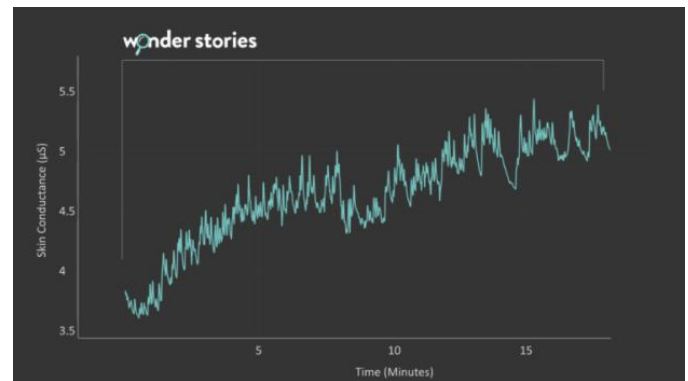During this same testing session, the student read a Wonder Story.

Fig. 3: *Skin conductance of student reading Wonder Stories*

Reading Wonder Stories, there is a substantial increase in the number of skin conductance spikes. The student answered every comprehension question correctly and reported that reading the story "was almost as fun as math."

In all of our research, we noticed a similar trend that interactive questions were a strong foundation for engagement and attention. Here is a zoomed-in skin conductance of another reader, reading a digital text with questions interspersed:
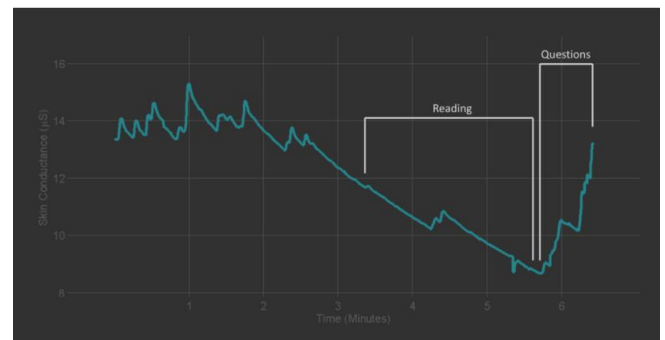

Fig. 4: *Skin conductance increases with questions*

Notice how reading itself fails to engage the reader but the question afterward increases his engagement substantially on its own.

With our eye tracking glasses, we noticed a similar trend. Children would skip past the reading consistently, speeding to the question, but would then read the question multiple times.

E. Social competition enhances readers' motivation

While questions were a strong motivator in our one-on-one tests, questions alone were typically not enough to motivate the class.

After trying a few different modifications, children's reading motivations substantially increased when we combined Kahoot! and Wonder Stories. When the social competition was added to the questions, students cared much more about answering correctly, an important factor to engagement (Hedman, Zanchi, Hedman, 2018).

It was only after Kahoot! was integrated with Wonder Stories that we started to see the participation behaviors of asking to play more and asking for help. Previous research suggests that social connections can play an important role in motivation (see Cooc & Kim, 2017; Barron,2006; Olivera & Strauss, 2004).

We believe this increase in motivation is in part due to where children are developmentally in terms of defining success. Students need support and belief in their competence to gain motivation (Ryan and Deci, 200). Starting as early as second grade, children begin defining their skill level in comparison to others (Ruble et al., 1980). Social comparison theory posits it is difficult to see oneself as "good at reading" without comparing oneself to another person (Festinger, 1954).

As an example, Malachi, a second-grade student, was one of our most reluctant readers, putting up strong resistance each day we taught. He refused to play Kahoot! or Wonder Stories at first. A few times, he did agree to play, and in one of those times he scored in the top three. At the end, he exclaimed, "I got in the top three!" This pride generated enthusiasm and confidence for future rounds. He started asking if he could read pages, so much so that we now are working with him on giving other children a chance to read out loud. After his first success, Malachi is now willing to read Wonder Stories with us.

A similar story occurred with the fourth-grade student Athena, who often scored last in the Kahoot! game. One day the teacher asked to read together with Athena and helped her think through each question. Athena earned second that day and was more enthusiastic to read the following days.

Adding a social competition to comprehension questions is a strong way to make correctly answering questions important and build reader confidence.

F. Keeping story length short sustains motivation

Most of the Wonder Stories we read are 300 to 600 words, designed to be read in less than 15 minutes. Originally, we started with longer stories that were about 1,200 words and took 20 or more minutes to read. For many of the readers, these long stories took too long. Partway through these long stories, children would start fidgeting, talking with each other, or stop participating. The kindergarten student James would consistently tell us after about 300 words, "I'm going to stop reading now."

We started providing texts shorter than 300 words, and students were able to sustain attention. Readers stopped asking, "How many more pages?" No student has complained about the stories being too short.

Social competition also created a problem for longer stories. Sometimes students would answer two to three questions wrong and know they were not going to win. In a short story, by the time they realize that, they only have one or two questions left to finish up. In the long stories, they may have to endure 20 or more minutes of reading, already feeling like they lost. (We may be able to add better game mechanics in the future to address this, like double points.)

Another benefit of shorter stories is that we are able to read more of them. We now typically read two to three stories in a 30-minute session. The new stories and restarted competition refresh students' attention span. Additionally, having multiple stories gives more students a chance to win.

IV. LIMITATIONS

A. How can we better use social competition to enhance motivation?

At the beginning of this study, social competition was not something we seriously considered, but it became increasingly important for improving motivation. We were limited by the scope of what Kahoot! could do and believe that there are many more ways of bringing competition into reading.

While many of the students, especially the boys, were motivated by competing with their peers, others were intimidated by the social competition aspect. Olivia, a proficient first-grade reader, often asked not to play. One time she hid behind a plant so the teacher would not call on her to play. For Olivia, we believe she needed a way to contribute without being judged.

Kaseem, in fifth grade, struggled with failure. As soon as he answered a problem wrong, he would quit, sometimes even acting out to the point the social worker would need to intervene. One day Kaseem partnered with Asha, the top performing reader. The partnership worked well, as Kaseem was able to answer all of the problems right with Asha's help.

Social competition is not always better for all students. Future research should look into how social competition can better celebrate struggling students. How can competition be across groups rather than within groups to better encourage collaboration? How can students stay engaged after getting a problem wrong? What other interventions work for children who do not like social competition?

B. External factors and teachers still matter

With COVID-19, things were often in flux at the Boys & Girls Club. Multiple times, classes would have a new homeroom teacher. On new teacher days, students would often push boundaries more, taking out their cell phones or intentionally skipping through readings.

For the fifth- and sixth-grade classes, students were much more likely to read and participate when prizes were incorporated with Classcraft. Having clear rewards and structures tied to getting in the "Top 3" had a strong effect.

Future studies should take into consideration the external factors in reading that help increase student participation. While interactive reading increases participation and engagement, classroom structure and management still play an important role.

C. How can interactive reading enhance longer texts?

A key strategy of our intervention was limiting reading to five- to 10-minute short stories. As kids progress, they will be expected to engage with reading for much longer periods. How can questions and social competition engage students for longer periods of time? How can interactive reading work for a chapter book?

V. Conclusion

Co-creating with over 300 students across four years, we set out to redesign books to help readers show up to reading. With psychophysiological sensors, eye tracking, and ethnographic methods, we created Wonder Stories. Wonder Stories provided frequent, story-based questions; added social competition; and provided short stories. For many students who were not normally motivated to read, Wonder Stories did motivate them to show up to reading and cognitively engage. Interactive, question-based reading shows great promise to increase children's participation and engagement in middle-grade reading.

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