# The Effect of Individualized Font Formats on Reading Speed and Comprehension for Students in Grades 3-5

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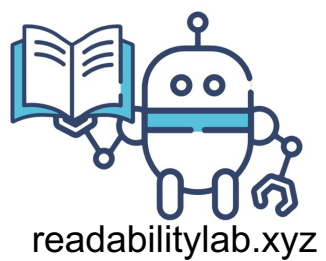
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Background

- **Format readability** includes the visual attributes of digital text such as font, font size, and character width and spacing. Format readability
  - is different than *content readability.*
  - shows sizable individual differences.
    -Wallace et al., 2020
- Adults have 'better' and 'worse' fonts, and between them reading speed can vary 35%, while reading comprehension does not vary.
    -Wallace et al., 2022
  - Common fonts which '**clash**' with individual needs are therefore an invisible cost.
- Digital reading technologies offer a unique opportunity to tailor format readability to individuals.
  - a 'format readability prescription' could displays documents in formats which '**fit**' individual reader needs.
    -Cai et al., 2022
- It is not clear how format readability can support reading for children.
  - More research is needed.

Research Questions

- Do **format readability** gains seen in adults generalize to children?

- Are **methods used** with adult populations appropriate for use with children?

Procedure

- 60 students participated in six 3rd-5th grade classrooms.

- Grade-leveled passages were utilized into the VRL readability tests (above) was taken in-classroom.
  - The test was administered through our online portal
  - See screenshots above

- Students and teachers completed exit feedback surveys. Secondary test data was collected from the school district.

The Virtual Readability Lab (VRL) Test

There was once a Prince who wished to marry a Princess; but then she must be a real Princess. He travelled all over the world in hopes of finding such a lady; but there was always something wrong. Princesses he found in plenty; but whether they were real Princesses it was impossible for him to decide, for now one thing, now another, seemed to him not quite right about the ladies. At last, he returned

Readability - Comprehension Questions

Who was at the Prince's palace door?
- ○ The gardener
- ○ The royal mailman
- ○ A self-proclaimed princess
- ○ His best friend

What led the Prince to search for a princess?
- ○ All his friends are getting married
- ○ He will not be able to be king if he doesn't get married soon.
- ○ It is his wish
- ○ His parents are forcing him to

What is the main idea of the passage?
- ○ The Queen doesn't believe the girl is a real princess.
- ○ The Prince who is searching for a princess has one arrive at his doorstep
- ○ The Prince is in search of someone to sleep on a tower of mattresses
- ○ The Princess did not sleep well because of all the stacked beds

👍 Please answer the above questions

Progress for Reading Round 2 of 12

"Do you really live by the river? What a jolly life!" "By it and with it and on it and in it," said the Rat. "It's brother and sister to me, and aunts, and company, and food and drink, and (naturally) washing. It's my world, and I don't want any other. What it hasn't got is not worth having, and what it doesn't know is not worth knowing. Lord! the times we've had together! Whether

Font manipulation:
Students read passages sets across 8 fonts:

Arial	Example
Times	Example
Poppins	Example
Roboto	**Example**
Open Sans	Example
Source Serif Pro	Example
Georgia	Example
Merriweather	Example

Spacing manipulation:
In their best-performing font students read passages in narrow, normal, and wide spacing, followed by comprehension questions.

comprehension questions.

Try the adult test at **readabilitylab.xyz**

Results

- Reading speed increases are significant.
  - Comprehension is stable, suggesting that children are not trading it for speed.
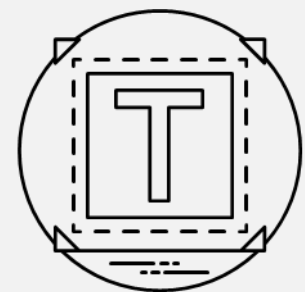
	Mean	SD
Speed (WPM): Font Fit	**451.40**	443.50
Speed (WPM): Font Clash	**152.66**	71.92
Comprehension: Font Fit	**0.56**	0.34
Comprehension: Font Clash	**0.61**	0.32

- VRL comprehension questions validate against the district-administered NWEA MAP Growth reading test. RIT Score was significantly related to overall comprehension scores on the VRL assessment. HLM results shows that better reading skills were associated with higher performance on the VRL comprehension questions.

Fixed Effect	Coeff.	S.E.	T-ratio	d.f.	p-value
Speed (WPM) Font Fit					
Speed (WPM) Font Clash	**2.19**	.996	**2.20**	29	.036
VRL Comp. %					
NWEA MAP RIT Score	**.01**	.01	**9.97**	29	<.001

Results (continued)

- **Methods used** resulted in means that are in-line with similar reported child reading speeds.
  - Max WPM rates contained some high values.
  - Children are much more variable than adults in terms of reading speed.
  - Follow-up work with confirmatory measures of reading speed is needed.

	Min	Max	Average
Mean WPM	97.98	1391.57	303.38

- Our methods for adults may translate to children, however more research will be needed to understand this effect and stability over time.

Discussion

- Children can potentially benefit from **format readability**.
  - Longitudinal work is needed.

- Utility of reading speed gain in children is unclear.

- Refined methods and analysis for comprehension is necessary in order to understanding how formats influence reading in children.

- In learning and training, format readability may provide lasting 'trajectory' impacts.

- **Future Questions and Directions:**
  - How do we best identify a child's format readability fits? Their clashes?
  - With a larger and more diverse population, are AI approaches possible?
  - How stable are the impact of formats on child reading over longer periods of time?
  - What aspects of format readability beyond font improve speed and/or comprehension?
  - Can we impact other reading outcomes? Engagement, enjoyment, immersion?

- All tools and passages used in this work will be released openly.

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