

Exploring Reading Speed Profiles in EFL Extensive Reading

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Abstract: Extensive Reading (ER) is recognized for enhancing English proficiency in EFL learners. Although understanding speed is essential for analyzing reading behavior, limited research has focused specifically on reading speed during ER sessions. This study addresses this issue by analyzing log data from junior high school students engaged in ER activities. Using agglomerative hierarchical clustering, we identified four distinct reading profiles based on Word Per Minute (WPM) changes. Future studies should further explore the impact of these profiles on the effectiveness of ER.

Keywords: Extensive Reading, English as foreign language, Reading Speed, Word per minutes

1. Introduction

Extensive Reading (ER) plays a crucial role in enhancing English proficiency for learners of English as a Foreign Language (EFL) by increasing their exposure to English texts (Day et al., 1998; AI, 2018). According to the top ten principles outlined by Day and Bamford (2002), reading with pleasure and reading materials as much as possible is important for ER, and it mentioned reading speed; reading speed is usually faster rather than slower. Understanding reading speed is essential for analyzing reading behavior (Huang & Liang, 2015). Variations in reading speed can occur due to multiple factors, including text difficulty, reader motivation, and the reading strategies employed (Chang & Millet, 2017; Soysal, 2022; Dyson & Haselgrove, 2000). Despite this, research on reading speed during ER sessions is limited. Therefore, understanding reading behavior through reading speed is crucial for optimizing ER strategies.

This study investigates the patterns in reading speed changes among EFL learners using student user logs in an e-book reader system called BookRoll (Ogata et al., 2015).

Our research question is: Are there identifiable patterns in the changing reading speeds during ER activity?

2. Method

2.1 Learning context and dataset

To measure reading speed, we adopted Words Per Minute (WPM) (Chang, 2010). Data were collected from a junior high school in Japan with 240 seventh-grade and eighth-grade students participating in ER activities from June to July 2022 conducted on BookRoll by Takii et al. (2022). We selected 8 books with the most student actions like "PREV," "NEXT," "OPEN," "CLOSE," and "PAGE_JUMP." To calculate stay time on each page, we subtracted the timestamp of the "NEXT," "PREV," "PAGE_JUMP," or "CLOSE" from the timestamp of the previous page's action. WPM was then calculated as the stay time per the number of

words on that page. Finally, the dataset contains 8 books and 145 students. student action logs, resulting in 145 students and 449 data points.

2.2 Analysis

We modeled reading behavior as WPM at each page and conducted agglomerative hierarchical clustering with Ward's method and dynamic time warping for distance calculation to detect reading profiles (Ward, 1963). We compared WPM between consecutive pages, assigning labels based on WPM changes to simplify the analysis. Table 1 shows the statistics of the dataset and books.

Table 1. *means and SDs of the dataset and books*

	mean	standard deviation
WPM(wpm)	160.42	284.56
stay time per page(seconds)	30.30	49.50
number of words per page(words)	31.93	11.42

Labels were assigned as follows:

- A label of 3 or -3 for changes exceeding 1000 WPM, indicating that the student might be flipping pages (Carver, 1977, 1984; Harris & Sipay, 1990). A change of this magnitude suggests a shift from reading to flipping pages.
- A label of 2 or -2 for changes over 100 WPM, reflecting a significant increase or decrease in reading speed (Iwahori, 2008).
- A label of 1 or -1 for changes between 50 and 100 WPM, suggesting the reader slowed down for comprehension or started skimming (Chang & Millett, 2017; Dyson and Haselgrove, 2001; Hewitt et al., 2007).
- Label 0 for changes less than 50 WPM, indicating consistent speed.

3. Discussion and Conclusion

Fig.1 presents the WPM changing in each cluster, where a row represents the WPM changes of a student on the pages of a book. We identified the reading characteristics for each cluster as follows:

- Cluster1 - slight declining reading: This profile shows a slight decrease in WPM change on a page, with no major changes afterward. Decrease in WPM might be due to challenging vocabulary, grammar, or story complexity (Chang & Millett, 2017). Despite these slowdowns, students seem to generally maintain their interest and motivation in the material.
- Cluster2 – change pace reading: These readers exhibit multiple WPM fluctuations, indicating possibility of potential issues with concentration or engagement. These fluctuations may indicate a lack of concentration on reading, as the reader may only turn the pages page by page, look at the pages briefly, or return to reading the text. Reading speed changes may result from uninteresting content, difficult vocabulary, or complex material. Such profiles may benefit from alternative materials to enhance reading effectiveness.
- Cluster3 – consistent pace reading: Reading behavior in this cluster shows minimal WPM changes, indicating consistent reading pace. This suggests good understanding and sustained interest in the material.
- Cluster4 – slight accelerating reading: This profile is characterized by slight increases in WPM on specific pages, with no major changes afterward likely due to techniques like skimming or increased motivation. It is assumed that effective use of these techniques helps improve reading speed while still understanding the content. Increased motivation and immersion in the story also contribute to a faster reading experience (Barber & Klauda, 2020).

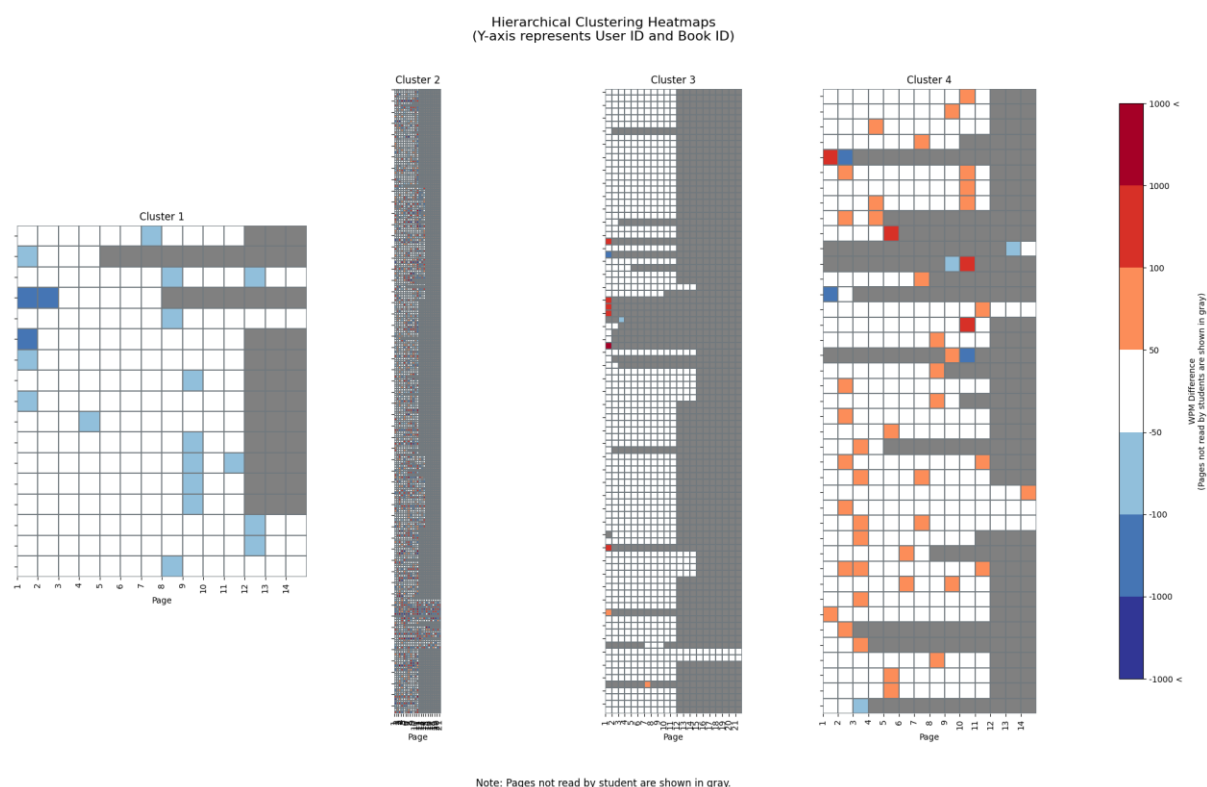


Figure 1 Four clusters of reading speed change, indicative reading profiles

These four clusters revealed different characteristics of reading behaviors in ER. Future research should continue to explore how these profiles impact ER effectiveness to optimize instructional approaches.

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