Exploring the Impact of Reading Speed on Learning Outcomes in an Introductory Statistics Course

Introduction

This report analyzes data collected from 1,625 students across 48 college-level introductory statistics and data science classes. The data provided by CourseKata includes information on student interactions with textbook pages, responses to questions, and engagement with videos. The objective is to investigate the relationship between reading speed and learning outcomes, both short-term (based on page questions) and long-term (based on end-of-chapter review questions).

Methodology

In our methodology, we initiated our analysis by converting NA values to NULL using NumPy to preserve data integrity and ensure accuracy. We analyze each student's first attempt on each question to assess their initial performance accurately.

For data transformation and analysis, we applied a logarithmic transformation to normalize the distribution of total engagement time per student per page. We then categorized students into fast, medium, and slow groups based on their total reading time ratio to the number of unique pages read. We divided these groups using equal frequency grouping at the 33rd, 66th, and 100th percentiles. Using SQL, we merged data from these first attempts with response data, allowing us to calculate the total points earned versus the possible points for both regular and review questions, further enriching our analysis framework.

Results

Our study found that slower readers generally achieved higher short-term correctness rates, but average readers exhibited the highest long-term correctness rates, particularly in end-of-chapter review questions. The impact of reading speed varied by question type, with multiple-choice questions showing similar correctness rates across all reading speeds, while short text and code categories favoured faster readers. Cloze association questions had comparable correctness rates, and medium readers outperformed others in the choice matrix category.

The density heatmaps reveal a positive correlation between student correction rates on average pages and review questions. The existing data shows a concentration of higher correction rates for review questions corresponding with moderate to high correction rates for typical questions. The new data displays a more significant correlation, suggesting an improvement in the consistency of student performance.

Conclusion

This study highlights the importance of students' initial understanding of material for long-term educational success. Students who demonstrate a firm grasp of concepts in their first attempts at average questions tend to perform better in subsequent review questions. Educators should focus on helping students build a solid foundation of understanding early in the learning process, as this may lead to improved outcomes.

Further research is needed to explore this relationship across different subjects and contexts and to identify strategies for promoting mastery of foundational concepts. By prioritizing the development of strong foundational knowledge, educators can help students build the necessary framework for long-term academic success.