

## THE EFFECT OF WORD LENGTH ON ITS RECOGNITION AMONG CHILDREN WITH DIFFERENT READING SPEED LEVELS

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### Abstract

When acquiring reading skills, a child must be able to decode the visual properties that characterize each letter, as well as the letters and written words as a whole. Phonological encoding enables recognition and construction of the sound structure of written symbols and word as a whole (Vellutino et al., 2004). When reading unfamiliar words, they are initially processed sequentially, letter by letter or syllable by syllable, through phonological processing. To successfully recognize a word, at least 10–20 ms is required for the perception and identification of each letter. This word recognition model is primarily used when attempting to recognize an unfamiliar or new word or when learning to read. In contrast, an experienced reader uses their accumulated knowledge of word forms, vocabulary, and meaning, processing graphemes in parallel through lexical processing (Coltheart et al., 2001). The main aim of the study was to investigate how word length affects its recognition in different groups of readers, categorized by their reading speed. Twenty-eight second-grade and twenty-seven third-grade children completed a word recognition test with 105 words of varying length and phonetic complexity, selected by the school speech therapist based on consonant cluster properties. The words consisted of 4-10 letters. For each word length, 15 words were presented in random order for 533 ms each. The analysis used the percentage of correctly answered words for each corresponding word length. Based on reading speed, the second-grade children were divided into two groups: one with an average reading speed of  $50 \pm 5$  wpm ( $n=14$ ) and the other with an average reading speed of  $78 \pm 4$  wpm ( $n=14$ ). The third-grade children were divided into a group with an average reading speed of  $67 \pm 7$  wpm ( $n=13$ ) and a group with an average of  $113 \pm 6$  wpm ( $n=14$ ). The results indicate that word length affects word recognition accuracy. This relationship is described by linear regression analysis. A more significant relationship is observed in the slower-reading groups. The slope coefficients of the relationship differ significantly between faster and slower readers - in the second-grade group ( $p < 0.012$ ), and in the third-grade group ( $p < 0.001$ ).

**Keywords:** *Reading speed, word recognition, school-age children.*

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### 1. Introduction

In Latvia approximately 15-20% of school-aged children are with reading difficulties (Tūbele, 2006). Recent studies suggest that the proportion of children with reading difficulties may reach as high as 28% of the child population (Serpa et al., 2023). There are many neural processes which participate in text decoding during reading such as processing rate, verbal short-term memory, phonological processing and visual processing, word identification, word memory and text comprehension (Laycock et al., 2006). Research indicates that a child's vocabulary at the age of 4-5 plays a crucial role in the initial stage of literacy acquisition. i.e., the larger the child's vocabulary, the more successful the literacy acquisition will be, and the child will be a more successful reader when starting school (Dickinson et al., 2019).

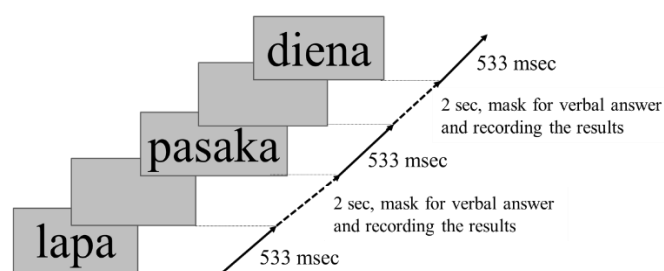
Scientists argue that reading a text for the second time offers a different experience. During the first reading, attention is focused on events and stories. However, during the second reading, emotions are rekindled, providing a deeper emotional benefit (Gibson & Gibson, 1955; Nazir et al., 2004). The aim of the study was to determine differences in visual word recognition for different length words shown in a short interval of time for children with different reading speed levels and to evaluate perceptual learning effect with repetition using long term and short-term memory.

### 2. Design and methods

Fifty-five children took part in the study. Thirteen children in Grade 3 (9-10 years old) and fourteen children in Grade 2 (8-9 years old) had a reading speed less than average in class, in Grade 3  $91 \pm 6$  wpm,

in Grade 2  $62 \pm 3$  wpm. These groups will be called children with lower word recognition speed, others - children with higher word recognition speed. The length of the words varied from four to ten letters. Each word length appeared 15 times in the 105-word stimulus set, with each word displayed on a computer for 533 ms. The answers were expected verbally and correctly/incorrectly named words were recorded (2 s) (Figure 1). Letter size corresponded to 6cycles/degree. Word samples for this research were selected by the school speech therapist. The approximate duration per child for one test session was 11 minutes. The test was repeated three times: the first for immediate recall, the second after 1–2 weeks to assess long-term memory, and the third to evaluate short-term memory. A short break is provided between the second and third session to allow for rest and maintain focus. The word samples stay equal for all three times.

Figure 1. Schematic slide show on monitor center with variable word length and mask between them.

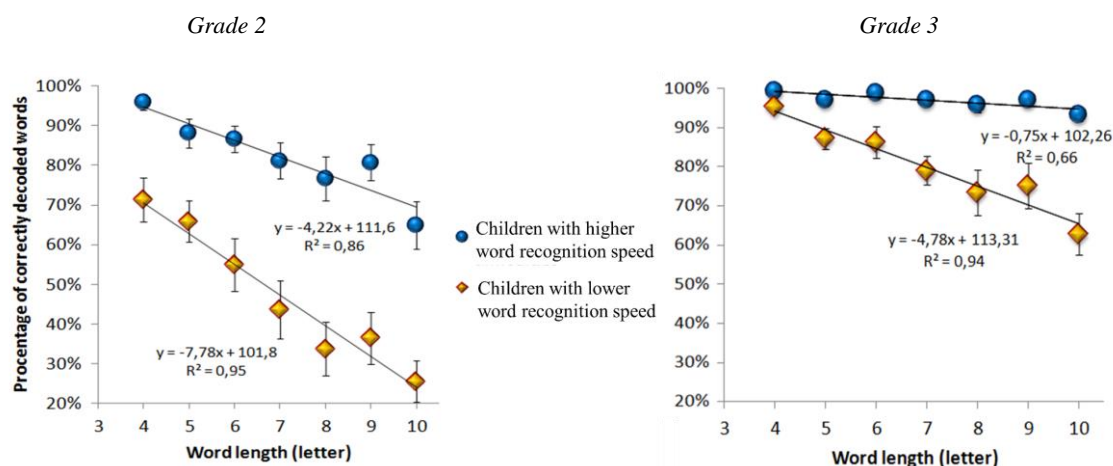


### 3. Results

Based on mean reading speed, the second-grade children were divided into two groups: one with an average reading speed of  $50 \pm 5$  wpm ( $n=14$ ) and the other with an average reading speed of  $78 \pm 4$  wpm ( $n=14$ ). The third-grade children were divided into a group with an average reading speed of  $67 \pm 7$  wpm ( $n=13$ ) and a group with an average of  $113 \pm 6$  wpm ( $n=14$ ).

Average data of correctly named words for children with different reading speed differed significantly ( $p < 0.05$ ; Welch's t-test) in both groups for all word lengths (Figure 2). When comparing the effect between word length and the percentage of correctly decoded words, the linear regression slope coefficients are substantially different between the different reader groups and the age groups ( $p < 0.05$ ), except for group with higher word recognition speed in Grade 2 and group with lower word reading recognition speed in Grade 3 the difference is not significant ( $p = 0.64$ ).

Figure 2. The effect of word length on its recognition among children with different reading speed levels at Grade 2 and Grade 3 in Latvia.



Two weeks after the first measurement, a repeated measurement was conducted to assess long-term memory in groups with reduced reading speed. In Grade 2 ( $n=14$ ), the slope coefficient for the first measurement was  $-7.77$ , while the second measurement showed a slope coefficient of  $-8.08$ , indicating a strong correlation and a trend towards a 10% improvement in word recognition. Comparing the first and the second measurements, recognition for 4-letter words improved from  $71.37 \pm 5.51\%$  to  $83.53 \pm 6.16\%$ , and for 9-letter words, it increased from  $36.47 \pm 6.52\%$  to  $47.84 \pm 7.33\%$ . All word groups showed an upward trend, indicating improved word recognition. In Grade 3 ( $n=13$ ), the slope coefficient for the first

measurement was -4.78, and the second measurement showed -3.99, with the greatest improvement for 10-letter words (from  $62.86 \pm 5.26\%$  to  $72.38 \pm 5.45\%$ ).

For short-term memory in Grade 2 students with slower reading speeds, the slope coefficient for the second measurement was -8.08, and the third measurement was -7.47, with a notable improvement in longer word groups, especially 8-letter words (+10.58%). A similar trend was observed in Grade 3 students with slower reading speeds, with slope coefficients of -3.99 and -2.64.

#### 4. Discussion and conclusion

The study confirms that children with reduced reading speed decode words more slowly than children with above-average reading speed. This could be explained by the fact that these children have different reading patterns – non lexical route, but the graphemes of a word are decoded into phonemes one- by-one, in serial way (Martens & De Jong, 2006). The results also indicate that word recognition improves with age and lexical experience, with differences in processing speed and attention between age groups. For example, in Grade 2, faster readers had a recognition rate of  $95.93 \pm 1.95\%$  for 4-letter words, while Grade 3 students with faster reading speeds achieved  $99.3 \pm 0.48\%$ . For slower readers, Grade 2 students recognized  $25.49 \pm 5.15\%$  of 10-letter words, whereas Grade 3 students recognized  $62.86 \pm 5.26\%$ , with a statistically significant difference ( $p < 0.05$ ). Repeated training for both short-term and long-term memory showed similar slope coefficients, with no significant differences. However, a consistent trend in word recognition improvement was observed. These findings suggest that the method of repeated word presentation and tasks to recognize them can be effectively utilized to enhance word recognition and facilitate word integration into a child's lexicon, for both short-term and long-term memory. It is already known that exercises aimed at improving phonemic awareness and decoding skills can significantly enhance not only overall reading accuracy and comprehension but also spelling abilities (Forné et al, 2022).

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