READING MISCUES AND SELF-REPAIRS DURING ORAL READING IN CHILDREN IN 3RD, 4TH, AND 5TH GRADE – A PILOT STUDY

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Abstract

The study analyses the relationships between reading miscues, self-repairs, and temporal characteristics in oral reading of children in 3rd, 4th, and 5th grades. Speech samples of 30 children were analysed from each of the GABI Speech Database. 10 children were selected from the three grades. Speech and articulation rates, pausing characteristics, frequency of reading miscues, and correction strategies and their durational patterns (error-to-cutoff time, editing phases, and error-to-repair time) were analysed.

Results show that although older children produce faster speech rates and less disfluencies and oral reading errors than younger children, the types and correction times of reading errors are similar in every age group. Results show great differences among the children independently of grade.

Results confirm the facts established by the prior literature while also providing new results on the types of reading miscues and the timing of error-repairs in oral reading. They also have pedagogical implications.

Keywords: oral reading, grade, reading miscue, self-repair, speech tempo

1. Introduction

The analysis of oral reading errors is very important in elementary age since oral reading fluency and tempo are main measuring tools of reading ability (e.g. Fuchs et al. 2001; Hasbrouck–Tindal 1992; 2006; Miller–Schwanenflugel 2008). Oral reading of a child who is in the process of learning to read or is simply a relatively inexperienced reader shows reliably whether the child is in the early stages of literacy or is already in the comprehensive phase (Gósy 2005). In the case of naive readers, a close relationship was found between reading fluency/tempo and reading comprehension (Fuchs et al. 2001). In adulthood this method is not suitable to distinguish between naive and skilled readers (Frederiksen 1981).

All this can be explained by the model of the reading process. According to the most widely used theories, reading consists of two parts: 1) decoding (matching letters to speech sounds and segmentation), 2) comprehension (Perfetti–Hogaboam 1975). The aim of reading is this latter (understanding the written text; Józsa–Steklács 2009). For naïve readers, even the decoding phase is challenging while for skilled readers, comprehension becomes the first and foremost. In this case visual decoding processes work quasi-automatically (Gósy 2005).

Oral reading is a complex process, in which there is no need for a higher level speech planning process but it requires well-functioning perception (Váradi 2011). Readers have to comprehend the text and then read it out loud with appropriate prosody, according to the

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meaning (Fuchs et al. 2001; Adamikné Jászó 2006; Váradi 2011). The fluency and tempo of oral reading increase during schoolyears. So the oral reading fluency value indicates the differences between children appropriately, and the performance of the certain child objectively (Fuchs et al. 2001). Oral reading fluency is connected to reading comprehension mostly at elementary school and at high school (Frederiksen 1981). There are differences between oral and silent reading in the activated areas of the brain: in the case of oral reading the auditory processing areas in the brain are activated, while in case of silent reading the visual processing areas (Berninger 1996).

In addition to oral reading fluency, miscues in oral reading can be examined. These miscues are quite frequent in the oral reading of typical lower-primary aged children. This analysis helps us find ways to improve the teaching of reading (Chinn et al. 1993). The teaching method of reading also affects the types of reading errors and how readers deal with them (Chinn et al. 1993). Oral reading is especially important also since it allows both teacher and student to notice mistakes of reading-technique (Steklács 2009).

Types of oral reading errors can be described in several ways. First, according to the linguistic process they can be insertions, omissions, substitutions and non-words. Secondly, they can be low-meaning-change errors and high-meaning-change errors, or similar or dissimilar errors from graphophonemical aspects (Chinn et al. 1993). Readers might react in different ways during making the error: with self-repairs, with the continuation of reading (this might happen both when they have noticed the error and when they have not), or with restarting the sentence altogether (Chinn et al. 1993). With regard to the oral reading of elementary school pupils, it was found that skilled readers produced more self-repairs than naive readers (Hoffman–Clements 1984; Hoffmann et al. 1984), but the ratio of self-repairs was also highly affected by the difficulty of the read text (McNaughton–Glynn 1981; Share 1990). In addition, oral readers might also produce other types of miscues like filled pauses, repetitions etc. (Hoffman–Clements 1984; Adamikné Jászó 2006).

Self-repair can happen in many different ways both in spontaneous and read speech. The repair consists of three main parts (Levelt 1983), but it can be divided to further units. The main parts are the following: original utterance, editing phase and repair. The original utterance contains the error (reparandum) and lasts until the moment of interruption. Speakers can interrupt the original utterance during pronouncing the error, right after it was made, or with some delay (delay). During the editing phase, speakers plan the repair. During this planning they can keep silent pauses or filled pauses, or they can pronounce filler words (editing term). The editing phase is the interval between the moment of interruption and the beginning of the repair. This latter is a correct version of the previously pronounced reparandum. The repair might begin with the corrected word or the speaker can retrace to an earlier point of the utterance (span of retracing).

1.1. Aims and hypotheses

This study analyses the oral reading of 3rd-, 4th-, and 5th-grade children with acoustic phonetic and psycholinguistic methods. Since the fluency of reading is also determined by the tempo of reading, the analysis also deals with its characteristics. It examines the temporal characteristics of oral readings, the frequency and types of disfluencies and errors, and then analyses the patterns of self-repairs. These age groups were chosen because 3rd-grade Hungarian children are not completely beginner but not yet proficient readers, while 5th graders are expected to understand and interpret the text and reflect on the content of what they read (Józsa et al. 2015). In the 5th grade (in typical development) the level of reading comprehension must

reach the level of hearing comprehension (Gósy 1996; Imre 2007). According to the hypotheses, 1) children in higher grades produce fewer miscues (disfluencies and errors) in oral reading than children in lower grades, 2) the proportion of types of miscues depends on grade (children in lower grades produce more disfluencies), and 3) children in higher grades repair their reading errors in a shorter time than children in lower grades.

2. Methods

Recordings of oral reading from 30 children were selected from the GABI – Hungarian Child Language and Speech Database and Information Repository (Bóna et al. 2019). Children were selected from three age groups: 3rd graders, 4th graders, and 5th graders. In each group there were 10 children (5 male and 5 female). According to the case histories filled in by the parents, all of them were native Hungarian children of typical development without any speech, language and hearing disorders, and all of them were students with average abilities at average elementary schools in Hungary. They were children of average middle-class families.

The recordings were made in a quiet room at school, or in the child's home, at the end of the first semester of the school year. Children read aloud 15 sentences and a short dialogue composed of 13 sentences. The dialogue contained nine turns, and in addition to the declarative sentences it contained one exclamatory, one imperative, and three interrogative sentences.

Speech samples were annotated by Praat 5.0 (Boersma–Weenink 2008). Speech units, pauses and reading miscues were annotated. The duration of speech units and pauses was measured, speech rate and articulation rate were calculated, and the proportion of pauses in the total speaking time was also defined. Frequency of pauses per 100 words was calculated. Miscues were categorized in three groups: hesitation phenomena (filled pauses, repetitions, part-word repetitions etc.), reading errors, and suprasegmental errors. Their frequency was also defined per 100 words. The proportion of self-repairs in all reading errors was calculated. There were altogether 76 self-repairs in the speech samples of the three groups (35 occurred in 3rd graders, 27 occurred in 4th graders, and 15 in 5th graders).

The number of syllables from the beginning of the error to the interruption point was counted. It was already considered to be a syllable if only one sound occurred from the planned syllable, and it was considered a new syllable if at least one sound occurred from a new syllable. The position of the interruption point was also analysed, i.e. whether it happened between words or within a word resulting in a fragment.

The characteristics of editing phases were also examined. Editing phases were categorized into 3 types: 1) zero editing phase, i.e. speakers corrected their errors right after the interruption point (editing phase was 0 ms); 2) silent editing phase when speakers produced silent pauses after the interruption point; 3) editing phase with editing term(s) when speakers produced a term during the editing phase which filled partly or completely the time between the interruption point and error repair.

The following measurements were carried out by Praat: error-to-cutoff times, duration of editing phases, and error-to-repair times. In accordance with the literature (Levelt 1983) error-to-cutoff and error-to-repair times were measured from the beginning of the reparandum.

Statistical analyses (Kruskal–Wallis-test and Mann–Whitney-test) were carried out by SPSS 20 at a confidence level of 95%.

3. Results

First, speech and articulation rates were calculated (Table 1). Results show that both speech rate and articulation rate increased in the speech of older children. According to the Kruskal–Wallis-test, there were significant differences between the groups both in speech rate (χ^2 = 10.366; p = 0.006) and articulation rate (χ^2 = 9.541; p = 0.008). Comparing the grades pairwise, there was a significant difference only between the 3rd graders and 5th graders in articulation rate (Mann–Whitney-test: Z = −2.948; p = 0.003). There were significant differences between 3rd graders and 5th graders (Mann–Whitney-test: Z = −3.024; p = 0.002), and 4th graders and 5th graders in speech rate (Mann–Whitney-test: Z = −2.041; p = 0.041).

Table 1. Speech and articulation rates

	Speech rate (word/minute)			Articulation rate (word/minute)		
	Mean	**SD**	**Min–max**	**Mean**	**SD**	**Min–max**
3rd graders	86.7	19.7	52.7–114.4	105.0	19.2	77.2–132.6
4th graders	101.0	23.1	61.1–140.3	119.8	23.4	72.7–161.0
5th graders	125.7	24.1	83.8–160.9	141.3	24.0	97.7–178.5

Pausing strategies were also analysed (Table 2). The proportion and frequency of pauses decreased in older children (results might be different from the results of other studies in which children had to read aloud a longer connected text). Kruskal–Wallis-test showed significant differences in the proportion of pauses between the groups (χ^2 = 8.299; p = 0.016). There were significant differences in the proportion of pauses between 3rd graders and 5th graders (Mann–Whitney-test: Z = −2.646; p = 0.008), and between 4th graders and 5th graders (Mann–Whitney-test: Z = −2.192; p = 0.028). There were no significant differences in the frequency of pauses between the groups. This means that the frequency of pauses was similar in 3rd graders and 5th graders and in 4th graders and 5th graders, but the average duration of pauses in 3rd and 4th graders was longer than in 5th graders.

Table 2. Data of pausing of the three groups

Group	**Proportion of pauses in the total reading time (%)**		
	Mean	**SD**	**Min–max**
3rd graders	18.0	6.6	9.9–31.7
4th graders	16.0	5.3	10.5–29.3
5th graders	11.4	3.4	5.1–17.3
	Frequency of pauses (number of occurrences in 100 words)		
	Mean	**SD**	**Min–max**
3rd graders	27.2	13.0	13.9–54.8
4th graders	22.6	9.2	9.0–38.6
5th graders	16.0	7.1	5.4–28.9

Altogether 294 miscues (disfluencies and reading errors) occurred in the analysed speech samples. 3rd grade children produced 9.3 miscues in 100 words, 4th graders 7.7, and 5th graders 3.5 (Table 3). According to the statistical analysis, there were significant differences between the groups (Kruskal–Wallis-test: χ^2 = 12.002; p = 0.002). Mann–Whitney-test showed significant differences between 3rd graders and 5th graders (Z = −3.411; p = 0.001), and between 4th graders and 5th graders (Z = −2.012; p = 0.044).

Table 3. Frequency of disfluencies and reading errors in the three groups

Group	Frequency of miscues (number of occurrence in 100 words)		
	Mean	SD	Min–max
3rd graders	9.3	3.3	4.2–14.5
4th graders	7.7	6.3	1.8–23.5
5th graders	3.5	2.2	0.6–7.2

There were three types of miscues during oral reading: 1) disfluencies, 2) reading errors, 3) suprasegmental errors. Disfluencies occurred in the highest proportion in the oral reading of 3rd graders. Third graders produced disfluencies in 57.4%, reading errors in 40.0%, and suprasegmental errors in 2.6%. Fourth graders produced disfluencies in 47.2%, reading errors in 50.4%, and suprasegmental errors in 2.4%. Fifth graders produced disfluencies in 50.0%, and reading errors in 50.0%.

There were altogether 7 suprasegmental errors in the analysed speech samples. 4 occurred in the reading of 3rd grade children, and 3 occurred in 4th grade children. Suprasegmental errors generally occurred in cases when participants began reading a question with intonation typical of declarative sentences. In one case, a participant read a declarative sentence with interrogative intonation, probably because the second sentence of the short turn was a question. Because of the shortness of the line and the question mark at the end, the reader might have assumed that the line contained a single question phrase.

Proficiency in oral reading is also shown by the occurrence of disfluencies (filled pauses, prolongations, whole-word repetitions, part-word repetitions, and pauses within the word). The lower their frequency, the more proficient the reader. Filled pauses and prolongations give time for decoding and articulatory planning. Repetitions and part-word repetitions have self-monitoring function (they occur when readers become uncertain whether the fully or partly read word was correct or not). The pause within the word occurs when there is a decoding problem during reading a word. The occurrence of disfluencies decreased in the older groups (Table 3). Kruskal–Wallis-test showed significant differences between the groups: $\chi^2 = 9.283$; $p = 0.010$. Comparing the groups pairwise, there were significant differences between 3rd graders and 4th graders (Mann–Whitney-test: $Z = -2.016$; $p = 0.044$); and 3rd and 5th graders (Mann–Whitney-test: $Z = -2.892$; $p = 0.004$).

As opposed to spontaneous speech, in oral reading, part-word repetition and pause within the word (broken word) were the most frequent in each group. Filled pauses only occurred in the two younger groups, 5th graders did not produce this type of disfluencies (Figure 1).

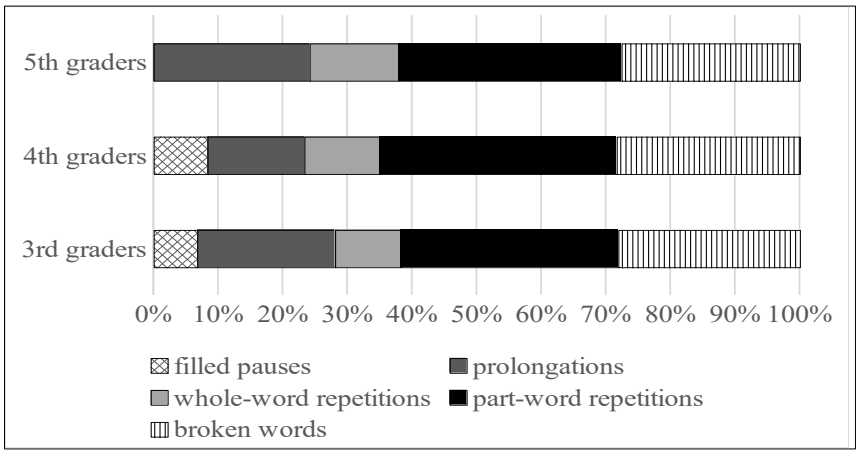

Figure 1. Proportion of types of disfluencies (without error repairs) depending on speakers' grade

Kruskal–Wallis-test showed significant differences in the frequency of reading errors between the groups: $\chi^2 = 7.633$; $p = 0.022$. The mean occurrences of reading errors were similar in the two younger groups, while there were significant differences in its frequency between 3rd graders and 5th graders (Mann–Whitney-test: $Z = -2.553$; $p = 0.011$), and between 4th graders and 5th graders (Mann–Whitney-test: $Z = -2.196$; $p = 0.028$).

The types of errors were analysed in several ways. First, the frequency of errors was analysed according to the three main types. Substitutions were the most frequent and insertions were the least frequent in each age group. Third graders produced substitutions in 58.1%, omissions in 33.9%, and insertions in 8.0%. Fourth graders produced substitutions in 56.3%, omissions in 26.5%, and insertions in 17.2%. Fifth graders produced substitutions in 58.6%, omissions in 34.5%, and insertions in 6.9%. The following example illustrates the phenomenon of substitution in the reading of a 3rd grader (SIL = silent pause): *Kérsz egy fagylaltot* SIL *az almá* SIL *egy falatot az almámból?* 'Would you like an icecream SIL from my appl SIL a bite from my apple?' Insertion mostly occurred in the form of inserting a definite article. The following example is from a 3rd grader: *Azt gondolod hogy az A* SIL *hogy Annának van igaza?* 'Do you think that the A SIL Ann is right?' Omission mostly affected the definite article, sounds or the negative particle: *Mikor megyünk Balatonra?* 'When are we going to Balaton?' (instead of *Mikor megyünk a Balatonra?* 'When are we going to the Balaton?').

Secondly, the categorization of errors was also carried out according to the levels of speech planning (Figure 2). 3rd and 4th graders produced word-recognition errors the most frequently, while 5th graders produced mostly articulatory errors.

The three groups repaired their errors in similar proportions: 58% of all errors were repaired by 3rd graders, 55% by 4th graders, and 59% by 5th graders. Table 4 shows the proportion of error-repairs in the three main error types.

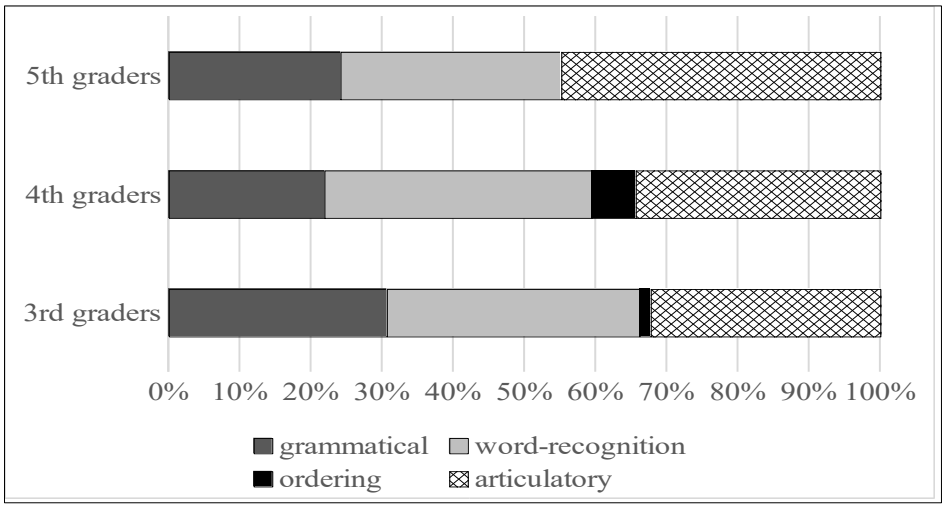

Figure 2. Types of errors depending on the speakers' grade and the levels of speech planning

Table 4. The proportion of error-repairs in the three main error types

Group	Substitution	Omission	Insertion
3rd graders	72%	43%	20%
4th graders	69%	35%	36%
5th graders	82%	30%	0%

Characteristics of error-repairs were analysed according to the parts of repairs, in the following order: error-to-cutoff time, characteristics of the interruption point, characteristics of the editing phase, error-to-repair time.

First, error-to-cutoff time was analysed (Figure 3). Error-to-cutoff time was on average 701 ms in 3rd graders (SD: 262 ms), 674 ms in 4th graders (SD: 348 ms), 481 ms (SD: 441 ms) in 5th graders. According to the statistical analyses, there were no significant differences between the groups in error-to-cutoff time.

Analysing the characteristics of interruption points, it can be stated that 3rd and 4th graders interrupted their speech within words more frequently, while 5th graders interrupted their speech on word boundaries in 50% of the interruptions. The proportion of fragments was 74% both in 3rd graders and 4th graders (and 26% on word boundaries in both groups).

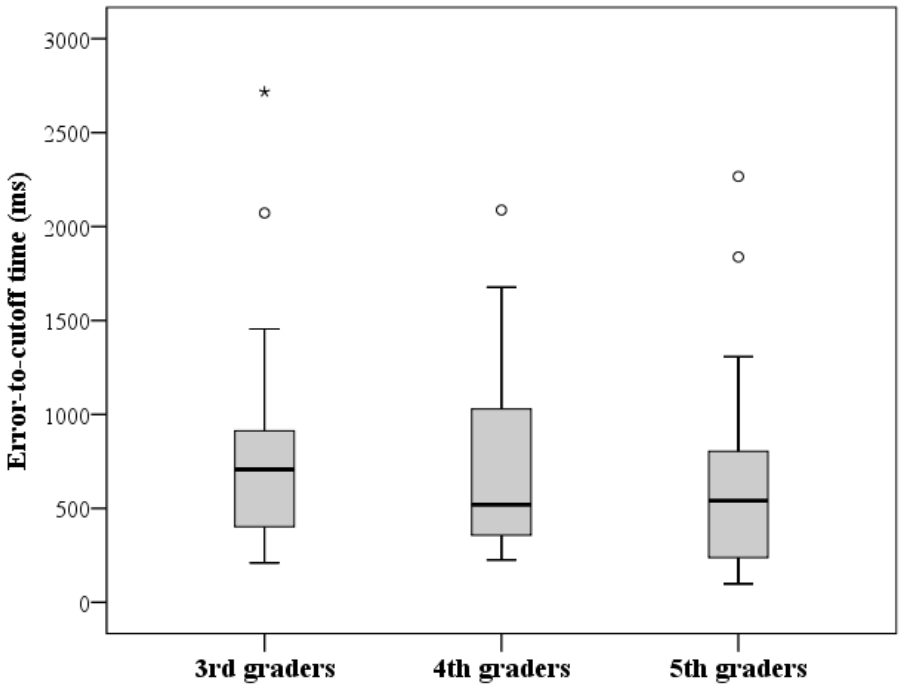

Figure 3. Error-to-cutoff times in the three groups
(the small circles show "out" values, star shows extreme values)

For editing phases, 635 ms was measured on average in the speech of 3rd graders (SD: 385 ms), 800 ms in 4th graders (SD: 820 ms), and 619 ms in 5th graders (SD: 304 ms) (Figure 4). According to the statistical analysis, there were no significant differences between the groups.

The position of interruption points did not show any difference in the number of syllables either: 3rd and 4th graders interrupted their speech after 2.5 syllables on average and 5th graders after 2.7 syllables on average.

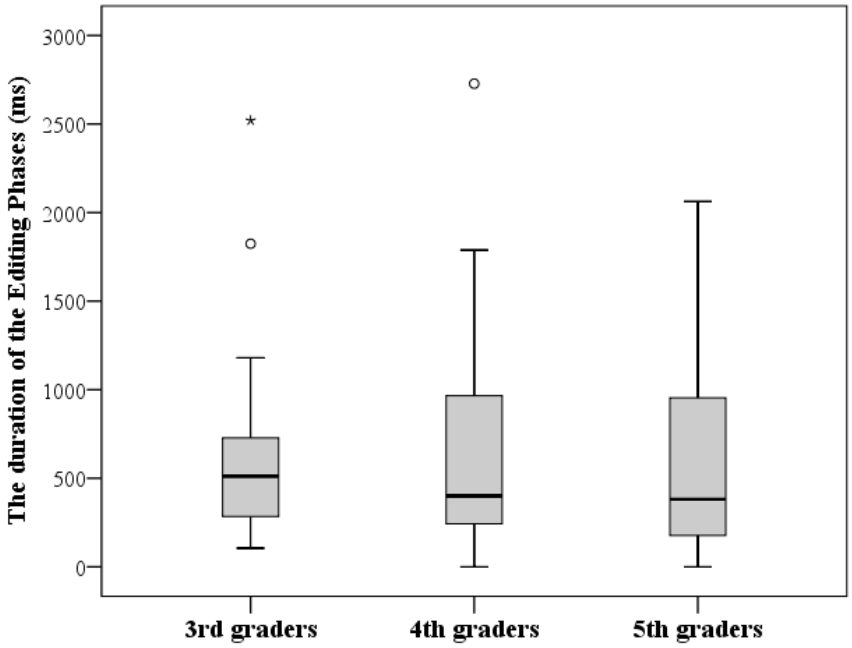

Figure 4. Duration of editing phases in the three groups (median and interquartile range) (the small circles show "out" values, star shows extreme values)

Most of the editing phases at each grade occurred as silent pauses (Figure 5). It was also common for 4th and 5th graders to use editing terms in a higher proportion than 3rd graders. For example: *a gyermekek be* SIL ***M*** SIL *b* SIL *bukfencezni is megtanulnak* 'children lu SIL M SIL l SIL learn to tumble; *a magyar űru* SIL ***Ö*** SIL *űr* SIL *turista* 'Hungarian space tou SIL Ö SIL space SIL tourist'.

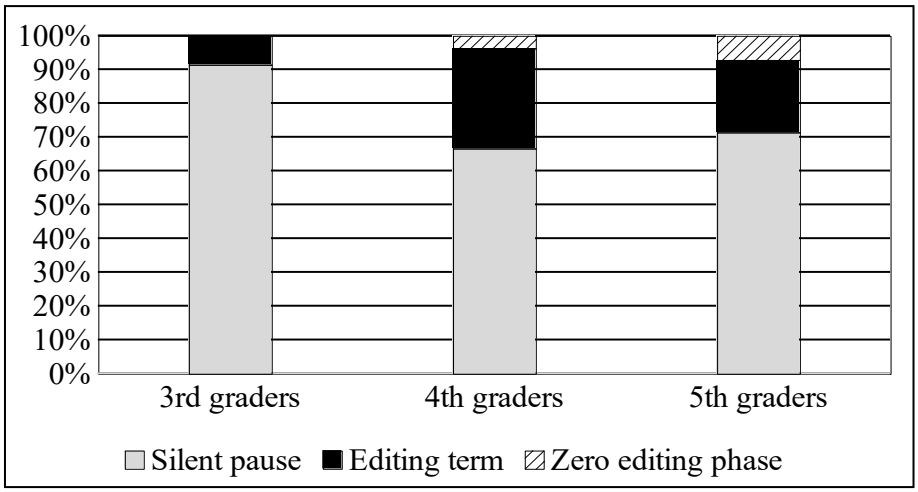

Figure 5. Proportion of types of editing phases

Finally, error-to-repair time was analysed (Figure 6). On average, 1336 ms was measured in the speech of 3rd graders (SD: 387 ms), 1474 ms in 4th graders (SD: 852 ms), 1099 ms in 5th graders (SD: 539 ms). Statistical analysis showed no significant differences between the groups.

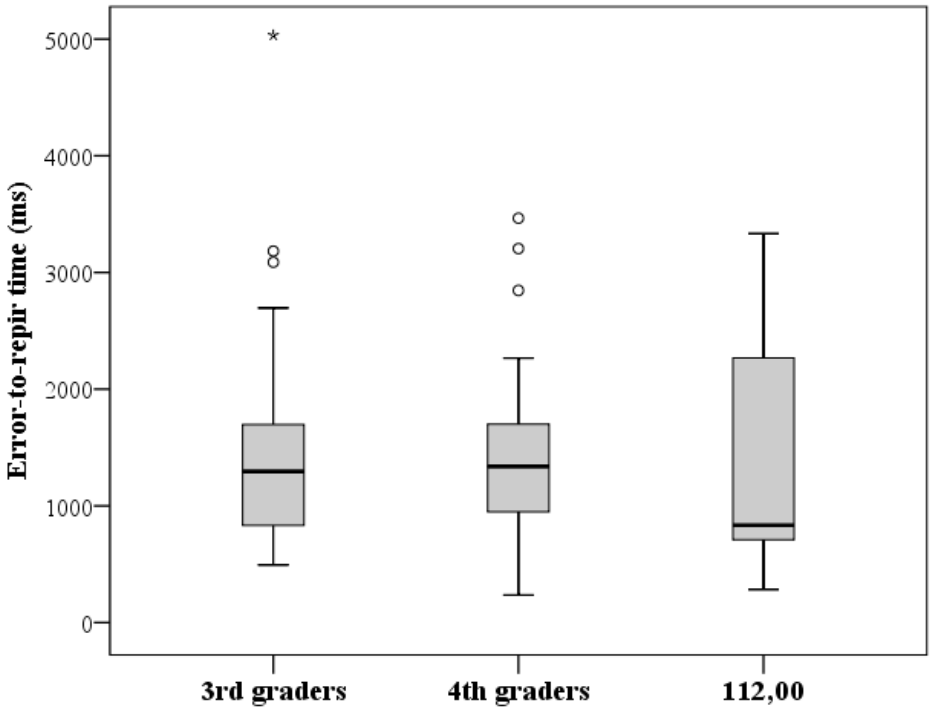

Figure 6. Error-to-repair time (median and interquartile range)
(the small circles show "out" values, star shows extreme values)

4. Discussion and conclusion

This paper analysed speech and articulation rate, pausing, disfluencies and error-repairs in the oral reading of 3rd graders, 4th graders, and 5th graders. The main questions and hypotheses were related to the frequency of disfluencies and error-repairs, the results of measuring speech tempo contribute to the interpretation of the former.

The analysis of the temporal parameters shows that as reading becomes more proficient, the speech and articulation rates increase, and the rate of pauses is reduced, but this increase or decrease is not linear according to the data of this study. Namely, there were no significant differences between third and fourth graders in tempo values and the rate of pauses. Only the speech rate of fifth grade students was significantly faster and their proportion of pauses was significantly lower than that of the other two younger age groups. The articulation rate and the frequency of pauses in the speech of 4th graders were not significantly different from the 3rd and 5th grade groups, however, there was a significant difference in the articulation rate between the latter two speakers' groups.

The first hypothesis was that there would be significant differences between the age groups in the frequency of reading miscues (older children produce miscues less frequently than younger children). This hypothesis was partially confirmed. The frequency of all reading miscues decreased with age (grade), but a significant decrease occurred only in the 5th graders

compared to the other two groups. Results show that 4th graders might be much more confident in reading than 3rd graders. However, their reading technique is similar to that of 3rd graders, as they make far more reading errors than 5th graders.

The second hypothesis was confirmed: grade and proficiency in literacy had an effect on the proportions of disfluencies and reading errors. The youngest children produced disfluencies at a higher rate than the older children, but filled pauses, for example, occurred only in the two younger groups.

Finally, the third hypothesis was that more proficient readers repair their reading errors in a shorter time than less proficient younger children. This hypothesis was not confirmed. The statistical analysis showed no significant difference between the groups in any of the parameters regarding error-repairs. There were no differences in the proportion of error-correction and correction strategies among children of different grades (which is in contradiction with previous literature, Chinn et al. 1993).

There are several reasons for the explanation. On the one hand, it is possible that there were no significant differences between the groups due to the relatively low number of the examined children. On the other hand, there were large individual differences between the children regardless of grade. There was a 3rd grader who read faster and more fluently than a slower reading 5th grader child. Thirdly, it is assumed that the duration of error-repairs might be largely determined by the type of error, and not only by the reader or the reader's grade. That is, it is probably not (only) reading proficiency which affects the duration and strategies of error-repairs, but also the characteristics of the error itself. In addition to these factors, the rare occurrence of error-repairs and large standard deviation of the data might contribute to the lack of differences in corrections produced by speakers of different grades. More proficient readers produced fewer errors, but when they did, they corrected them in the same way as less proficient readers.

The analysis has several limitations, as described in the explanation of the results. On the one hand, relatively few children participated in the study. However, because average children of typical development participated in the study, the results can be used to design further research. On the other hand (due to the characteristics of the used speech database), the participants read a relatively short text, which resulted in fewer errors. This rare occurrence also influenced the results of the statistical analysis.

The results also have pedagogical implications. Although oral reading and silent reading already assume different processes for skilled readers, silent reading can also be inferred from the types of reading errors and corrective strategies. The results indicate that passages which are harder to read in the text can also be difficult for more skilled readers. These readers do not always notice the mistake either, and they have the same strategies for correction as those in the lower grades.

The results of the study confirm the facts established by the prior literature. However, they provide new results on the types of disfluencies and on the rate and timing of error-repairs in oral reading, which require further studies involving a larger number of participants.

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