



Approaches and Models in Special Education and Rehabilitation



Belgrade 2020.

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THEMATIC COLLECTION OF INTERNATIONAL IMPORTANCE

Belgrade, 2020

Approaches and Models in Special Education and Rehabilitation
Thematic Collection of International Importance

Publisher

University of Belgrade – Faculty of Special Education and Rehabilitation
Publishing Center of the Faculty

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Proceedings will be published in electronic format CD.

Circulation 150

ISBN 978-86-6203-139-6

By decision no. 3/9 from March, 8th 2008. The Teaching and Research Council of the University of Belgrade – Faculty of Special Education and Rehabilitation initiated Edition: Monographs and papers.

By decision no. 3/63 from June, 30th 2020. The Teaching and Research Council of the University of Belgrade – Faculty of Special Education and Rehabilitation has given approval for the printing of Thematic Collection "Approaches and Models in Special Education and Rehabilitation".

HANDWRITING SPEED STUDENTS OF LOWER GRADES OF ELEMENTARY SCHOOL

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SUMMARY

Writing as one of the most complex human activities is the ability to properly graphic formatting of letters, the quality of which is viewed through the speed of writing and the legibility of written text. The main aim of this research is to investigate the writing speed of elementary school students. The survey was conducted in Belgrade, 2016 in eight elementary schools. The sample of research was formed from 1156 elementary school students, students from I to IV grade. The McMaster Handwriting Assessment Protocol was used as the measuring instrument. The obtained data show that the average writing speed of the students of lower grades of elementary school is the highest in the writing task to mind (40.86 letters per minute) and the lowest when the text is transcribed from a longer distance (36.31 letters per minute). Consequently, there is a difference in the average writing speed of the students in the classroom, with respect to the class of students, with a significant effect of the type of task on the writing speed ($F(2.778, 3208.02) = 466.34, p = 0.000$). The speed of writing increases with age, that is, with class, both on individual and total tasks. Inadequate writing speed, when looking at average speed on all four tasks, occurs in 78 (6.7%) students. Since most of the school activities are based on the writing process, and the existing results show that a number of students face a problem of writing speed, special attention must be paid to the adaptation of the educational process to these students. In addition to the difficulty of achieving a satisfactory writing speed, these students very often achieve worse school achievement, so this problem may also affect the emotional aspects of the students.

Key words: elementary school, handwriting speed, school success, student, writing difficulties

INTRODUCTION

Going to school is a very important period in the development of every child. The new environment, the new organization of day and time, and the new activities that form the basis for mastering the teaching material, are the challenges that each student faces when entering the first grade of elementary school. Writing is one of the main tasks that students master in the lower grades of elementary school, and students are expected to master writing of a certain quality, defined through the speed of writing and the legibility of written text. It is defined as "the ability to copy letters or numbers in a particular time and form" (Ashiani, Havayi, Toozandehjani, 2014: 1681).

Many students experience difficulties in writing during their education, manifested by difficulties in writing speed, difficulty in readability the written text, or very often associated difficulties. Research shows that the number of students with writing

disabilities varies from researcher to researcher, but in the professional and scientific literature, the most common prevalence is varies on average between 6% and 12% children of elementary school (Berninger, Mizokawa, & Bragg, 1991; Maeland, 1992; Overvelde & Hulstijn, 2011; Rubin & Henderson, 1982; Smits-Engelsman, Niemeijer, & van Galen, 2001). Although most attention is directed to learning and practicing writing in school classrooms, between 30% and 60% of time spent in educational process (Volman, van Schendel, & Jongmans, 2006), over time, difficulties in writing occur with increasing numbers of students. Beside the current educational trends and the possibilities of applying modern assistive technology in working with this group of students, as well as the possibility of adapting the teaching process to students who face these difficulties, there is no decrease in the number of students with difficulties in writing. Therefore, special attention should be paid to the study of this problem and the task of the researcher should be oriented towards finding the factors that influence the writing process. In order to classify strategies that will contribute to reducing the number of students with disabilities, first we need to acquire knowledge about the writing quality of elementary school students, and this is a special contribution of this research.

The quality of writing of elementary school students

By entering first grade, from students are expected to master the writing skills of the appropriate quality. The ability to write quickly and legibly, according to Bosga-Stork et al., (2016) is necessary and important, and is a complex functional task that is essential for expressing ideas and thoughts in textual form.

The speed of writing, as one of the elements of the quality of writing of the elementary school students, is very important for the writing process and is the speed at which the student writes a certain number of letters over a period of time, usually one minute. The results of various studies (Bosga-Stork et al., 2016; Graham et al., 1998; Ziviani & Watson-Will, 1998) show that writing speed, as one of the parameters of writing quality, changes with age. Due to the development of perceptual, motor and gnostic skills, as well as exercise, the speed of writing increases during the elementary school period.

Studies (Bosga-Stork et al., 2016; Tse, Thanapalan & Chan, 2014) show that the writing speed of elementary school students who have writing problems is much lower than the writing speed of students who do not have these problems. When transcribing text, students with writing difficulties, at the age of 10, write with an average writing speed of 29.9 letters per minute, while students without difficulty with writing have an average writing speed of 40.9 letters. The writing speed of these two groups of students also differs in dictation, with the average writing speed of students with difficulty writing is 28.5 letters and students without difficulty 38.8 letters per minute (Tse et al., 2014).

Researching the speed at which students write is very important because it can represent a parameter on the basis of which educational programs are created and adjust the teaching process to students. Curricula are, today, defined and oriented towards the average student, thus neglecting those students who have some difficulties in teaching, but also those students who are particularly prominent in their realization. Consequently, students who have difficulty writing at the speed expected of their age, will encounter difficulties in following the teaching process on a daily basis. Usually

these students will not be able to get the time to copy the text from the board or when dictating, they will have difficulty writing the composition because they will always lack the time to complete the required task.

Consequently, inadequate writing speeds may also affect students' academic achievement, and over time, these students become unsuccessful students with lower grades. As research (Center & Wascom, 1986; Kravetz et al., 1999) shows that difficulties in mastering teaching materials reflect the socio-emotional aspect of personality, special attention must be paid to this issue.

METHOD

The subject of this research is the writing speed of students lower grades elementary school, students from grades I to IV, with the aim of determining are there any differences in the speed of writing depending on the manner of accomplishing the tasks and the age of the respondents. The research tasks are defined in relation to the way the tasks are accomplished and are:

- Examine student writing speed to mind;
- Examine student writing speed when transcribing text from short distance;
- Examine student writing speed when transcribing text from a longer distance;
- Examine student writing speed when writing by dictation.

The starting hypothesis is that there are differences in the writing speed of students of different grades, as well as that there are differences in the writing speed depending on how the tasks are accomplished.

Assessment of writing speed was performed by student testing. The McMaster Handwriting Assessment Protocol - 2nd edition (Pollock et al., 2009), which was translated and adapted to the Serbian-speaking language (Denić and Milivojević, 2014) was used as a measuring instrument for writing assessment. The protocol involves evaluating writing across multiple modalities. Writing is assessed as writing to mind, transcribing text from a short distance, transcribing text from a longer distance, and writing by dictation. The texts used in the protocol were taken from the Serbian language classbook for the first, second, third and fourth grades, and therefore adapted to the age of the students. During each activity, was recorded the time the activity was completed. The counting writing speed was based on the formula and then compared to the defined norms and it was determined whether it was adequate, below or above average. The defined rate of writing speed for first grade students is 15-32 letters per minute. The defined writing rate for second grade students is 20-35 letters per minute. The defined rate of writing speed for third grade students is 34-70 letters per minute. The defined rate of writing speed for fourth grade students is 46-91 letters per minute. Based on the assessment of writing speed, students were divided into a group of students with difficulties in writing and a group of students without difficulty in writing.

The survey involved 1156 students lower grades from eight Belgrade elementary schools. Regarding the gender structure of the sample, data were collected for 564 (48.8%) boys and 592 (51.2%) girls. The survey included 278 students (24% of the total sample) of the first grade, 325 students attended the second grade (28.1%), 270 students

attended the third grade (23.4%) and 283 students attended the fourth grade (24.5%). Excluded from the study were students who, based on school and medical records, were found to have low intellectual functioning, as well as some of the neurological impairments that manifest themselves in the quality of mobility of the upper extremities.

The survey was completed during the second half of 2016 in Belgrade. The schools included in the survey are those located in the urban municipalities of the city of Belgrade, excluding suburban municipalities and thus the impact of the environment on the results of the research. One school was selected from each municipality, and from each school all classes of the first, second, third and fourth grades.

The analysis and interpretation of the data referred to the results obtained by the assessment of the respondents. Descriptive statistics measures were used in the statistical processing of data, and Pearson's correlation coefficient was used to examine the correlation of variables. The data were analyzed using the SPSS statistical package, 20 for the social and humanities sciences.

RESULTS

Respondents' writing speed on individual tasks as well as average writing speed are shown in Table 1.

Table 1. *Descriptive indicators of writing speed on individual tasks and in total*

| Task | N | Min. | Max. | M | SD |
|---|------|-------|-------|-------|-------|
| Writing to mind | 1156 | 12.00 | 97.83 | 40.86 | 16.54 |
| Transcribing text from a short distance | 1156 | 7.47 | 94.04 | 37.88 | 16.17 |
| Transcribing text from a longer distance | 1156 | 7.82 | 91.47 | 36.31 | 15.90 |
| Dictation | 1156 | 9.53 | 95.45 | 38.23 | 16.44 |
| Average on four tasks | 1156 | 11.00 | 94.30 | 38.31 | 16.06 |

As can be seen in Table 1, the average writing speed is the highest in the writing task to mind, slightly lower in the short-distance and dictation tasks, and the lowest when the long-distance text is transcribed. The average writing speed of a student when writing to mind is 40.86 letters per minute. The average typing speed when transcribing text from a short distance is 37.88 letters per minute, while transcribing text from a longer distance is 36.31. The average writing speed for dictation is 38.23 letters per minute. The average writing speed across all four tasks is 38.31 letters per minute.

The effect of task type on writing speed was examined using one-way analysis of variance (ANOVA) with repeated measurements, and in the analysis the tasks were treated as different levels of factors. The results of the statistical analysis applied confirm the significant effect of type of task on writing speed ($F(2.778, 3208.02) = 466.34, p = 0.000$), with task type explaining 29% of the variance in writing speed. An additional (Bofferroni post hoc) test showed that differences among all arithmetic environments were statistically significant, and that the overall effect of type of task on writing speed could be first attributed to the significant difference in the rate at which subjects write to mind compared to the other three tasks ($SD = 2.62 - 4.54, p = 0.000$), significantly higher typing speed from a smaller distance than transcribing text from a longer distance ($SD =$

-1.57, $p = 0.000$), significantly faster typing than dictation short distance text ($SD = -0.35$, $p = 0.010$) and longer distance transcription ($SD = -1.92$, $p = 0.000$).

The following table (Table 2) shows the correlation between writing speed tasks.

Table 2. *Correlations between writing speed tasks*

| Task | 1 | 2 | 3 | 4 |
|---|--------|--------|--------|--------|
| 1 - Writing to mind | 1 | | | |
| 2 - Transcribing text from a short distance | 0.96** | 1 | | |
| 3 - Transcribing text from a longer distance | 0.97** | 0.96** | 1 | |
| 4 - Dictation | 0.97** | 0.97** | 0.97** | |
| 5 - Average on four tasks | 0.98** | 0.99** | 0.98** | 0.99** |

Note. ** level significant correlation 0.001

Correlations among individual tasks indicate that performance on one task can be a significant predictor of performance on other tasks as well as overall score. All correlations between tasks are very high (over 0.90), positive and statistically significant (Table 2), which means that not all four tasks need to be used in the estimation of writing speed, but that in a situation where a more economical evaluation procedure can be applied just one of them. However, deciding whether only one of the assessment methods will be applied in this case depends first on what we evaluate and what the purpose of the results is.

Table 3 shows the average writing speed of individual tasks by grade.

Table 3. *Descriptive indicators of writing speed on individual tasks by grade and results of checking the significance of differences between groups*

| Task | Grade | N | M | SD | Min. | Max. | Welch's t (df) | p |
|---|-------|-----|-------|-------|-------|-------|-------------------------------------|--------------|
| Writing to mind | I | 278 | 25.12 | 6.55 | 12.00 | 79.67 | 846.85 (3, 611.29) | 0.000 |
| | II | 325 | 31.30 | 6.74 | 13.71 | 56.23 | | |
| | III | 270 | 47.71 | 10.32 | 28.00 | 97.83 | | |
| | IV | 283 | 60.76 | 11.55 | 27.50 | 97.14 | | |
| Transcribing text from a short distance | I | 278 | 22.27 | 5.98 | 8.40 | 42.26 | 841.31 (3, 613.14) | 0.000 |
| | II | 325 | 28.80 | 6.97 | 7.47 | 54.86 | | |
| | III | 270 | 44.71 | 9.66 | 23.11 | 78.00 | | |
| | IV | 283 | 57.12 | 11.89 | 18.38 | 94.04 | | |
| Transcribing text from a longer distance | I | 278 | 20.96 | 5.72 | 7.82 | 40.20 | 875.05 (3, 611.02) | 0.000 |
| | II | 325 | 27.50 | 6.69 | 9.92 | 53.68 | | |
| | III | 270 | 42.52 | 9.91 | 20.71 | 77.65 | | |
| | IV | 283 | 55.58 | 11.26 | 15.72 | 91.47 | | |
| Dictation | I | 278 | 21.85 | 5.73 | 10.60 | 42.00 | 934.78 (3, 610.54) | 0.000 |
| | II | 325 | 29.24 | 6.78 | 9.53 | 58.89 | | |
| | III | 270 | 45.30 | 9.99 | 20.79 | 77.78 | | |
| | IV | 283 | 57.89 | 11.57 | 21.00 | 95.45 | | |
| Average on four tasks | I | 278 | 22.55 | 5.52 | 11.00 | 41.42 | 926.23 (3, 610.74) | 0.000 |
| | II | 325 | 29.21 | 6.53 | 12.14 | 54.28 | | |
| | III | 270 | 45.06 | 9.57 | 24.42 | 76.49 | | |
| | IV | 283 | 57.84 | 11.15 | 22.31 | 94.30 | | |

An overview of the arithmetic means given in Table 3 clearly indicates that writing speed increases with age (grade), both on individual and total tasks. This conclusion is supported by the results of the statistical verification of the significance of differences between arithmetic means. First grade students, at literacy stage, write slowest when transcribing text from a longer distance ($M = 20.96$) and when writing by dictation ($M = 21.85$), second grade students write the fastest to mind ($M = 31.30$) and while writing in dictation ($M = 29.24$), while in upper grades students achieve the highest writing speed by letter ($M = 47.71$ in III grade students, $M = 60.76$ in IV grade) and dictation ($M = 45.30$ for grade III students, $M = 57.89$ for grade IV students).

Because Levin's test for homogeneity of variance showed that sub-sample variance is unequal, instead of results of one-factor analysis of variance, the results of robust tests (t-test for independent samples) and the corresponding Welch's t-statistic (Welch's t) are shown. The Welch t-test is significant in all comparisons and confirms the existence of a statistically significant class effect on writing speed on all tasks.

Table 4 shows the results of Bonferoni's follow-up test.

Table 4. Results of Bonferoni's follow-up test

| Dependent variable | (I) Grade | (J) Grade | Grade AS (I-J) | R |
|---|-----------|-----------|----------------|-------|
| Writing to mind | I | II | -6.17* | 0.000 |
| | | III | -22.59* | 0.000 |
| | | IV | -35.63* | 0.000 |
| | II | III | -16.41* | 0.000 |
| | | IV | -29.46* | 0.000 |
| | III | IV | -13.05* | 0.000 |
| Transcribing text from a short distance | I | II | -6.53* | 0.000 |
| | | III | -22.44* | 0.000 |
| | | IV | -34.86* | 0.000 |
| | II | III | -15.91* | 0.000 |
| | | IV | -28.32* | 0.000 |
| | III | IV | -12.41* | 0.000 |
| Transcribing text from a longer distance | I | II | -6.53* | 0.000 |
| | | III | -21.56* | 0.000 |
| | | IV | -34.62* | 0.000 |
| | II | III | -15.02* | 0.000 |
| | | IV | -28.08* | 0.000 |
| | III | IV | -13.06* | 0.000 |
| Dictation | I | II | -7.38* | 0.000 |
| | | III | -23.44* | 0.000 |
| | | IV | -36.04* | 0.000 |
| | II | III | -16.07* | 0.000 |
| | | IV | -28.66* | 0.000 |
| | III | IV | -12.59* | 0.000 |
| Average on four tasks | I | II | -6.66* | 0.000 |
| | | III | -22.51* | 0.000 |
| | | IV | -35.29* | 0.000 |
| | II | III | -15.85* | 0.000 |
| | | IV | -28.63* | 0.000 |
| | III | IV | -12.78* | 0.000 |

Subsequent (post hoc) tests confirm that the increase in writing speed is consistent, and that the order on all tasks can be described as follows: children in grade I write slowest, type II write faster than them, grade III students write more words than children from the first two grades and, finally, respondents attending grade IV achieve significantly higher success on all tasks than children from the first three grades (Table 4).

The analysis at the level of the respondents shows that inadequate writing speed, when looking at the average speed on all four tasks, occurs in 78 (6.7%) students, while in the remaining 1078 (93.3%) the writing speed is in line with the age standards ie. class. The percentage of children writing at an inadequate rate by grade is shown in Table 5.

Table 5. *Frequency of subjects with inadequate writing speed per class*

| | Grade | | | |
|---------------------------|-------|-----|-----|-----|
| | I | II | III | IV |
| N within the class | 19 | 16 | 18 | 25 |
| % within the class | 6.8 | 4.9 | 6.7 | 8.8 |

Table 5 makes it clear that students who write slower than expected for age are evenly ranked by grade level. This is also confirmed by the insignificant value of the Hi-square test ($\chi^2(3) = 3.68, p = 0.298$). The highest percentages of students who have difficulty writing speed attend fourth grade (25 or 8.8%), followed by first grade (19 or 6.8%), while these difficulties are reported in 18 third grade students (6.7%). Difficulties in writing speed are the least common among second grade students (16 or 4.9%).

DISCUSSION

Writing quality of student of elementary school was observed based on an assessment of writing speed. The average writing speed of lower elementary school students is highest in the writing task to mind (40.86 letters per minute), slightly lower in the tasks of short-distance text transcription (37.88 letters per minute) and dictation (38.23 letters per minute) and the smallest when is transcribing text from a longer distance (36.31 letters per minute). The average writing speed across all four tasks is 38.31 letters per minute. There was a significant effect of task type on writing speed ($F(2.778, 3208.02) = 466.34, p = 0.000$), with a correlation between tasks ($r < 0.90$).

Writing to mind, in this case, writing the first and last name of the student and the name of the school they attend, is first mastered, and therefore becomes first automated in students (Gerth et al., 2016). Levin et al., (2005) have shown that preschoolers write their name much better than other words, while Fayol and Miret (2005) find that students with poorer graphic skills have worse achievement when writing text dictates.

As expected, the writing speed on these four tasks also varies with the age of the subjects. First grade students, at the literacy stage, write slowest when transcribing text from a longer distance ($M = 20.96$) and when writing by dictation ($M = 21.85$), while in upper grades students achieve the highest writing speed when writing to mind ($M = 47.71$ for grade III students, $M = 60.76$ for grade IV students) and writing by dictation ($M = 45.30$ for grade III students, $M = 57.89$ for grade IV students). As students practice their writing skills, so does increases their writing speed. It is characteristic

for first grade students who write at the literacy stage that the slower writing speed is achieved when writing by dictation, due to insufficient spelling of the letters, but also when writing from a greater distance, due to numerous obstructive factors (short-term attention deficit, visual perception, visual motor coordination, motor planning), and because they are in the process of getting used to copying text from a board, or from a greater distance.

As in previous studies (Graham et al., 1998; Stievano et al., 2016; Ziviani & Watson-Will, 1998), the results of this study show that writing speeds increase with age, both on single and total tasks. The first grade children write slowest, the second grade faster than them, the third grade students write more words than the children in the first two grades, and finally, the students attending the fourth grade achieve significantly higher success on all assignments than the children in the first three grades. By examining the speed and legibility of text in elementary school students, ages 7 to 12, Ziviani and Elkins (1984) found that the slowest writing was for students between the ages of seven and eight (girls 38.77 ± 15.12 , and boys 34.90 ± 11.05), and the fastest writing is for students who are more than 12 years old (girls 84.68 ± 18.77 and boys 110.76 ± 28.49).

The speed at which students write is influenced by a number of factors, which is why there are decent differences in writing speed when completing different tasks. So, for example, transcribing text is different from spontaneous writing because students have to look at the transcribed text, memorize it, reproduce it accurately on paper, and take care of the organization of the text in relation to the paper, lines and margins. If their attention is dispersed, and there are some factors that hinder their attention at that moment, with difficulty in sensory integration, students may achieve a writing speed lower than the writing speed by writing to mind or by dictation.

Based on the study conducted by Tse et al., (2014) and Longcamp et al., (2006) conclude that visual and kinesthetic feedback are very important parameters of writing, as complex visual-perceptual abilities. Therefore, when dividing students into a group that has difficulty writing, the average writing speed across all four tasks was observed. Inadequate writing speed, if one considers the average speed on all four tasks, occurs in 78 (6.7%) students and their frequency is evenly distributed across classes. Difficulties in writing, observed through inadequate writing speed, occur in 6.8% of first grade students, 4.9% of second grade students, 6.7% of third grade students and 8.8% of fourth grade students. As in previous studies (Santos Damasceno, Brandao de Avila, & Arnaut, 2015), the results show that there are no differences ($p=0.164$) in the frequency of writing problems among students of different grades.

CONCLUSION

Based on the results presented and analyzed, the following conclusions can be drawn:

- The average writing speed of a student lower grades elementary school is the highest in the writing task to mind (40.86 letters per minute) and the lowest when text is transcribed from a longer distance (36.31 letters per minute). Consequently, there is a difference in the average writing speed of the students

of elementary school with the class of the students, with a significant effect of the type of the task on the writing speed ($F(2.778, 3208.02) = 466.34, p = 0.000$);

- A review of arithmetic means clearly indicates that the speed of writing increases with age, that is, with class, both on tasks individually and on the overall score;
- Inadequate writing speed, when looking at the average speed on all four tasks, occurs in 78 (6.7%) students, while in the remaining 1078 (93.3%) the writing speed is in line with the norms for age or class.

All four tasks need not be used in the estimation of writing speed (writing to mind, transcribing text from a short distance, transcribing text from a longer distance, writing by dictation), but in a situation where a more economical estimation procedure may be required, only one of them can be applied. Assessment through all four tasks is only meaningful when adapting teaching materials to students who have difficulty writing. However, the decision whether to apply only one of these four methods of assessment and which depends first of all on the needs of the assessment itself, that is, on the very purpose of the results obtained.

Looking at the school system today, it can be concluded that school plans are too large for most students because the teaching process is planned according to the average student. Research (Coker et al., 2016; Cutler & Graham, 2008) shows that teachers mostly apply front-line work in the literacy process, then apply small group work in about 23% and devote to individual instruction in about 24%. Cutler and Graham (2008) also concluded that teachers focus more on instruction than on the writing process itself. When a student who have difficulty mastering school skills, such as writing skills, is found in these conditions, the problem arises because of the no conformity of the program to the student. In recent years, the school system has been making changes to its curricula and thus adapting the educational process to students with special educational needs, allowing full participation of students in teaching. As a result, a more adequate acquisition and expansion of students' knowledge, skills and habits results.

The results obtained are very important for the process of adapting the teaching process to students with difficulties in writing, as well as finding a way of writing that most convenient the student, his needs and abilities. Individualization measures and an individual education plan are ways of adapting the educational process to students with disabilities, thus fully enabling students to participate in teaching activities, respecting the individuality of the student, while respecting his or her strengths and capabilities.

Writing problems are very often the first indication that there is a developmental delay in perceptual, motor and speech capacities (Bosga-Stork et al., 2016; Piller & Torrez, 2019). Therefore, many students who have problems with writing need the help and support of a special educator, or specialist who deals with writing problems (Bonney, 1992), because knowledge of the factors that affect writing skills is necessary to create an adequate plan to stimulate writing (Deninis & Swinth, 2001), and the stimulation of these abilities is significantly related to the writing skill (Mehta & Nandgaonkar, 2019).

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