

Franc, Vendi**PHONOLOGICAL AWARENESS AS A PREDICTOR OF
ACADEMIC ACHIEVEMENT IN GRADES FIVE TO SEVEN OF
PRIMARY SCHOOL****Introduction**

The development of phonological awareness is one of the most important factors enabling successful reading acquisition. Numerous studies emphasise that early phonological training has short- and long-term positive effects on the markers of early literacy.¹ This work is a continuation of the research whose first phase was conducted in 2015, when the level of early phonological awareness and letter knowledge was examined among 110 children who then attended a Montessori kindergarten and 110 children who attended traditional preschool. Within the research, differences were found in the level of phonological awareness and letter knowledge, i.e. the children who underwent systematic training for encouraging phonological awareness development were more successful in solving exercises in the FONT test, which was used as a research instrument.² The test was originally designed in Bosnia and Herzegovina and later adapted to the specificities of the Croatian language.³ The test comprises the exercises of division into syllables and phonemes, phonemic analysis and rhyme recognition.

In 1980, Lundberg conducted the first comprehensive research into the relationship of phonological awareness and reading among children in preschool and first grade of primary school. Along the lines of Lundberg's study, it was assumed that the children whose phonological awareness was higher would achieve better results in initial reading, so the second research phase was conducted when the same children who participated in the first phase started the first grade. The investigation into reading was operationalized by two variables: 1) reading accuracy and 2) the number of correctly read words in a minute. The research included 79 children, and it was conducted via the text *First Grader*. The research results have shown that phonological awareness is a statistically significant predictor of reading achievement in the first grade of primary school. The third phase of the research was implemented in 2022, when the children finished their primary education. The research aimed to find out whether the children who had achieved higher results in the FONT test and initial reading were subsequently more successful students. The data were obtained on their grades in two individual school subjects (Croatian and Mathematics) and their overall school achievement (grade point average).

¹ Subotić & Franc, 2015.

² Subotić, S.: *Konstrukcija testa fonološke svjesnosti na srpskome jeziku*. Primenjena psihologija, 2011/2.

³ Franc, V.: *Razlike u fonološkoj svjesnosti i ranome poznavanju slova kod djece predškolske dobi iz Montessori i redovitoga programa i njihov utjecaj na početno čitanje: doktorski rad*. Zagreb, 2015.

First research phase

Attending preschools that implement traditional programmes coincides with the developmental period of phonological awareness, which, according to the existing research findings, can be trained and potentially lead to short- or long-term advantages in relation to early literacy.⁴ Therefore, this study was conducted with the aim of determining whether the Montessori method facilitates early literacy and, if so, to which extent. It is a fact that proper development of prereading skills is influenced by quality, content-filled environment and certainly instruction that facilitates both phonological awareness and the application of the alphabetical principle.⁵ Based on these findings, we assumed that the children who attended the Montessori programme would achieve better results in the test for assessing phonological awareness and have higher reading achievement than the children who attended a traditional programme. The research heretofore in the Croatian language on phonological awareness was mostly focused on school-age children; it aimed at identifying children with poor achievement in order to timely detect disabilities in language and speech development. This research included preschool children and schoolchildren of average language and speech development with the aim of examining the correlation of phonological awareness, early letter knowledge and initial reading achievement, as well as determining the possible differences in phonological awareness of children attending two different preschool programmes. Since the traditional programme of preschool institutions does not include systematic implementation of language exercises for developing phonological awareness, our goal was to determine the extent to which phonological awareness itself and early letter knowledge predict successful reading acquisition and how different the programmes of preschool institutions themselves are. The first research phase set the following goals:

- (1) Determine the measure to which early-age training according to a structured Montessori programme influences the level of phonological awareness as a strong predictor of acquiring literacy.
- (2) Examine the measure to which early-age training according to a structured Montessori programme contributes to letter knowledge.

With regard to the goals of the first research phase, two hypotheses were formulated:

- H1- The children who attended the Montessori programme will be more successful in phonological awareness than the children who attended the traditional programme.
- H2- The children who attended the Montessori programme will be more successful in letter knowledge than the children who attended the traditional programme.

⁴ Lundberg, I., Olofsson, A., & Wall, S.: *Reading and spelling skills in the first school years predicted from phonemic awareness skills in kindergarten*. Scandinavian Journal of Psychology, 1980/21. 159–173.

⁵ Čudina-Obradović, M.: *Igrom do čitanja*. Školska knjiga, Zagreb. 2003.

The materials and methods of the first research phase

The research was conducted in nine different kindergartens where the Montessori programme was implemented, and one kindergarten in Zagreb and three kindergartens in Samobor with a traditional programme. The research was implemented in the period from 10 November 2013 until 15 March 2014, with a pause of a month (15 December 2013–15 January 2014, due to winter holidays), wherefrom it is obvious that the first research stage, which examined the level of phonological awareness and early letter knowledge in children aged five to seven, lasted three months.

A semi-structured questionnaire was used to interview the preschool teachers (a total of 30 Montessori preschool teachers and 19 preschool teachers of traditional programmes) and the parents (220 overall) of the participants, in order to establish whether and to which measure the children were exposed to language training.⁶

Test exercises

FONT

The data on the level of children's phonological awareness were obtained via the FONT test,⁷ which was intended to measure the development of phonological awareness in children. The FONT was originally designed and evaluated in the area of Bosnia and Herzegovina and Serbia, where it proved as a solid psychometric tool, and it was adapted to the specificities of the Croatian language for the needs of the author's dissertation.⁸ It is a test based on the theoretical paradigm of the distinction between phonemic and non-phonemic phonological awareness. It comprises the following exercises: rhyme recognition, recognition/identification of the initial and final phoneme, matching syllables, phonemic segmentation, substitution and omission, and, in the latest version (including the Croatian adaptation), an exercise of syllabic segmentation (to extend the measure of non-phonemic phonological awareness). Alongside the FONT test, the test for measuring the knowledge of capital and small block letters was used.

The results of the first research phase and discussion

Considering the fact that the knowledge of capital and small letters is in very high correlation ($r=.91$, $p<.001$), these two variables were joined in a single variable of letter knowledge, which was used in the rest of the analyses. Thereupon, the differences between two preschool groups were tested in relation to the value of this (unified) letter knowledge variable and the level of phonological awareness variable. This was done via the t-test. Due to unequal variances of the measured variables between the preschool groups, the Welch's version of the t-test was used.

⁶ Franc, 2015.

⁷ Subotić, 2011.

⁸ Franc, 2015.

Variance and covariance analysis (including the related previous transformations and corrections of the variables and coefficients), chi-square and correlational analyses were conducted, as well as the verification of moderation effects.

The differences in the results of phonological awareness and letter knowledge

In accord with the initial assumptions, statistically significant differences were found in phonological awareness between children in Montessori and traditional kindergartens both in phonological awareness ($M_M=44,85$, $SD_M=5,94$, $M_{tr}=36,00$, $SD_{tr}=10,73$, $t(170,08)=7,55$, $p<,001$, $d=1,02$) and letter knowledge ($M_M=23,34$, $SD_M=7,65$, $M_{tr}=18,12$, $SD_{tr}=9,47$, $t(208,82)=4,49$, $p<,001$, $d=0,61$), wherein the children in the Montessori group achieved higher results in both cases. Based on the Cohen's (1992) convention for assessing the effect size in the t-test, which states the d values of 0,20, 0,50 and 0,80 for small, medium and large effect sizes, respectively; it could be concluded that the difference in the level of phonological awareness was of small, whereas the difference in the letter knowledge was medium. Attention should also be paid to the fact that children from the Montessori kindergarten achieved considerably more even (less variable) results in comparison to the children from traditional kindergartens, whose results deviate from the arithmetic mean (M) more significantly, that is, their standard deviations (SD) are considerably higher. This is especially pronounced in the measure of phonological awareness.

Checking the differences between the groups was also conducted separately for five- and six-year-olds. In five-year-olds, the differences in favour of the Montessori group both in phonological awareness ($M_M=43,80$, $SD_M=7,42$, $M_{tr}=30,52$, $SD_{tr}=11,25$, $t(93,51)=7,30$, $p<,001$, $d=1,39$) and letter knowledge ($M_M=21,27$, $SD_M=8,21$, $M_{tr}=13,87$, $SD_{tr}=9,85$, $t(104,58)=4,28$, $p<,001$, $d=0,82$) were more pronounced than in the six-year-olds (phonological awareness: $M_M=45,89$, $SD_M=3,74$, $M_{tr}=41,49$, $SD_{tr}=6,70$, $t(84,77)=4,25$, $p<,001$, $d=0,81$; letter knowledge: $M_M=25,40$, $SD_M=6,50$, $M_{tr}=22,37$, $SD_{tr}=6,86$, $t(107,68)=4,28$, $p=,02$, $d=0,45$). Namely, although the advantage of the Montessori children was obvious also at the age of six, it was more visible in the five-year-olds. It was not possible to determine whether this drop in effect sizes occurred due to the characteristic of the concrete tested groups, was it age- or programme-related, or whether the (statistically significant) age difference of 0,15 years in favour of the children from traditional kindergartens contributed to the drop. The assumption on the effect of the age difference in the group of six-year-olds was tested via covariance analysis, where the age variable was statistically controlled. A statistically significant age effect was also found in the case of phonological awareness and letter knowledge (for phonological awareness: $F(1, 107)=4,348$, $p=,04$, $\eta^2=,03$; for letter knowledge: $F(1, 107)=10,97$, $p=,001$, $\eta^2=,09$). In the case of phonological awareness, adding the age category into the model resulted in the decrease of the differences (estimated based on the η^2 measure of the size effect) between the Montessori and traditional kindergarten group ($F(1, 107)=22,22$, $p<,001$, $\eta^2=,17$) in relation to the effect without the control of age ($F(1, 108)=18,09$,

$p < .001$, $\eta^2 = .24$). In the case of letter knowledge, adding age in the model resulted in the increase of differences in letter knowledge between the Montessori and traditional kindergarten group ($F(1, 107) = 10.65$, $p = .001$, $\eta^2 = .08$) with regard to the effect without the control of age ($F(1, 108) = 5.65$, $p = .02$, $\eta^2 = .05$).

Second research phase

Since a large number of studies point out the development of phonological awareness and early letter knowledge as precursors of general metalinguistic development in children and one of the key factors that empowers reading achievement,⁹ the second research phase aimed to determine the measure to which phonological awareness and early letter knowledge are predicative for reading acquisition. As metacognitive abilities, including phonological awareness, can be very efficiently trained and effect a long-term and powerful influence on the later acquisition of literacy, it was assumed that children who had the advantage in early phonological development would have higher reading achievement within this research. From the stated research goal, the following hypotheses were formulated:

H1- The children who attended the Montessori programme were assumed to have higher reading achievement than the children who attended the traditional programme.

H2- Global positive correlation between the initial level of phonological awareness, letter knowledge and reading achievement was assumed.

The differences in reading skills between children who previously attended the Montessori programme, that is, traditional preschool programmes was operationalised via two variables:

- 1) Reading accuracy (RA) = the number of correctly read words/total number of words * 100. Therefore, the obtained values corresponds with the percentage of the correctly read words.
- 2) The number of correctly read words in a minute (NCW/min) = the number of correctly read words/reading duration (in minutes).

The materials and methods of the second research phase

This research was conducted between 26 January 2015 and 16 February 2015 in four different schools in Samobor, nine different schools in Zagreb and one in Bregana (Slovenia). The research implementation was approved by the principals of the participating schools and the children's parents, who signed the consent forms.

The second research phase was meant to include 110 children from the older preschool group. Namely, it was expected for all children from the first phase to start primary school; however, ten children were still in preschool institutions and, due to the sample's dispersal, it was possible to include only 79 of them, i.e. 71,81%. Therefore, the sample included 39 children who had previously attended

⁹ Whitehurst & Lonigan, 1998, 2003; Snowling, 2000; Reid, 2009.

Montessori kindergartens (23 girls and 16 boys) and 40 children who had previously attended traditional kindergartens (18 girls and 22 boys).

Although quality reading assumes reading comprehension, our research was based solely on the examination of the reading technique because it was conducted at the beginning of the second term of the first grade, by which point the children acquired the knowledge of all block letters (capital and small) of the alphabet, i.e. the formal Latin alphabet. This indicates that most children primarily direct their attention while reading to „reading letters“, not the content of what is being read. Therefore, reading assessment was done via the following parameters: 1) reading accuracy (RA) = the number of correctly read words/total number of words * 100, which means that the obtained value matches the percentage of correctly read words, and 2) the number of correctly read words in a minute (NCW/min) = the number of correctly read words/reading duration (in minutes).

The research was conducted on the text *First grader* by Barbara Tonodi-Kukolj, which was taken from the workbook *First Steps* by A. Bežen and V. Budinski.

The results of the second research phase

Group differences were examined via the t-test. Correlations and regression analysis were utilised to examine the correlation between the prereading skills (phonological awareness and letter knowledge at a preschool age) and reading skills (RA and NCW/min at a school age). All these analyses were conducted only in the subgroup of participants ($N=79$) who were included in the additional test. It was found that the children who had attended the Montessori kindergartens realised higher percentages of correctly read words ($M_M=94,91$, $SD_M=3,55$) than the children who had attended traditional preschools ($M_{tr}= 91,49$, $SD_{tr}=4,79$). This difference reached the level of statistical significance: $t(71,91)=3,61$, $p=,001$, $d=0,81$. According to the Cohen's (1992) criterion, it is an effect of large intensity.

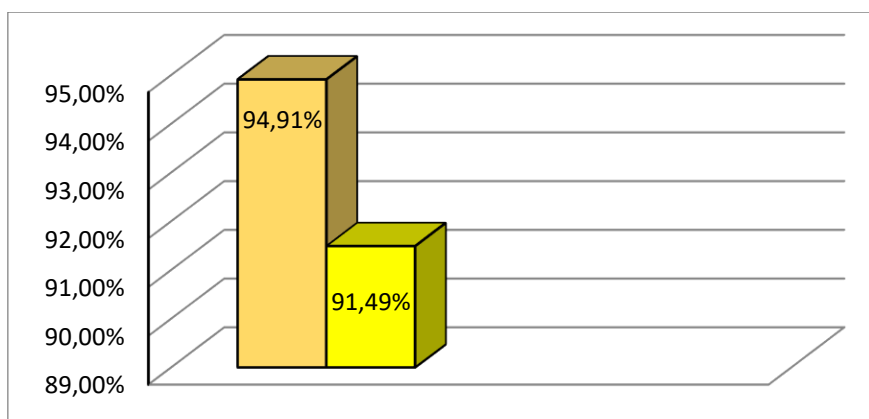


Table 1. Percentages of correctly read words (Franc, 2015)

Regarding the differences in the number of correctly-read words in one minute, the children who previously attended Montessori kindergartens also achieved higher average results ($M_M=32,13$, $SD_M=19,26$) than the children who had gone to traditional kindergartens ($M_{tr}=26,54$, $SD_{tr}=19,20$). However, this difference has not reached the level of statistical significance: $t(76,94)=1,29$, $p=,20$, $d=0,29$, despite the fact that the effect can be characterised as practically nontrivial, i.e. relevant ($d>0,20$; Cohen, 1992), although its intensity is small. It is immediately evident that the variability of the results around the arithmetic mean is expressed in both groups (standard deviations are 59,94%, that is, 72,34% of the mean's value), although none of the participant children have been identified as a statistical outlier.

As can be seen from Table 2, all prereading skills (phonological awareness and letter knowledge of the preschoolers) and reading skills (reading accuracy (RA) and the number of correctly read words in a minute (NCW/min) of the first-graders) are in mutual correlation.

Variables	Phonological awareness	Letter knowledge	RA	NCW/min
Phonological awareness	1,00			
Letter knowledge	,52***	1,00		
RA	,28*	,26*	1,00	
NCW/min	,36**	,50***	,46***	1,00

Table 2. Correlations between prereading and reading skills (Franc, 2015)

Notes: * $p<,05$, ** $p<,01$, *** $p<,001$.

A focal point of particular significance was to determine the possibility of foreseeing the value of reading variables in early school age based on the values of the preschool children's prereading skills. This was determined via two linear regression analyses.

In the first analysis, phonological awareness and letter knowledge in preschool children were set as precursors, while the first-grade students' reading accuracy was set as a criterion. A statistically significant model was obtained ($F(2, 76)=7,25$, $p=,001$) with the coefficient of determination $R^2=,096$. This means that the phonological awareness and early letter knowledge explained around 9,6% of the later reading accuracy variance. According to Cohen's (1992) recommendations, this is a small effect. The coefficients of partial correlations (β) are presented in Table 3.

Variables	β	Standard error	T	p
Phonological awareness	,20	,099	2,00	,049
Early letter knowledge	,16	,097	1,62	,110

Table 3. The prediction of initial reading based on phonological awareness and early letter knowledge (Franc, 2015)

Note: Standard errors and p -values were calculated with the correction of heteroskedasticity.

As can be seen, although both phonological awareness and letter knowledge in preschool children are individually correlated to reading precision in the first grade of primary school (Table 11), when they are observed in combination (Table 12), only phonological awareness remains a statistically significant predictor. This means that, out of the two, phonological awareness is a better predictor of the later reading precision, although this prediction does not pertain to a large effect size.

In the second regression analysis, phonological awareness and letter knowledge of the preschoolers were set as predictors, while the number of correctly read words in one minute in the first grade was set as a criterion. A statistically significant model was obtained ($F(2, 76)=14,50$, $p<,001$) with the determination coefficient $R^2=,26$. This leads to the conclusion that phonological awareness and early letter knowledge explain around 26% of the variance of the number of correctly read words in a minute. According to the Cohen's (1992) propositions, this is a large effect. Partial correlation coefficients (β) are presented in Table 4.

Variables	β	Standard error	T	P
Phonological awareness	,14	,07	2,10	,04
Early letter knowledge	,42	,09	4,68	<,001

Table 4. The prediction of the number of correctly read words in a minute based on phonological awareness and early letter knowledge

Note: Standard errors and p -values were calculated with the correction of heteroskedasticity.

As can be seen from the obtained results, both phonological awareness and letter knowledge of preschool children are in statistically significant correlation with the number of words the first-grade students can read correctly in one minute. However, early letter knowledge, in this case, was proven as a better predictor.

It is important to consider that phonological awareness and letter knowledge are prereading skills each in its own right, and they significantly influence reading acquisition, but it is almost impossible to expect nowadays that even one child in an older kindergarten group does not know at least one letter. Therefore, it is not only about letter knowledge, or solely about phonological awareness, because it is evident that examining one of these prereading skills independently of the other is almost impossible. Namely, our research also shows that the children, all 220 participants, knew at least a few letters, which emphasises the previously stated – it is impossible to find a pre-schooler attending a kindergarten (regardless of the programme) who does not know at least a letter. Along the same lines, it was realistic to expect in the second research phase, when all the children were in the first grade, that they already mastered reading, at least nominally, as they were tested in the so-called period of the skill's

consolidation in which they are not yet proficient. In any case, they were already relatively literate, and it was not realistic to expect expressed differences to arise. However, the advantage of children who previously attended the Montessori programme was evident in one of the two measured outcome variables (the percentage of correctly read words), while in the other (the number of correctly read words in one minute), an advantage was also noted, although not statistically significant. These results are very important because they show that early advantage on the behalf of the Montessori children is certainly very significant, i.e. this advantage in the prereading skills has a far-reaching effect, which confirms the Montessori concept as the more serving. Research by Hogan et al. (2005), Whitehurst and Lonigan (1998, 2003), Reid (2009) and Snowling (2000) has shown that phonological awareness and letter knowledge are the two best predictors of reading achievement, which was also found in our research. Furthermore, already in 1983, Bradley and Bryant established that the effect on reading improvement is greater when the training of phonological awareness is combined with instruction on joining letters and phonemes. The results of our research show that both phonological awareness and letter knowledge taken as separate variables are predictors of literacy development, each in its own right. Namely, both phonological awareness and letter knowledge are positively correlated to the two reading variables. However, when taken together, as in the case of initial reading, phonological awareness has greater predictive value than letter knowledge (letter knowledge loses its statistical significance in a joint model although the sample is small, so this should be considered). On the other hand, letter knowledge is a better predictor of the number of correctly read words in one minute. However, taken together, both phonological awareness and letter knowledge have significant predictive power, wherefrom the conclusion arises that each of the two variables bears a piece of useful information as powerful precursors of the number of words read in a minute. Therefore, phonological awareness and letter knowledge are better predictors of the number of correctly read words in a certain period than the number of mistakes.

The results of the first two research stages

H1- The children who attended the Montessori programme were assumed to have higher achievement in phonological awareness than the children who attended the traditional programme.

H2- The children who attended the Montessori programme were assumed to have higher achievement in letter knowledge than the children who attended the traditional programme.

Regarding the first hypothesis, the children from the Montessori programme were proven statistically different from the children who previously attended the traditional programme regarding the results in the phonological awareness test. Moreover, the obtained results also point to a statistical difference in favour of the children from the Montessori programme regarding early letter knowledge, whereby both the first and second research hypothesis were confirmed.

H3- The children who previously attended the Montessori programme were assumed to have higher reading achievement than the children who attended the traditional programme.

H4- Global positive correlation was assumed between the level of phonological awareness and letter knowledge and the later reading ability.

As for the third hypothesis, it was assumed that the children from the Montessori programme would have higher reading achievement, i.e. more pronounced reading skills than the children from the traditional programme, which the results of this research also confirmed on one of the two examined measures, whereas in the second, only an inkling of a trend was found. The last, i.e. fourth hypothesis has also been confirmed by the research results, as well as the fact that phonological awareness by itself and early letter knowledge, independent of phonological awareness, are strong predictors of children's reading skills.

Although the four hypotheses set in the first two research phases were almost completely confirmed, it is important to point out that the degree of control was relatively low and the possible influence of numerous other factors that were not measured (e.g. intelligence) or could not be controlled satisfactorily (socio-cultural differences and the like) cannot be excluded. Along the same lines, it is necessary to point out that in some analyses the inklings of insufficient sample size existed. However, albeit the number of participants was relatively low, it is indicative that all the obtained results weigh in favour of the Montessori programme, and for these indicators, it is advisable to implement future research on a larger population of preschool children, i.e. early school-age children. The results of this research can be applied in assessing and monitoring the proper development of phonological awareness of preschool children. The exercises whereby phonological awareness was examined can be applied in future research on prereading skills, more specifically, phonological awareness, which this research found important for the development of reading skills. The author of this paper concludes that more activities or exercises should be introduced for the encouragement of language skills development within traditional preschools; they should not only be a part of the programme for the oldest preschool children but start at the age of three, as is the practice in Montessori kindergartens. Namely, although our research entailed a relatively small number of children, the results still weigh in favour of the children from the Montessori programme with regard to prereading and reading skills. Therefore, the author considers this programme already entails a good system of elaborated and practically verified exercises, and it would be useful to introduce a part of them into the traditional preschool programme. In doing so, a possibility would be given to all children to realise the results that are for the time being achieved only by the children who previously attended the Montessori programme. This study has shown a significant advantage of the children from the Montessori programme in prereading and reading skills, proving the efficiency of these exercises, which is in line with the already existing research results in the English speaking countries.

Third research phase

A retest among one part of Franc's sample (2015) was done on two occasions: 1) when the children were at preschools and 2) when they were in the first grade of primary school, at which point they already mastered reading and writing, and their reading skills were tested with two measures – a) reading accuracy = (the number of correctly read words in a text / total number of words in the text) *100 and b) reading speed = the number of correctly read words / reading duration (in minutes).

The third research phase was conducted in June and July 2022, when it was possible to note the data on the children's overall academic achievement (grade point average) upon finishing the eighth grade of primary school. The obtained data for the 45 children who participated in both previous research phases (22 girls and 23 boys; 23 from the Montessori programme and 22 from traditional kindergartens).

The results of the third research phase

Descriptive statistics of the research variables are presented in Table 5. All these values were calculated only for the students who were available for the given measurement/variable (i.e. $N=45$ for T_0 i T_2 , $N=35$ for T_1). The comparison between the children who previously attended the Montessori or traditional programmes is presented in Table 6.

Variables	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Phonological awareness T_0	45	44.87	5.40	20.00	48.00
Reading accuracy T_1	35	94.88	3.90	82.09	100.00
Reading speed T_1	35	38.06	22.84	10.41	85.53
Grade in Croatian 5 th grade T_2	45	4.56	0.66	3.00	5.00
Grade in Maths 5 th grade T_2	45	4.47	0.81	2.00	5.00
GPA 5 th grade T_2	45	4.74	0.40	3.50	5.00
Grade in Croatian 6 th grade T_2	45	4.53	0.66	3.00	5.00
Grade in Maths 6 th grade T_2	45	4.42	0.84	2.00	5.00
GPA 6 th grade T_2	45	4.77	0.35	3.69	5.00
Grade in Croatian 7 th grade T_2	45	4.49	0.79	2.00	5.00
Grade in Maths 7 th grade T_2	45	4.33	1.00	2.00	5.00
GPA 7 th grade T_2	45	4.68	0.52	3.21	5.00
Grade in Croatian 8 th grade T_2	45	4.51	0.76	2.00	5.00
Grade in Maths 8 th grade T_2	45	4.38	1.01	2.00	5.00
GPA 8 th grade T_2	45	4.70	0.51	3.21	5.00

Table 5. Descriptive statistics for the research variables

Variables	Kindergarten group from T ₀	N	M	SD	Min	Max	Intensity of the difference (Cohen's <i>d</i>) and the corrected significance	Non-corrected significance (<i>p</i>)
Phonological awareness T ₀	Montessori	23	46.70	3.43	35.00	48.00	0.73	.021*
Phonological awareness T ₀	Traditional	22	42.95	6.42	20.00	48.00		
Reading accuracy T ₁	Montessori	18	96.19	2.57	91.04	100.00	0.72	.046*
Reading accuracy T ₁	Traditional	17	93.50	4.63	82.09	100.00		
Reading speed T ₁	Montessori	18	41.94	22.20	12.12	85.53	0.35	.309
Reading speed T ₁	Traditional	17	33.95	23.46	10.41	80.82		
Grade in Croatian 5 th grade T ₂	Montessori	23	4.83	0.39	4.00	5.00	0.91	.005*
Grade in Croatian 5 th grade T ₂	Traditional	22	4.27	0.77	3.00	5.00		
Grade in Maths 5 th grade T ₂	Montessori	23	4.83	0.39	4.00	5.00	0.99*	.003*
Grade in Maths 5 th grade T ₂	Traditional	22	4.09	0.97	2.00	5.00		
GPA for 5 th grade T ₂	Montessori	23	4.92	0.14	4.55	5.00	1.07*	.002*
GPA for 5 th grade T ₂	Traditional	22	4.54	0.49	3.50	5.00		
Grade in Croatian 6 th grade T ₂	Montessori	23	4.83	0.39	4.00	5.00	1.00*	.002*
Grade in Croatian 6 th grade T ₂	Traditional	22	4.23	0.75	3.00	5.00		
Grade in Maths 6 th grade T ₂	Montessori	23	4.78	0.42	4.00	5.00	0.96*	.003*
Grade in Maths 6 th grade T ₂	Traditional	22	4.05	1.00	2.00	5.00		
GPA for 6 th grade T ₂	Montessori	23	4.93	0.12	4.62	5.00	1.04*	.002*
GPA for 6 th grade T ₂	Traditional	22	4.61	0.43	3.69	5.00		

Grade in Croatian 7 th grade T ₂	Montessori	23	4.87	0.34	4.00	5.00	1.12***	<.001***
Grade in Croatian 7 th grade T ₂	Traditional	22	4.09	0.92	2.00	5.00		
Grade in Maths 7 th grade T ₂	Montessori	23	4.83	0.49	3.00	5.00	1.15***	<.001***
Grade in Maths 7 th grade T ₂	Traditional	22	3.82	1.14	2.00	5.00		
GPA for 7 th grade T ₂	Montessori	23	4.93	0.20	4.15	5.00	1.08*	.001**
GPA for 7 th grade T ₂	Traditional	22	4.42	0.63	3.21	5.00		
Grade in Croatian 8 th grade T ₂	Montessori	23	4.83	0.39	4.00	5.00	0.92	.005*
Grade in Croatian 8 th grade T ₂	Traditional	22	4.18	0.91	2.00	5.00		
Grade in Maths 8 th grade T ₂	Montessori	23	4.83	0.49	3.00	5.00	1.01*	.002*
Grade in Maths 8 th grade T _{2.002*}	Traditional	22	3.91	1.19	2.00	5.00		
GPA for 8 th grade T ₂	Montessori	23	4.93	0.19	4.15	5.00	1.02*	.002*
GPA for 8 th grade T ₂	Traditional	22	4.46	0.63	3.21	5.00		

Table 6. Comparison of the children who attended the M and R kindergartens according to the research variables

Note: * $p < .05$, ** $p < .01$, *** $p < .001$; statistical significance is given without the correction for multiple comparisons, and with the Bonaferroni correction.

The data in Tables 5 and 6 show that the children who previously attended the Montessori programme had 1.07 standard deviations higher grade point average than the children who originally attended the traditional preschool programme. The effects of the difference are given with and without the correction of statistical significance for multiple comparisons. The sample was relatively small, so, due to high dispersion in the first phase, it was difficult to reach a precise conclusion on individual differences, with or without the correction of statistical difference. However, the primary meta-point here is that the children who attended the Montessori programme have shown a general trend of higher achievement in all variables, on all occasions of measurement, regardless of the statistical significance.

Correlations with T ₀ phonological awareness	<i>r</i> (with the corrected significance)	Non-corrected significance (<i>p</i>)	<i>r</i> _{Montessori} – <i>r</i> _{TK}
Reading accuracy T ₁	.52*	.001**	.02
Reading speed T ₁	.49*	.003**	-.04
Grade in Croatian 5 th grade T ₂	.56***	<.001***	-.41
Grade in Maths 5 th grade T ₂	.30	.046*	-.01
GPA for 5 th grade T ₂	.48***	<.001***	-.21
Grade in Croatian 6 th grade T ₂	.49***	<.001***	-.29
Grade in Maths 6 th grade T ₂	.47***	<.001***	-.34
GPA for 6 th grade T ₂	.50***	<.001***	-.51
Grade in Croatian 7 th grade T ₂	.46*	.001**	-.15
Grade in Maths 7 th grade T ₂	.46*	.002**	-.27
GPA for 7 th grade T ₂	.48***	<.001***	-.26
Grade in Croatian 8 th grade T ₂	.58***	<.001***	-.22
Grade in Maths 8 th grade T ₂	.36	.015*	-.47
GPA for 8 th grade T ₂	.53***	<.001***	-.42

Table 7. The correlations of the initial phonological awareness and the subsequent measures of academic achievement

Note: * $p < .05$, ** $p < .01$, *** $p < .001$; statistical significance is given without the correction for multiple comparisons, and with the Bonaferoni correction.

The results regarding the correlation of phonological awareness and all the other variables are presented in Table 7. Statistical significance with and without the probability correction is given. It is obvious from the data that all the hypotheses are functionally confirmed because phonological awareness is in positive correlation (the principle of medium to moderately large intensity) with all the subsequent measurements, where even the two that lost their significance after the correction have an effect of medium intensity.

The obtained findings point out that the results in the phonological awareness test are generally in higher correlation to all the indicators of consequent achievement in children who attended the traditional programme than in children who attended the Montessori programme. Namely, the training of phonological awareness might be more important for the children in the traditional programme (wherein the training of phonological awareness is certainly less present) than for the Montessori children (who most certainly undergone a more pronounced phonological awareness training). The obtained results indicate that the children who attended the Montessori programme have higher academic achievement and at the same time higher scores in phonological awareness – in the Montessori group even 19 out of the 23 children, i.e. 82.6% achieved the maximum FONT score (848), whereas in the traditional programme, only 5 out of the 22 children, i.e. 22.7% achieved the same.

Conclusion

The longitudinal research presented in this paper indicates that early training of phonological awareness effects higher results in the FONT test, wherein the children from the Montessori programme displayed a higher level of phonological awareness than the children from the traditional preschool programme. The same children participated in the second research phase, and the reading achievement (accuracy and speed) of the children from the Montessori programme was higher as well. The third phase of the research was conducted with the goal of determining whether the children who achieved better results in the FONT test and higher initial reading achievement were also more successful as students. The gathered information on the grades in individual school subjects, Croatian and Mathematics, and overall academic achievement (grade point average) confirmed the hypothesis which assumed that the children who had high levels of achievement in the first two phases of the research would also realise higher GPA at the end of primary education. Albeit the number of participants was low, it was nevertheless sufficient to motivate reflection on the importance of encouraging the development of prereading skills at an early age, when children attend preschool institutions, in order to possibly prevent the differences in the level of phonological awareness, wherefrom not only the distinctions in reading ensue but also in the overall academic achievement.

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Abstract

Numerous relevant studies indicate that phonological awareness is one of the key predictors of initial reading achievement. Encouraging the development of phonological awareness begins already in preschool and continues in the first grade of primary school, when the reading and writing instruction is introduced. This paper presents research that is a continuation of a longitudinal study on the correlation between the first-grade students' phonological awareness and initial reading achievement and their overall academic achievement in grades five to seven of primary school. The author hypothesized that children whose level of phonological awareness was higher would have higher achievement in both individual school subjects (Croatian and Mathematics) and overall academic achievement, that is, grade point average in grades five to seven of primary school.

Key words: academic achievement, initial reading, phonological awareness