REVISTA CEFAC
SPEECH, LANGUAGE, HEARING SCIENCES AND EDUCATION JOURNAL
Rev. CEFAC. 2019;21(4):e10618 http://dx.doi.org/10.1590/1982-0216/201921410618

Original articles

Phonological awareness in elementary school students with low versus normal vision: a comparative study

Mayla Myrina Bianchim Monteiro
https://orcid.org/0000-0002-6930-7233

Maria Elisabete Rodrigues Freire Gasparetto
https://orcid.org/0000-0002-5221-0064

[1] Universidade Estadual de Campinas, Faculdade de Ciências Médicas, Departamento de Desenvolvimento Humano e Reabilitação, Campinas, São Paulo, Brasil.

Funding: Brazilian Federal Agency for Coordination for the Improvement of Higher or Education Personnel - CAPES.

Conflict of interests: Nonexistent

Received on: July 28, 2018
Accepted on: September 4, 2019

Corresponding address:
Mayla Myrina Bianchim Monteiro
Rua Tessália Vieira de Camargo, 126 - Cidade Universitária
CEP: 13083-887 – Campinas, São Paulo, Brasil
E-mail: maylamonteiro@gmail.com

ABSTRACT

Objective: to evaluate and compare the phonological awareness of low vision students with normal vision ones.

Methods: this is a cross-sectional, descriptive and quantitative research that was performed through the application of the Oral Phonological Awareness Test, which is composed of ten subtests, with four items each. The population consisted of 30 students attending public elementary school, aged 8 to 14 years, and divided into two groups of 15 participants each: the study group and the control one.

Results: the p value found was less than 1% for the Phonemic Synthesis, Rhyme, Phonemic Segmentation, Syllabic Manipulation, Phonemic Manipulation questionnaires, in addition to the two Phonemic Transposition questionnaires, thus, considering the significance level of 1%, and rejecting equality in the results of the questionnaires. Considering the significance level of 1%, and since the p-value obtained was less than 1%, a statistically significant difference was observed in the variance analysis of the sum of the points obtained in all questionnaires.

Conclusion: the Study Group, which was represented by low vision students, had lower results in most of the subtests of the Oral Phonological Awareness Test, except for the Syllabic Synthesis test, in which they had similar results as those of the Control Group, represented by normal vision students.

Keywords: Vision, Low; Language; Phonological Awareness

INTRODUCTION

The development of children's phonological system takes place gradually and naturally, but it respects the maturational stages and depends on the environment in which children are inserted due to the stimuli that they will receive[1].

Since phonological awareness embraces the ability to explicitly reflect on the word structure, understanding it as a sequence of phonemes and/or syllables[2,3], the relevance of phonological awareness for written language learning was highlighted, once children need to understand the graphophonemic relationship in order to learn to read and write in the alphabetic writing system. The skills in identification, analysis, synthesis and manipulation of phonological components at syllable and phonemic levels, which make up phonological awareness, are crucial to this end[4].

Phonological awareness seems to develop gradually, from the awareness of more global phonological units - words and syllables - to the development of phonemic awareness. In general, the different types of skills follow an emergency sequence - word awareness skill, which is followed by rhyme awareness, then syllables awareness, and finally phonemes awareness[5].

The relationship between phonological awareness and written language acquisition is well described in the scientific production of the field, since the greater the children's attention to the phonological structure of words, the greater their success in learning to read and write[3].

Efficient reading implies the functioning of several cognitive processes, such as perception, memory and attention. Moreover, it also implies the efficient functioning of both peripheral and central vision that must present the stimuli correctly to the brain, thus connecting all the systems required for reading and writing learning. The word recognition process accelerates to the extent that the subject assigns a meaning to the signifier. The subject must structure the lexical elements in the syntactic structure, that is, they must give a meaning to what is decoded. Thus, in addition to recognizing the meaning of the code, the subject is required to recognize the meaning of this code and integrate it into the message as a whole[6].

Favila et al. (2014)[7] found that children with decreased visual acuity need constant and specialized stimulation since the early years of life. Thus, the child may present the expected development for the age group. However, if the child is not stimulated, they will show delays in the acquisition of basic motor skills, language, social competence, and cognition.

The inclusion of low vision students in the educational field is not a recent fact. On the contrary, this introduction comes from a historical struggle, being significantly consolidated as a social movement, known worldwide, with the World Declaration on Education for All. The topic addresses new policy proposals for the inclusion of disabled students in regular schools, providing multiple perspectives and conceptions that contribute to the understanding of the scenario and complexity of the processes in which they operate[8].

According to the 10th review of the International Statistical Classification of Diseases and Related Health Problems (ICD-10), low vision occurs when the corrected visual acuity value in the better eye is less than 0.3 and greater than or equal to 0.05 (visual impairment categories 1 and 2), and blindness occurs when these values are below 0.05 (visual impairment categories 3, 4 and 5)[9].

Even with the political changes and the many new documents produced in the field, generalizations may arise regarding the potential learning disability of this population due to the belief in a lack of capacity and potential of low vision people.

Few studies have explored phonological awareness and how it may affect the written language acquisition of low vision children. Therefore, this research aimed to be a comparative study of the phonological awareness of low vision students and normal vision ones, attending public elementary schools.

METHODS

Study Design e Ethical Aspects

This is a cross-sectional, descriptive and quantitative research[10] that was approved by the Research Ethics Committee (REC) of the Faculty of Medical Sciences of the Universidade Estadual de Campinas under the protocol No. 042122/2017. The research method complied with the ethical principles for research involving human subjects, as regulated by the Resolution No. 466/12. All participants had their Free Prior Informed consent signed by parents and/or guardians.

Study Population

The population consisted of 30 students enrolled in elementary school of public schools, aged 8 to 14 years and divided into two groups of 15 participants

each: the study group and the control group, as shown below. Considering the purpose of the research, the study chose a non-probabilistic population[11].

- STUDY GROUP (SG) - Study group consisted of fifteen students of both genders who had congenital or acquired low vision;
- CONTROL GROUP (CG) - Control group consisted of fifteen students of both genders who had normal vision.

Exclusion criteria for the SG were blindness and the presence of other associated disabilities. While for the CG, the exclusion criteria were the presence of disabilities and learning difficulties.

Procedures

The evaluations were conducted at the Center of Studies and Research of their institutions.

Students were identified through the records of the municipal government. After reaching a list of students, the researchers contacted the schools and presented the purpose and the methods of the research. After the acceptance of each school, the students' parents were invited to attend the school so that the researcher could explain the research procedures. After the acceptance to participate in the study, the parents signed the Free Prior Informed consent and, as available, received a document with the date and location where the Oral Phonological Awareness Test (PCFO), which was designed by Capovilla and Capovilla (1998), would be applied individually[12].

The PCFO is composed of ten subtests, with four items each. The application of each task was preceded by two initial examples in which the researcher explained what should be done to the subject:

- In the Syllabic Synthesis subtest, the subject must combine the syllables spoken by the researcher saying which word results from the combination;
- In the Phonemic Synthesis subtest, the subject must combine the phonemes spoken by the researcher;
- In the Rhyme subtest, the subject must choose from three words which two end with the same sound;
- In the Alliteration subtest, the subject must choose from three words which two start with the same sound;
- In the Syllabic Segmentation subtest, the subject must divide a word spoken by the researcher according to its component syllables;
- In the Phonemic Segmentation subtest, the subject must divide a word spoken by the researcher according to its component phonemes;
- In the Syllabic Manipulation subtest, the subject must add and subtract syllables from words saying which word was formed;
- In the Phonemic Manipulation subtest, the subject must add and subtract phonemes from words saying which word was formed;
- In the Syllabic Transposition subtest, the subject must swap the syllables of the words saying which word was formed;
- In the Phonemic Transposition subtest, the subject must swap the phonemes of the words saying which word was formed.

Analysis of Results

A variance analysis was performed using the *aov* function of the R software to test whether there was a statistically significant difference between the SG-Low Vision and the CG. Then, a second analysis was performed: the permutation test using the perm.test function of the jmuOutlier package of the R software, which tested the null hypothesis that the SG-DV had the same performance as the CG against the hypothesis that low vision children would have a worse performance in the questionnaire.

RESULTS

The students who participated in this study and were included in the study group (SG) were 8 to 14 years old, mostly male (10). Only seven subjects wore glasses. Participants in the control group (CG) also were 8 to 14 years old, and also mostly male (9). Only two students of this group wore glasses. The participants were students enrolled from the first to ninth grade of elementary school.

Table 1 shows the categorization data of the sample.

Table 2 lists the values that show the difference between the SG and the GC in each of the subtests that are part of the Test.

A p-value of 14% was obtained for Syllabic Synthesis to test for the presence of a difference between the SG and the CG. As a 5% alpha value was adopted, there is not enough statistical evidence to reject equality between the two groups in this questionnaire.

A p value of less than 5% was obtained in the Questionnaires on Alliteration and Syllable Segmentation, with 2.4% and 1.9%, respectively. Considering the significance level of 5%, the equality of the groups was rejected in both questionnaires.

Table 1. Sample characterization: Study Group and Control Group

Group	Gender	Age	Education level	Use of Assistive Technology Devices
STUDY				
Subject 1	M	13	8th Grade of ES	
Subject 2	F	12	6th Grade of ES	
Subject 3	M	8	3rd Grade of ES	Yes
Subject 4	F	12	7th Grade of ES	
Subject 5	F	11	6th Grade of ES	
Subject 6	M	9	4th Grade of ES	
Subject 7	M	10	5th Grade of ES	
Subject 8	F	14	9th Grade of ES	Yes
Subject 9	M	14	9th Grade of ES	Yes
Subject 10	M	11	6th Grade of ES	
Subject 11	M	13	8th Grade of ES	
Subject 12	F	8	3rd Grade of ES	Yes
Subject 13	M	9	4th Grade of ES	Yes
Subject 14	M	10	5th Grade of ES	Yes
Subject 15	M	10	5th Grade of ES	Yes
CONTROL				
Subject 1	F	8	3rd Grade of ES	
Subject 2	F	11	6th Grade of ES	
Subject 3	M	13	8th Grade of ES	
Subject 4	M	14	9th Grade of ES	
Subject 5	M	12	7th Grade of ES	Yes
Subject 6	F	9	4th Grade of ES	
Subject 7	M	9	4th Grade of ES	
Subject 8	M	10	5th Grade of ES	
Subject 9	F	14	9th Grade of ES	
Subject 10	F	8	3rd Grade of ES	
Subject 11	F	9	4th Grade of ES	
Subject 12	M	10	5th Grade of ES	
Subject 13	M	11	6th Grade of ES	Yes
Subject 14	M	12	7th Grade of ES	
Subject 15	M	8	3rd Grade of ES	

Sample characterization. Research data. 2017. Legend: F: female; M: male; ES: Elementary School.

The p value found was less than 1% for the Phonemic Synthesis, Rhyme, Phonemic Segmentation, Syllabic Manipulation, Phonemic Manipulation questionnaires, in addition to the two Phonemic Transposition questionnaires. Thus, and considering the significance level of 1%, rejecting equality in the results of the questionnaires.

Considering the significance level of 1%, and since the p-value obtained was less than 1%, a statistically significant difference was observed in the variance analysis of the sum of the points obtained in all questionnaires (Table 2).

Table 2. Analysis of the phonological awareness variance test between the Study Group and Controls

Questionnaire	SG	CG	P. value
Syllabic Synthesis	49/60	56/60	14%
Phonemic Synthesis	30/60	44/60	0.8%
Rhyme	31/60	43/60	0.8%
Alliteration	28/60	42/60	2.4%
Syllabic Segmentation	26/60	41/60	1.9%
Phonemic Segmentation	24/60	39/60	0.3%
Syllabic Manipulation	18/60	37/60	<0.1%
Phonemic Manipulation	14/60	36/60	<0.1%
Syllabic transposition	11/60	35/60	<0.1%
Phonemic Transposition	7/60	35/60	<0.1%
Total Score	238/600	408/600	<0.1%

Variance analysis. p-value<1. Research data. 2017. Legend: SG: Study Group; CG: Control Group.

Table 3, showing the analysis of the phonological awareness permutation test, revealed that the CG had a better performance. The group had a small difference in p-values from the variance analysis, but they remained in the same ranges as in the other test (Table 3).

Table 3. Analysis of the phonological awareness permutation test between the Study Group and Controls

Subtest	SG	CG	P. value
Syllabic Synthesis	49/60	56/60	10.8%
Phonemic Synthesis	30/60	44/60	0.7%
Rhyme	31/60	43/60	0.8%
Alliteration	28/60	42/60	1.9%
Syllabic Segmentation	26/60	41/60	1.5%
Phonemic Segmentation	24/60	39/60	0.3%
Syllabic Manipulation	18/60	37/60	<0.1%
Phonemic Manipulation	14/60	36/60	<0.1%
Phonemic Transposition 1	11/60	35/60	<0.1%
Phonemic Transposition 2	7/60	35/60	<0.1%
Total Score	238/600	408/600	<0.1%

Permutation Analysis. p-value<1. Research data. 2017. Legend: SG: Study Group; CG: Control Group.

DISCUSSION

The results of this study showed that most subjects of the SG, which have low vision, had difficulties in PFCO tests. Statistically significant differences were presented between both groups in most subtests, except for the Syllabic Synthesis test. This result leads to the conclusion that, besides the visual difficulty, these children face difficulties in other learning journeys, since these tests are not vision-dependent.

However, it is important to note that this Syllabic Synthesis subtest is the most simple to perform, as syllable analysis and other suprasegmental skills tend to develop more naturally, since syllables are units that require less effort for analysis.

Most works published in Brazilian Portuguese address the phonological awareness of blind children who use the Braille System, which is not related to this study. No references have been found yet on how to address spelling "mistakes" in blind children. However, the research conducted by Capovilla and Capovilla (1997)[13] found the importance of phonological awareness for the acquisition of spelling rules in psychic children[9].

Therefore, it is assumed that phonological awareness is also of utmost importance for writing acquisition of children with visual impairment. The lack of visual information may be responsible for delays and changes in child development, especially during the early stages of language acquisition in low vision children, as seen in the study conducted by Lima and Nunes (2015)[14]. Low vision children had a better performance in subtests when compared to blind children in this study, which analyzed the phonological awareness of blind and low vision children. This supports the hypothesis that the lower the visual acuity, the greater the difficulty that the subject will face with phonological awareness.

The subtest in which children had greater difficulty to perform was the Phonemic Transposition. In this subtest, children are expected to swap the order of the phonemes of a given word, creating a new word, such as *AMOR - ROMA*. This data proves to be a negative aspect of development, since most children of the same age as the participants should have already completed the phonological acquisition process.

In general, phonemic transposition ability and phonemic skills are stimulated from the contact with writing, and, therefore, children with visual impairment could face more difficulties as they do not have the same access to writing as children with typical visual development (visual capabilities within normal parameters).

The learning process is not the same and does not follow the same pace for all children, so this difference may be directly related to intrinsic factors, which in turn depend on environmental or socioeconomic and cultural influences[15].

As mentioned earlier, the literature is scarce on phonological awareness in children with visual impairment. Thus, this study aims to analyze the written language acquisition process of low vision students, since the work with phonological awareness with these students should be done properly, providing accessibility.

Since speech therapy awareness is a prerequisite for the writing acquisition, it can be noted that there are no studies in the literature that show that students with visual impairment have changes. The results found in this research reveal the need for greater attention to these students during the written language acquisition stage.

One of the limitations in this study was the access to a small number of low vision students enrolled in municipal elementary school, which was only achieved through the Municipal Department of Education. Another limitation was the difficulty of finding literature showing results of phonological awareness tests of people with low vision.

CONCLUSION

The Study Group, which was represented by low vision students, had lower results in most of the subtests of the Oral Phonological Awareness Test, except for the Syllabic Synthesis test, in which they had results similar to those of the Control Group, represented by normal vision students.

The study is of great relevance, since there is almost no literature on phonological awareness of low vision children. And, in the way it is recognized, phonological awareness has a great influence on reading and writing learning. But the opposite is also true. The results found in this study allow suggesting that SG students may have difficulties in this ability.

Low vision is characterized by a reduction of information, in which the damages to the macula region significantly affect visual perception, thus, compromising the visual fixation, details view, sharpness and consequently restricting the amount of visual opportunities that are important for building the phonological system and reading and writing learning.

Therefore, education and health professionals working with low vision children should be aware of the specificities of these children, checking if there is a need for assistive technology devices to identify, more easily and quickly, the materials that are used in the classroom.

REFERENCES

1. Stefanini MR, Oliveira BV, Marcelino FC, Maximino LP. Performance in phonological awareness of children with phonological disorder: comparison of two instruments. Rev. CEFAC. 2013;15(5):1227-35.
2. Cavalheiro LG, Santos MS, Martinez PC. Influência da consciência fonológica na aquisição de leitura. Rev. CEFAC. 2010;12(6):1009-16.
3. Rosal AGC, Cordeiro AAA, Queiroga BAM. Phonological awareness and phonological development in children of public and private schools. Rev. CEFAC. 2013;15(4):837-46.
4. Suehiro ACB. Roteiro de avaliação da consciência fonológica (RACF). Act. Colom. Psicol. 2011;14(1):147-54.

5. Cielo CA. Habilidades em consciência fonológica em crianças de 4 a 8 anos de idade. Pró-Fono R. Atual. Cientif. 2002;14(3):301-12.
6. Capovilla AGS, Capovilla FC. Efeitos do treino da consciência fonológica em criança com baixo nível sócio-econômico. Psicologia: Reflexão e Crítica. 2000a;13(1):7-24
7. Favilla M, Cruz AFI, Martins P, Arruda SMCP, Gagliardo HGRG. Avaliação da visão funcional de uma criança prematura com cegueira congênita. Cad. Ter. Ocup. 2014;22(2):429-34.
8. Barros AB, Silva SMM, Costa MPR. Dificuldades no processo de inclusão escolar: percepções de professores e de alunos com deficiência visual em escolas públicas. Bol. - Acad. Paul. Psicol. 2015;35(88):145-63.
9. CID - Classificação Estatística Internacional de Doenças e Problemas Relacionados à Saúde. 10ª rev. São Paulo: Edusp; 2004. Cap. 7; Doenças do olho e anexos (H00-H59).
10. Gil AC. Como elaborar projetos de pesquisa. São Paulo: Atlas, 2002.
11. Laville C, Dione J. A construção do saber. Belo Horizonte, Ed. UFMG; 1999.
12. Capovilla AGS, Capovilla FC. Prova de Consciência Fonológica: desenvolvimento de dez habilidades de pré-escola a 2 a. série. Temas sobre Desenvolvimento. 1998b;7(37):14−20.
13. Capovilla A, Capovilla F. O desenvolvimento da consciência fonológica durante a alfabetização. Temas sobre o Desenvolvimento. 1997;35(6):15-21.
14. Lima AL, Nunes RTD. Phonological profile of children with low vision from 6 to 9 years old at an institution for the blind in the city of Salvador - BA. Rev. CEFAC. 2015;17(5):1490-8.
15. Segin M, Dias NM, Seabra AG, Teixeira MCTV, Carreiro LRR. Phonological awareness assessment in Williams syndrome. Rev. CEFAC. 2015;17(5):1483-9.