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RESEARCH ARTICLE

Evaluation of phonological awareness training on reading improvement and skills

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Abstract

Background and Aim: Reading is not only a fundamental skill in learning but also an important channel in dealing with the outside world. However, hearing impairment affects linguistic growth, including speaking and reading; development of understanding; and academic achievement. The purpose of this study was to investigate the effect of phonological awareness training on improving phonological reading and awareness in primary school children with hearing impairment.

Methods: The present study has a quasi-experimental design. The research was conducted as pretest, intervention and posttest. A total of 20 children with moderate to severe hearing loss were enrolled in the experimental group and 20 subjects in another group as the control. Reading and dyslexia test (NEMA) was used to assess reading improvement and phonological awareness was assessed by the phonological awareness questionnaire. The data normality was checked by Kolmogorov-Smirnov test and non-parametric Wilcoxon and Mann-Whitney U test were used to evaluate non-parametric data.

Results: Based on the results, after teaching the phonological awareness strategies to the experimental group, their reading and phonological awareness scores increased significantly higher than the control group ($p<0.05$). Also the results show higher phonological awareness scores in girls.

Conclusion: The results of this study showed that improvement of phonological awareness in children with hearing loss can improve and resolve their reading performance and problems.

Keywords: Phonological awareness; reading skills; hearing impairment

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Introduction

Reading is one of the most important skills in modern societies. However, dyslexia accounts for approximately 5-17% of children's problems and is the most common form of learning impairment [1]. Generally, the weakness in reading skills can be seen in all academic failures [2].

Dyslexia is described as a specific learning disorder originates from a psychological neurology and is characterized by problems in the proper recognition of words, spelling, and decoding ability. These problems lead to defects in other cognitive abilities [3]. People with difficulty in reading have problems in their most academic courses. In addition, the negative impact of this disorder is not limited to educational affairs, but

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extends to low self-esteem, anxiety, depression and tendency to antisocial and destructive behaviors. However, when these problems are accompanied with another problem, such as hearing impairment, they will have more destructive effects [4].

It is generally believed that the difficulty in reading is related to the lower levels of neuropsychological performance and the factors of multiple impairments [1]. Recently, many studies emphasize the role of phonological awareness in reading. For example, Ramus et al. suggested that dyslexic children are defective in phonological, visual, auditory and cognitive skills, even phonological problems may be due to the more fundamental defects of the basic perception mechanisms which is responsible for processing time-sensitive information. They stated that phonological awareness skills include identification, naming, decomposition, composition, deletion, substitution, and phonological reversal [5]. Seki et al. defined phonological awareness the knowledge the sounds of the word builder, and one can divide one word into several phoneme, syllable, and intra-syllable units. Therefore, there can be at least three phonological awareness problems in dyslexic children: phonological awareness, syllabic consciousness, intra-syllable unit's consciousness [6]. In a study by Leikin and Zur Hagit, the results showed that dyslexic people have good spontaneous knowledge, but their phonological processing is delayed. They found out that phonological processing and mere awareness would play a key role in decoding words. Their dysfunctions are inadequate awareness of their defects in inferiority knowledge and phonological problems [7]. Also, studies by Di filippo et al. showed that children with difficulty in reading were less likely to be tested in a fast-titled auto test, which is one of the phonological awareness assignments [8].

In Iran, studies have also been conducted on the significant role of phonological awareness in reading skills. For example, Soleimani's research findings showed that syllabic and intracurricular skills exist both in preschool and primary school children, but, phonological awareness skills were observed only in children who received formal instruction in reading, and not in preschool children [9]. Studies have also been conducted to prove the effectiveness of phonological awareness training on improving reading skills. For example, Habibi-Kaleybar et al. showed that both phonological awareness and mental rotation would significantly improve reading performance in dyslexic children [10]. However, there is no research on the effectiveness of these trainings on the reading skills of children with hearing impairment. One of the issues discussed in hearing impaired children is how phonological information is acquired in these children. In other words, what prohibits hearing loss from full reading and writing acquisition is a flaw in phonological processing of the written words. The permanent lack of auditory stimulation significantly interferes with the internalization of precise representations of spoken words (which is the expression of spoken words), including the growth of awareness of the phonological structure of those words [11]. Phonological awareness skills grow less well in the hearing impaired than normal children, and phonological awareness in hearing impaired students may be less specialized, due to the inability of the hearing impaired child to understand all the phonetic distinctions heard by the hearing attendant [12].

Considering the importance of reading skill in deaf and hearing impaired children, it is important to use methods that can improve the reading skills of these people. Regarding the lack of studies in this field and in order to evaluate the proper methods for improving the reading skills of deaf and hearing impaired children, this study aimed to evaluate the effectiveness of phonological awareness training on improving reading skills in children with hearing impairment.

Methods

The present study was a quasi-experimental study with pretest and posttest and control group. This study was carried out to evaluate the effect of phonological awareness training on improvement of reading performance in primary school children with hearing impairment in

Bahare stan City, Tehran Provinc e, Iran. The

Table 1. Group phonological awareness training sessions

Session	Topic	Purpose
1	Play with letters	Familiarity with words that are similar to the first and last letters
2	Play with letters	Make a meaningful word with alphabets
3	Play with letters	Write ten names, the first is "S"
4	Play with the word	Find meaningful words from table of letters to coincide
5	Play with the word	Find different words in each row with five words
6	Play with the word	Separating the chain of words
7	Play with phonemes	Finding the segments that differ from the rest in each row is six parts
8	Play with phonemes	Add a section and make a meaningful word to the written section
9	Play with phonemes	Make a meaningful word from the table to the coins
10	Play with phonemes	Write a few meaningful words with a specific section

study population comprised all 65 primary school children with hearing impairment in Baharestan City. A random sampling method was used to enroll 40 subjects. 20 subjects were assigned in the intervention group (11 boys and 9 girls) and 20 in the control group (11 boys and 9 girls). The study subjects should have completed the first grade without history of psychosis or intellectual deficits. The instruments used in this research were phonological awareness test [13] and facial reading test [14]. The phonological awareness test has 10 subscales. In each subscale, two to three words are given. First, the subject is trained on how to do each section. Then the images of that section are presented to the subject. If the respondent answers the requested item, he will receive a score of 1, and if he or she does not respond or gives an incorrect answer, the score will be 0. The Cronbach α coefficient of phonological awareness test is 98% [13]. In the reading test, the subscales used in the dyslexic test included reading test, comprehension test, word chain test, word compreension test, rhyme test, vouchers test, nonsense meaning reading test, image naming test, letter sign test, and a test of the sign of words, which is described below. The test was conducted on 1614 students (770 male and 844 female students) in five educational districts in Tehran, Sanandaj, and Tabriz. The α coefficient of reading and dyslexia was obtained as 81% [14]. After selecting students, they were taken phonological reading and knowledge tests and then the experimental group received 10 sessions of phonological awareness group training and the control group did not receive any training. The phonological awareness training includes skills such as recognizing words with the same initial voice or the same ending voice, as well as phonemic and syllabic discovery. The content of the sessions is briefly summarized in Table 1. It should be noted that success was considered in the whole reading not in each section separately. After completing the phono-

Table 2. Mean (standard deviation) scores of the phonological awareness and reading tests in hearing-impaired boys and girls of the experimental group before and after phonological awareness training

	Mean (SD) scores in boys (n=11)			Mean (SD) scores in girls (n=9)		
	Before	**After**	**p***	**Before**	**After**	**p***
Syllable fragmentation	4.7 (0.90)	8.33 (0.67)	<0.001	5.51(1.03)	31.5 (2.1)	<0.001
Congenital Diagnosis	5.6 (0.92)	8.84 (0.60)	<0.001	5.44 (0.82)	8.6 (0.67)	<0.001
Rhyme detection	57 (0.90)	9.16 (0.60)	<0.001	6.13 (0.29)	9.2 (0.19)	<0.001
Phoneme composition	5.1 (1.42)	8.90 (0.70)	<0.001	5.60 (0.92)	8.7 (0.78)	<0.001
Detect words with initial phonemes	5.2 (1)	8.84(0.75)	<0.001	5 (0.63)	8.8 (0.60)	<0.001
Detecting words with ending phoneme	5.6 (1.02)	9.09 (0.70)	<0.001	5.37 (1.12)	8.9 (0.70)	<0.001
Phoneme fragmentation	5.09 (0.70)	8.73 (0.46)	<0.001	5.15 (0.75)	8.9 (0.70)	<0.001
Naming and deleting the final phoneme	5.09 (1.34)	8.71(0.78)	<0.001	6.12 (0.75)	9.09 (0.53)	<0.001
Middle phoneme removal	5.9 (1.12)	8.25 (0.64)	<0.001	5.21 (0.46)	8.5 (0.68)	<0.001
Naming and removing phonemes	5.5 (0.68)	8.51 (0.52)	<0.001	5.58 (0.82)	8.9 (0.70)	<0.001
Reading test	17.71 (4.42)	21.01 (4.60)	<0.001	17.63 (5.84)	20.6 (3.8)	<0.001

* Wilcoxon test

logical awareness training sessions, the subjects of both groups received the reading and phonological knowledge test and the results were recorded and analyzed by Mann-Whitney U test and Wilcoxon test in SPSS 19.

Results

The results of phonological reading and phonological awareness tests are presented in Table 2. Based on the results, with regard to phonological awareness, the average score of all subscales in the posttest increased and the results of the Wilcoxon test show that this increase is statistically significant ($p<0.001$). Also Table 3 shows that total score of phonological awareness test of the experimental group in posttest has increased compared to pretest scores. The mean (SD) score test before intervention was 54.51 (3.92) that increased to 87.73 (2.33) in the posttest. According to the Wilcoxon test results, this increase was statistically significant ($p<0.001$). While in the control group, the total score of phonological awareness test in posttest was not significantly increased. The mean (SD) score of the test before the intervention was 56.73 (3.6), which after the test increased to 57.74 (2.50), but according to the Wilcoxon test results, this increase was not statistically significant ($p>0.05$). Also this study aimed to investigate the effectiveness of phonological awareness training on improving reading skills in hearing impaired students.

Table 3. Mean (standard deviation) of total scores of the phonological awareness and reading tests in the experimental and control groups before and after phonological awareness training

	Mean (SD) scores in experimental group (n=20)			Mean (SD) scores in control group (n=20)		
Test	**Before**	**After**	**p***	**Before**	**After**	**p***
Phonological awareness	54.51 (3.9)	87.82 (2.3)	<0.001	56.73 (3.6)	57.74 (2.5)	>0.05
Reading	17.35 (4.9)	20.83 (4.6)	<0.001	16.45 (3.4)	16.82 (4.1)	>0.05

* Wilcoxon test

As shown in Table 4, reading scores increased in the experimental group in the posttest as compared to the pretest results. The pretest reading skill score in the experimental group was 17.35 and in the post-test it was 20.83. The results of the Wilcoxon test also showed that this increase was statistically significant ($p<0.001$). However, reading scores in the control group in the posttest were not significantly different from the pretest scores. The pretest score of reading skills in the experimental group was 16.45 and 16.22 in the experimental group and the results of the Wilcoxon test showed that this increase was not statistically significant ($p>0.05$).

Table 4 also presents that the outcome of phonological awareness training to girls' phonological awareness (89.83) was more than boys (85.75). According to the results of Mann-Whitney U test, this increase is statistically significant ($p<0.05$). Also, the results of this Table show that boys' posttest score (21.81) is more than girls (19.01) in reading test, but according to the results of Mann-Whitney U test this difference is not statistically significant.

Discussion

The purpose of this study was to evaluate the effectiveness of phonological awareness skills training on reading skills and phonological awa-

Table 4. Mean (standard deviation) of score improvement in boys and girls of both experimental and control groups after phonological awareness training

	Mean (SD) score improvement in experimental group			Mean (SD) score improvement in control group		
Test	**Boys (n=11)**	**Girls (n=9)**	**p**	**Boys (n=11)**	**Girls (n=9)**	**p**
Phonological awareness	21.44	25.64	<0.001	4.06	4.76	<0.19
Reading	4.96	2.89	<0.03	0.95	0.71	<0.11

reness of children with hearing impairment. The results of this study show that phonological awareness training improves the reading and phonological awareness of children with hearing impairment. These findings are consistent with the research by Ramus et al. and Soleimani, reporting that phonological awareness is influential in reading skills [5,9]. The results of this study are also consistent with Habibi-Kaleybar et al. research, reporting that phonological awareness training has an impact on the reading skills of children with dyslexia [10]. To explain the results of our study, one of the phases of the word recognition is identification of the word's letters and sounds. As long as the child cannot properly recognize and read the word in terms of its appearance, he or she will never be able to reach the level of understanding and meaning of the word, because in the first stage it is difficult to read the word itself [15]. Understanding the letters in any language is an essential requirement for reading. Therefore, the acquisition and use of such knowledge in the cognitive structure of a person helps him in reading accurately and quickly, also a small amount of phoneme structure can increase the errors and reduce reading speed, and mental reading can be difficult [15]. In perceptual dysfunction, the child attempts to find the relationship between the shape, letters, and sound of the concept each time, and since this relationship has not been completely formed, the reading becomes interrupted [16] and the child makes mistakes. Several problems, such as fast reading, interruptions, and hang on the words, affect the speed and fluidity of reading [17]. In linguistic dysfunction, the normal procedure fails to recognize the form of the word to then transform it into sound and meaning. Thus, the phonological awareness training approach aims at helping children to recognize the appearance of the word and raise their level of phonological awareness. This training will ultimately lead to the correct reading of the word. In fact, it seems that the use of phonological awareness with the ability to identify words sounds is an essential skill for the

development of spelling through understanding the spoken language units of the phoneme and syllables as well as making a meaningful and correct connection between words and sounds. Also, sound awareness helps the child to correctly classify spoken words and then write them down [17]. All of these issues indicate the importance of identifying problems in the phonological awareness of children with hearing impairment and implementing timely intervention programs. Phonological awareness allows the individual to manipulate the phonological components of the language and thereby convert the phoneme into a text and understand the meaning of the text [18]. Accordingly, the acquisition and use of such knowledge in the person's cognitive structure helps him or her to read correctly and promptly [18]. Phonological awareness skills are a strong predictor of reading skills, and it is even said that this skill is stronger in predicting reading skills than intelligence, vocabulary, and listening comprehension [19].

Another finding of this study was the effectiveness of phonological awareness training on phonological awareness of students with hearing impairment. It should be said that phonological awareness can be improved by improving the accuracy and subsequent improvement of phonological awareness by increasing student awareness of letters and sounds, syllables, communication between phrases and sounds, recognizing first letters, middle and end words, phoneme combinations, and phonemic manipulation. In fact, phonological awareness is the ability to hear and manipulate the smallest unit of sound in a language, and is the key to learning to read for children. Therefore, the training of phonological awareness increases the phonological awareness skill, and one can gain knowledge about the structure of voice and phonological speech, which in turn results in improved reading skills [20]. The vocabulary awareness training used in this study includes a task that is quantifiable in the phonological awareness test, so training these skills can improve phonological awareness in these children.

We also found that phonological awareness training is more effective on phonological awareness of girls than boys. The results of this study are consistent with the research by Moura et al., which showed that phonological awareness training has a greater effect on girls than boys [21]. Also, the results of Chipere's research showed that phonological awareness is generally better in girls than boys. The results of these studies show that the increase in phonological awareness skills in girls is easier than boys [22]. In explaining the results, we can point out the overall superiority of girls in verbal intelligence compared to boys. This superiority, which is rooted in girls' brain structures, help them to benefit more from phonological trainings [23].

In the end, it should be noted that this research has also some limitations, including the use of available sampling method, absence of follow-up, and use of only children in the sample. It is recommended that in future studies, follow-up courses be used to assess sustainability of the trainings, i.e. the effectiveness of treatment over time, also different levels of deafness be examined individually. It is also suggested that the effectiveness of this treatment be compared with other treatments and trainings.

Conclusion

The current research shows the strong link between phonological awareness and reading success. According to the findings, phonological awareness training improves reading skill in hearing impaired primary school children.

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Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

1. Gathercole SE, Pickering SJ, Knight C, Stegmann Z. Working memory skills and educational attainment: evidence from national curriculum assessments at 7 and

14 years of age. Appl Cogn Psychol. 2004;18(1):1-16. doi: 10.1002/acp.934
2. Snowling M, Nation K, Moxham P, Gallagher A, Frith U. Phonological processing skills of dyslexic students in higher education: a preliminary report. J Res Read. 1997;20(1):31-41. doi: 10.1111/1467-9817.00018
3. Rendall AR, Tarkar A, Contreras-Mora HM, LoTurco JJ, Fitch RH. Deficits in learning and memory in mice with a mutation of the candidate dyslexia susceptibility gene Dyx1c1. Brain Lang. 2017;172:30-8. doi: 10.1016/j.bandl.2015.04.008
4. Hutzler F, Kronbichler M, Jacobs AM, Wimmer H. Perhaps correlational but not causal: no effect of dyslexic readers' magnocellular system on their eye movements during reading. Neuropsychologia. 2006;44(4): 637-48. doi: 10.1016/j.neuropsychologia.2005.06.006
5. Ramus F, Rosen S, Dakin SC, Day BL, Castellote JM, White S, et al. Theories of developmental dyslexia: insights from a multiple case study of dyslexic adults. Brain. 2003;126(Pt 4):841-65.
6. Seki A, Kassai K, Uchiyama H, Koeda T. Reading ability and phonological awareness in Japanese children with dyslexia. Brain Dev. 2008;30(3):179-88. dio: 10.1016/j.braindev.2007.07.006
7. Leikin M, Zur Hagit E. Morphological processing in adult dyslexia. J Psycholinguist Res. 2006;35(6):471-90. doi:10.1007/s10936-006-9025-8
8. Di Filippo G, Brizzolara D, Chilosi A, De Luca M, Judica A, Pecini C, et al. Naming speed and visual search deficits in readers with disabilities: evidence from an orthographically regular language (Italian). Dev Neuropsychol. 2006;30(3):885-904. doi: 10.1207/s15326942dn3003_7
9. Soleimani Z. [Phonological awareness and effect of reading in 5.5 and 6.5 years old Persian children]. Archives of Rehabilitation. 2000;1(2):27-35. Persian.
10. Habibi-Kaleybar R, Farid A, Shaban Besim F. [The Comparison of the effect of mental rotation and phonological awareness training on accuracy, speed and comprehension in students with dyslexia in city of Tabriz]. J Arak Uni Med Sci. 2017;20(2): 10-21. Persian.
11. Goswami U. Phonological skills and learning to read. Ann N Y Acad Sci. 1993;682(1):296-311. doi: 10.1111/j.1749-6632.1993.tb22977.x
12. Briscoe J, Bishop DV, Norbury CF. Phonological processing, language, and literacy: a comparison of children with mild-to-moderate sensorineural hearing loss and those with specific language impairment. J Child Psychol Psychiatry. 2001;42(3):329-40. doi: 10.1111/1469-7610.00726
13. Soleymani Z, Kazemi Dastjerdi M. [Valldi1y and reliabiu1y of the phonological awareness test]. Journal of Psychology. 2005;9(1):82-100. Persian.
14. Hosaini M, Moradi A, Kormi Nouri R, Hassani J, Parhoon H. [Reliability and validity of reading and dyslexia test (NEMA)]. Advances in Cognitive Science. 2016;18(1):22-34. Persian.
15. Xu M, Yang J, Siok WT, Tan LH. Atypical lateralization of phonological working memory in developmental dyslexia. Journal of Neurolinguistics. 2015;33: 67-77. doi:10.1016/j.jneuroling.2014.07.004
16. Lovett MW, Borden SL, DeLuca T, Lacerenza L, Benson NJ, Brackstone D. Treating the core deficits of developmental dyslexia: Evidence of transfer of learning after phonologically- and strategy-based reading training programs. Dev Psychol. 1994;30(6):805-22.
17. Torgesen JK, Morgan ST, Davis C. Effects of two types of phonological awareness training on word learning in kindergarten children. J Educ Psychol. 1992;84(3):364-70. doi: 10.1037/0022-0663.84.3.364
18. Nation K, Snowling MJ. Beyond phonological skills: broader language skills contribute to the development of reading. Journal of research in reading. 2004;27(4):342-56. doi: 10.1111/j.1467-9817.2004.00238.x
19. Leinonen S, Müller K, Leppänen PHT, Aro M, Ahonen T, Lyytinen H. Heterogeneity in adult dyslexic readers: Relating processing skills to the speed and accuracy of oral text reading. Read Writ. 2001;14(3-4):265-96. doi: 10.1023/A:101111762
20. Yeung SS, Siegel LS, Chan CK. Effects of a phonological awareness program on English reading and spelling among Hong Kong Chinese ESL children. Read Writ. 2013;26(5):681-704. doi: 10.1007/s11145-012-9383-6
21. Moura SR, Mezzomo CL, Cielo CA. Phonemic awareness stimulation and its effects regarding the variable gender. Pro Fono. 2009;21(1):51-6.
22. Chipere N. Sex differences in phonological awareness and reading ability. Language Awareness. 2014;23(3): 275-89. doi: 10.1080/09658416.2013.774007
23. Lundberg I, Larsman P, Strid A. Development of phonological awareness during the preschool year: the influence of gender and socio-economic status. Read Writ. 2012;25(2):305-20. doi: 10.1007/s11145-010-9269-4