



# Effects of listening ability on speaking, writing and reading skills of children who were suspected of auditory processing difficulty

Fulya Yalçinkaya<sup>a</sup>, Nuray Bayar Muluk<sup>b,\*</sup>, Semra Şahin<sup>c</sup>

<sup>a</sup> Hacettepe University, Faculty of Medicine, ENT Department, Division of Audiology and Speech Pathology, Ankara, Turkey

<sup>b</sup> Kırıkkale University, Faculty of Medicine, ENT Department, Kırıkkale, Turkey

<sup>c</sup> Hacettepe University, Faculty of Health Sciences, Department of Child Development, Ankara, Turkey

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## ABSTRACT

**Objectives:** The aim of this study was to investigate the effects of listening ability on speaking, writing and reading skills of children who was suspected of auditory processing difficulty (APD).

**Method:** This research was conducted with 67 children in 1st or 2nd grade of primary school. The first group (Group I—control) was comprised of 41 children without APD. The second group (Group II—study group) was comprised of 26 children with APD. Listening, speaking, reading and writing skills were evaluated by Observational Rating Scale (ORS) and analyzed in both groups.

**Results:** Listening value of ORS in APD group was significantly lower; and, speaking, reading and writing values of ORS in APD group were significantly higher than control group ( $p = 0.000$ ). It was also found that, the main effect of listening skills was on speaking in normal children, and on writing ability in children with APD.

**Conclusion:** It was concluded that, for school-aged children, APD can lead to or is associated with difficulties in written language.

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## 1. Introduction

Auditory processing is the ability to listen, comprehend, and respond to information that we hear through our auditory channels. This includes the detection of sound by the external ear and the transmission of sound through the auditory pathways to the brain. Listening, speaking, reading and writing skills of children are important in the development of their communication and language. Every language in the world comprises of four basic principles: it does not matter what sort of language it is, where it is from and how it is structured. They are all made up of reading, writing, speaking and listening. These four principles are intrinsically linked but also very different [1]. “Listening” is defined as an active, focusing process which allows for a quick and precise analysis of sounds that are heard [2]. The foundation on which receptive (reading) and expressive (written) skills are built is spoken language. If the sounds that form the basis of language are not clearly recognized and thoroughly analyzed, this can pose an obstacle to the development of written language skills.

The critical role of listening is a key for the development and enhancement of language and learning skills in the poor listening conditions (e.g., noise backgrounds, distance from speaker, reverberation). Since noise masks speech sounds, decreased speech perception abilities, comprehension of information and academic achievement, increased social–emotional problems are observed [3]. Student’s ability to process and analyze the sounds of language may also influence their ability to translate the sounds of language into their written form. Especially, listening ability of the 1st or 2nd grade students affects the quality of both their spoken on written and reading language development. Some children do not understand words and sentences because of the poor listening conditions since certain sounds arrive in reverse order. Poor listening skills are characterized by decreased attention for auditory information, distractible or restless in listening situations, difficulty with auditory discrimination expressed as diminished ability to discriminate among speech sounds (phonemes), deficiencies in remembering phonemes and manipulating them (e.g., in tasks related to reading and spelling, and phonics, as well as phonemic synthesis or analysis) [4–6].

Children with listening-based communication problems are frequently seen to have very poor audio-vocal control or self-listening, confusion or reversal of letters, poor reading comprehension, poor reading aloud, poor spelling and auditory synthesis. Reading is not simply a visual process. It involves the rapid analysis of graphic images (letters), which represent sounds. In other

\* Corresponding author at: Birlik Mahallesi, Zirvekent 2. Etap Sitesi, C-3 Blok, No. 62/43, 06610 Çankaya, Ankara, Turkey. Tel.: +90 312 4964073/90 532 7182441; fax: +90 318 2252819.

E-mail addresses: [nbayarmuluk@yahoo.com](mailto:nbayarmuluk@yahoo.com), [nurayb@hotmail.com](mailto:nurayb@hotmail.com) (N.B. Muluk).

words, it is sound which gives meaning to the letter or graphic image. The process of decoding the graphic images or letters into sounds, and subsequently, the recognition of their meaning, is more efficient when auditory processing skills are well developed. Writing may be viewed in a similar way. It is a process in which sounds are translated into graphic form. If the sounds of language are poorly integrated, it is likely to be a disturbance in their graphic reproduction. The ability to spell may be hindered by such an underlying disturbance [2,7].

Language-based learning disabilities are not necessarily those that involve impairments with speech but rather than with the use of language whether it is in speaking, reading, spelling and/or writing. In many researches, it was determined that listening problems directly influenced language in the critical periods of language development (0–3 and 3–6 years) and lowered their success during school age. This result was observed in children having auditory processing disorder (APD) [8]; specific language impairment (SLI) [9]; disorders of language development [10]; poor language and phonological skills [11]; and speech and language problems [12]. Among these disorders, especially in children having APD and SLI, significant listening problems are observed and their success in school is adversely affected. APD describes a mixed and poorly understood listening problem characterized by poor speech perception, especially in challenging environments. The listening performances of 64 children (probably having central auditory processing (Central) auditory processing disorders [(C)APD] but not diagnosed) were obtained from teachers using the Children's Auditory Processing Performance Scale [13].

The central auditory processing disorders [(C)APD] is a deficit in neural processing of auditory stimuli that is not due to higher order language, cognitive, or related factors. Children with [(C)APD] may have spelling, reading, and other academic problems. Auditory processing difficulties become more pronounced in challenging listening situations. This can have a negative impact on both language acquisition and academic performance. The data obtained indicated that the listening performances of these children vary greatly, depending upon the listening conditions and the listening functions being rated.

Typically, screening questionnaires, checklists, and related measures probe auditory behaviors related to academic achievement, listening skills, and communication. At this time, there is no universally accepted method of screening for (C)APD (ASHA). Checklists that ask teachers and parents to observe the child's

auditory behaviors may be used to determine a need for the APD evaluation. The parent's description of the child's auditory behavior at home is an especially important contribution to the diagnosis of APD [14,15].

For school-aged children, [(C)APD] can lead to or be associated with difficulties in learning, speech, language (including written language involving reading and spelling), social, and related functions.

In literature, studies related to the assessment of listening skills of children can be seen although they are not sufficient [3,13,16]. However, there is no study in literature about the effect of listening on speaking, writing and reading skills of school age children. In the present study, we investigated the effects of listening ability on speaking, writing and reading skills in 1st and 2nd grade children who was suspected of APD.

## 2. Materials and methods

### 2.1. Subjects

Normal children and children with the risk of auditory processing difficulty (APD), attending to 1st and 2nd grade of primary school, were included to the study.

### 2.2. Selection criteria for normal group and children who was suspected of APD group

All of children (1st and 2nd grade) were selected by their teacher. It was reported that all of the children had average or above-average intelligence and had no history of hearing impairment and IQ by their teacher. According to their teachers, they have normal speak and language (uses voice appropriately, uses sentences oral communication, maintains topic, speaks fluently and talks, for an appropriate length of time, responds to audience on request).

These selected children were applied checklists (Table 1), searching auditory processing difficulty, by their teachers. Checklist was prepared according to both observations on school-aged children attending to our Hearing and Speech Center and literature survey [8,17,18].

If there were  $\geq 6$  behavioral item, these child were included into pathological group (children who was suspected of auditory processing difficulty (APD)). If there were  $< 6$  behavioral item, these child were included into normal group.

**Table 1**

For school-aged children, the signs for auditory processing disorders.

1.	Does not seem to hear or listen (this can be intermittent).
2.	Difficulty in receiving and processing incoming messages simultaneously/competing.
3.	Inconsistent responses to auditory information (sometimes responds appropriately, sometimes not) or inconsistent auditory awareness (one-to-one conversation is better than in a group).
4.	Poor listening skills characterized by decreased attention for auditory information; distractible, inattentive or restless in listening situations.
5.	Needs instructions to be repeated back.
6.	Difficulty in understanding speech in the presence of background noise.
7.	Deficiencies in remembering phonemes and manipulating them (e.g., in tasks related to reading and spelling, and phonics, as well as phonemic synthesis or analysis).
8.	Need more time to process information, taking longer to respond in oral communication situations.
9.	Speech sound discrimination difficulties, i.e. troubles in understanding what is heard when there is background noise, more than one person speaking, or other sound distractions.
10.	Difficulty following complex auditory directions or commands.
11.	Difficulty in directing, sustaining, or dividing attention.
12.	Difficulty following multi-step directions.
13.	Difficulty following long conversations.
14.	Difficulty in understanding rapid speech.
15.	Have low academic performance.
16.	Have behavioral problems at home or in school.
17.	Difficulty in taking notes.
18.	Difficulty with auditory discrimination (for example, confuses "puppy" with "puffy").
19.	Difficulty in learning songs or nursery rhymes.
20.	Needs to have the same information repeated over and over before they can begin to comprehend.

**Table 2**

Listening, speaking, reading and writing skills of normal and APD group according to the Observational Rating Scale (ORS).

ORS skills	Groups								p <sup>*</sup>
	Group I—control				Group II—APD				
	Mean	Standard deviation	Minimum	Maximum	Mean	Standard deviation	Minimum	Maximum	
Listening	10.44	2.13	9.00	18.00	7.67	0.81	9.00	36.00	0.000
Speaking	23.19	5.47	19.00	39.00	50.63	18.16	21.00	76.00	0.000
Reading	7.56	2.47	6.00	16.00	17.17	5.35	8.00	24.00	0.000
Writing	7.58	2.50	6.00	18.00	18.33	5.67	7.00	24.00	0.000

\* p-Value shows the results of Mann–Whitney U-test.

Normal group (Group I—control) comprised of 41 children (25 males and 16 females). Their mean age was 7.58 ± 0.66 years (range: 7–8 years). APD group (Group II) comprised of 26 children (21 males and 5 females). Their mean age was 7.66 ± 0.81 years (range: 7–8 years).

2.3. Instrumentation

2.3.1. The Observational Rating Scale

The Observational Rating Scale (ORS) [19] was designed to more broadly assess aspects of language functioning by gathering qualitative information from parents and teachers on how school-aged children use language and communication skills in the domains of listening, speaking, reading, and writing. ORS is composed of four categories which are listening, speaking, reading, and writing. For each category, the degree of skills that children have is rated as follows:

- Never:* 1-point ratings: indicates that the target skill has not been observed.
- Sometimes:* 2-point ratings: indicates that the target skill is emerging, but is not observed as consistently as those skills that are rated 3 points.
- Often:* 3-point ratings: indicates that the target skill is emerging.
- Always:* 4-point ratings: indicates that the target skill is observed consistently.

2.4. Method

Observational Rating Scale (ORS) was applied to both groups. Listening, speaking, reading and writing skills were assessed in both groups. Ratings of listening, speaking, reading and writing skills of children with APD were compared to normal children's performances.

All steps of the study were planned and continued according to the principles outlined in the Declaration of Helsinki [20]. All children in the study and control groups were included into the study with their parents' agreement by written informed consent to participate in the study, and to give permission for the use of their children's all data.

2.5. Statistical analysis

Statistical packet for SPSS (Version 8.0) was used for statistical evaluation. The difference between age; and ORS results of control and APD groups was analyzed by Mann–Whitney U-test.

To observe the effect of listening skills on speaking, reading and writing skills, ratings were compared. Ratings of obtained data were statistically analyzed by "Spearman Correlation Rho Efficient" for both groups (normal and APD).

p-Value <0.05 was considered as statistically significant.

3. Results

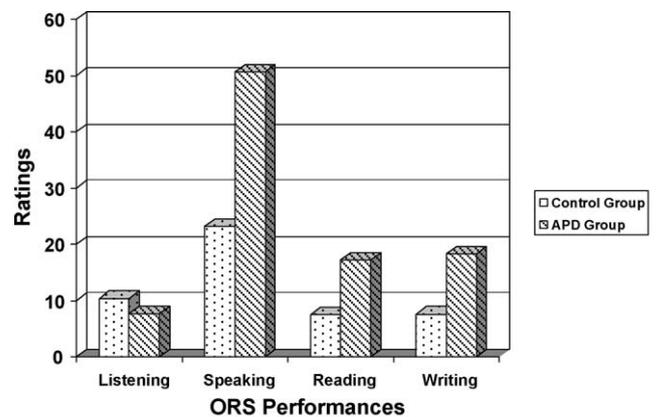
The performances of children in normal and APD groups in listening, speaking, reading and writing skills, according to the Observational Rating Scale (ORS) are demonstrated in Table 2 and Fig. 1.

The difference between ages of control and APD groups was analyzed by Mann–Whitney U-test; no significant difference was present (p = 0.828).

The difference between ORS results of control and APD groups was analyzed by Mann–Whitney U-test; and it was determined that the difference was statistically significant for listening, speaking, reading and writing ratings (p < 0.05) (Table 2):

- Listening ratings of ORS in APD group (mean: 7.67 ± 0.81) were significantly lower than control group (mean: 10.44 ± 2.13) (p = 0.000).
- Speaking ratings of ORS in APD group (mean: 50.63 ± 18.16) were significantly higher than control group (mean: 23.19 ± 5.47) (p = 0.000).
- Reading ratings of ORS in APD group (mean: 17.17 ± 5.35) were significantly higher than control group (mean: 7.56 ± 2.47) (p = 0.000).
- Writing ratings of ORS in APD group (mean: 18.33 ± 5.67) were significantly higher than control group (mean: 7.58 ± 2.50) (p = 0.000).

To observe the effect of listening skills on speaking, reading and writing skills, ratings were compared. Ratings of obtained data



\*Listening ratings of ORS in APD group was significantly lower (p=0.000); and, speaking (p=0.000), reading (p=0.000) and writing (p=0.000) ratings of ORS in APD group were significantly higher than control group.

**Fig. 1.** The performances of children in normal and APD groups in listening, speaking, reading and writing skills\*. *Deep note:* \*listening ratings of ORS in APD group were significantly lower (p = 0.000); and, speaking (p = 0.000), reading (p = 0.000) and writing (p = 0.000) ratings of ORS in APD group were significantly higher than control group.

**Table 3**

Correlations for the listening, speaking, reading and writing skills of control and APD groups by "Spearman Correlation Rho Efficient".

Groups		Listening	Speaking	Reading	Writing	
Control (n = 41)	Listening	r		0.632	0.632	
		p		0.000	0.000	
	Speaking	r	0.747		0.618	0.718
		p	0.000		0.000	0.000
	Reading	r	0.632	0.618		0.906
		p	0.000	0.000		0.000
	Writing	r	0.642	0.718	0.906	
		p	0.000	0.000	0.000	
APD (n = 26)	Listening	r	0.774	0.769	0.814	
		p	0.000	0.000	0.000	
	Speaking	r	0.774		0.776	0.815
		p	0.000		0.000	0.000
	Reading	r	0.769	0.776		0.910
		p	0.000	0.000		0.000
	Writing	r	0.814	0.815	0.910	
		p	0.000	0.000	0.000	

were statistically analyzed by "Spearman Correlation Rho Efficient" for both groups (normal and APD).

### 3.1. In the control group (normal—Group I)

In the control group, statistically significant difference was found between *listening* and *speaking* skills ( $p = 0.000$ ). These two skills were positively correlated and the correlation coefficient was 0.747 (see in Table 3).

Statistically significant difference was also observed between *reading* and *writing* skills ( $p = 0.000$ ). There was a positive correlation between these two skills. Correlation coefficient was 0.906 (see in Table 3).

### 3.2. In APD group (Group II)

In APD group, statistically significant difference was observed between *listening* and *writing* skills ( $p = 0.000$ ). There was a positive correlation between these two skills with a correlation coefficient of 0.814 (see in Table 3).

The difference between *speaking* and *writing* skills of children in this group was found as statistically significant ( $p = 0.000$ ). There was a positive correlation between speaking and writing skills. The correlation coefficient was 0.815.

Statistically significant difference was also observed between *reading* and *writing* skills ( $p = 0.000$ ). The correlation coefficient was 0.910 (see in Table 3).

## 4. Discussion

Since children having listening problems perceive information in a different way, they have difficulty in storing, locating, retrieving, and/or clarifying information to make it useful for academic and social purposes. The listening problems may have a negative impact on academic performance. Listening problem was expected to affect speaking skill in pathological group. However, it was observed that the mostly affected skill from the listening problem was writing. Writing is a process in which sounds are translated into graphic form (letters). Listening the sounds of letters is required for reading and writing. The results obtained from this study show that teaching how to write is based on the relation between listening and writing. If the sounds of language are poorly integrated, there is likely to be a disturbance in their graphic reproduction.

In children with APD, there is no problem in recognition of letters (written or graphic forms). Their problems are to combine

the letter sounds and syllables and encoding. Moreover, there is also problem in process of decoding the graphic images or letters into sounds. Because, they have deficiencies in remembering phonemes and manipulating them (e.g., in tasks related to reading and spelling, and phonics, as well as phonemic synthesis or analysis).

Auditory processing disorders (APD) is not a type of specific learning difficulty. It is a deficit in neural processing of auditory stimuli which is not due to higher order language, cognitive, or related factors. The dysortographia is a type of specific learning difficulty which impacts the application of grammatical rules. It is manifested by the severe difficulties with understanding the grammar structures of the language. Therefore, it could be said that children with APD have not dysortographia.

For school-aged children, APD can lead to or be associated with difficulties in learning, speech, language (including written language involving reading and spelling) [21–23]. However, the correlation between auditory deficits and language, learning, and communication sequelae is far from simple.

In the present study, the children's language development is normal. Classroom teachers declare that there are no difficulties in these children's communications with their friends and teachers, require language and speech, and in learning academic information. But, they have difficulties in written language involving reading and spelling. For example, language comprehension problems can occur in the presence of normal central auditory processing and APD does not always present with language problems. They are considered higher order cognitive–communicative and/or language-related functions and, thus, are not included in the definition of AP. The language *processing* and *auditory processing* are not synonymous; however, disorders of language and auditory processing may lead to similar behavioral symptoms.

A relation between speaking and listening was found in this study. The foundation on which receptive (reading) and expressive (written) skills are built is listening and spoken language. If the sounds that form the basis of language are not clearly recognized and thoroughly analyzed, this can pose an obstacle to the development of written language skills. For example, the relation between listening and speaking skills of children in control group was higher as compared to other variables. In addition, the relation between writing and reading skills was also higher as compared to other variables. If the relation between listening and reading had been higher, it would not have been possible to see the effect of listening problem directly. It can be concluded that listening problem affected writing directly but reading skills indirectly.

Listening-based learning problems do not necessarily involve impairments with speech but rather with the use of language whether it is in speaking, reading, spelling and/or writing. For some individuals these difficulties do involve speech impediments that make it hard to communicate verbally, while others can technically speak correctly.

If the relation between listening and reading had been higher as compared to other variables, it would have been possible to state that the children might have difficulties in learning the things that they had listened. According to the study of Weinberg et al. [24], the performance of good readers was not affected by listening also. Generally, the difficulty in reading is based on the factors such as dyslexia, deficits in the development of phonological representations and IQ [6,25–28].

Spring and French [29] studied with disabled and nondisabled readers in Grades 4, 5, and 6. They validate a method to identify children with specific reading disabilities from the discrepancies between their reading and listening comprehension scores. It was found that the nondisabled readers were scored slightly higher on reading than on listening comprehension while children with

reading disabilities scored significantly lower on reading than on listening comprehension. In the study of Badian [30], it was aimed to determine whether defining reading disability by a discrepancy between group-administered tests of listening and reading comprehension would produce result similar in terms of stability, gender ratio, and prevalence to IQ-achievement test discrepancy definitions. It was concluded that defining reading comprehension disability in terms of a discrepancy between listening and reading comprehension provided a fairly accurate estimate of the stability, gender ratio, and prevalence of the disorder.

The researchers have shown that deficits in fundamental auditory processes are related to higher order reading and spelling difficulties in some cases; however, this relationship is affected differentially by the types of reading or spelling difficulties that are present as well as by the presence of significant variability in the nature of auditory deficits across subjects (e.g., Refs. [21,31–32]). Keith [14] reported, modify the environment by reducing background noise and enhancing the speech signal to improve access to auditory information.

In this study, the highest correlation was observed between listening performance and writing. This study showed that it is necessary to search whether children having writing problem have also listening problem or not. If it is thought that the children have listening problem, it is beneficial to remove factors producing noise in their class. The most important thing is to understand the reason of the problem. Also, children with listening-based listening problems constituted heterogeneous groups. Therefore, it is necessary to investigate the reasons of problem in different aspects. Students who are good listeners and speakers tend to become strong readers and writers.

The auditory stimulus travels along the neural pathways where it is “processed,” allowing the listener to determine the direction from which the sound comes, identify the type of sound, separate the sound from background noise, and interpret the sound. The listener builds upon what is heard by storing, retrieving, or clarifying the auditory information to make it functionally useful.

APD is an impaired ability to attend to, discriminate, remember, recognize, or comprehend information presented auditorily in individuals who typically exhibit normal intelligence and normal hearing [18]. This definition has been expanded to include the effects that peripheral hearing loss may contribute to auditory processing deficits [15]. Auditory processing difficulties become more pronounced in challenging listening situations, such as noisy backgrounds or poor acoustic environments, great distances from the speaker, speakers with fast speaking rates, or speakers with foreign accents [33].

If listening, speaking, reading and writing disorders are related to learning difficulties and language disorders, the diagnosis of APD cannot be made anyway. As it is known, intelligence and learning developments of children with APD, and language levels of most of them are normal. In the present study, reading, writing and speaking skills of the APD children are better than the controls. It may be speculated as probable different causes of the APD such as noisy backgrounds or poor acoustic environments, great distances from the speaker, speakers with fast speaking rates, or speakers with foreign accents, poor phonics and speech sound discrimination, difficulty listening or paying attention in noisy environments, etc.

As a conclusion, the ability to speak, read and write is strongly influenced by the ability to listening. Traditional educational and therapeutic approaches can be employed to remediate areas of need in listening and writing. Many techniques that have shown to be effective with children with APD would be beneficial to all children, with and without APD. Environmental modifications such as classroom acoustics, placement, and seating may help. Teach the child to listen selectively. Acoustic modifications can

be made to the classroom (e.g., carpeting, acoustic ceiling tiles, window treatments) which should help to minimize the detrimental effects of noise on the child’s ability to process speech in the educational setting. Finally, teachers and parents can assist the child in overcoming his or her auditory deficits by speaking clearly, rephrasing information, providing preferential seating, using visual aids to supplement auditory information, and so forth.

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