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The Contribution of Phonological Awareness to Reading Fluency Among Elementary School Students who are Hard of Hearing

Khalaf Alfadeed

Northern Borders University, Kingdom of Saudi Arabia

Abstract

In this study, the relationship between phonological awareness (PA) and reading fluency (RF) of students who are hard of hearing (SHH) was analyzed. Participants in the study were (26) SHH in the fourth to sixth grades in public elementary schools in Riyadh, Saudi Arabia. The PA and the RF scales were applied. Findings of the study indicated that there was a medium to strong relationship between the variables. Results also showed that SHH had low PA and RF skills. The study proposed topics for further research to enhance the linguistic and academic development of this group of students.

Keywords: Phonological Awareness, Reading Fluency, Hard-of-Hearing

Introduction

Reading is at the top of the scale of major academic goals for students who are hearing and hard of hearing. According to the National Reading Panel, effective reading skills consist of five critical components: phonological awareness, phonics, fluency, vocabulary, and comprehension (National Reading Panel, [NRP], 2000). In general, students who are hard of hearing (SHH) often show lower reading and sub-reading skills than their hearing peers (Zhao, et al., 2021; Antia, et al., 2020; Zhao et al., 2019; Karchmer & Mitchell ,2011). These poor results persist despite the increase in inclusive education placements, access to general curricula, extensive use of cochlear implants, digital amplification systems, proliferation of interpreters, annotations, and inclusions that ensure access to education (Luft, 2019). This weakness can be attributed to many considerations and circumstances, but some researchers have argued that the lack of access to phonemic units hinders the chain of processes leading to effective reading (Suggate, 2016). It is known that SHH demonstrate lower levels than their hearing peers in PA and RF, which are the two main components of reading skills (Miller and Clark., 2011). More specifically, the relationship between PA and RF is very complex and unresolved (Landerl et al., 2019; Luft, 2018; Elhassan et al., 2017). Accordingly, this study attempts to explore this relationship by selecting a sample of SHH, on whom PA Scale and RF Scale are applied, and then analyzing the results to find out the type of this relationship. Understanding the relationship between phonological awareness and reading fluency is expected to improve reading levels in SHH, by opening avenues for researchers and practitioners to choose the best strategies to enhance the reading skill and its sub-components for SHH. Therefore, we can say that this study will try to answer the following question: How does Phonological Awareness contribute to Reading Fluency Among Elementary School Students who are Hard of Hearing?

Phonological Awareness (PA)

PA refers to sensitivity to the phonemic structure of spoken language (Vloedgraven & Verhoeven, 2009). More specifically, it is a child's sensitivity to the various phonemic units that make up spoken language, including words, syllables, beginnings, intonations, and phonemes (Justice, 2006). Early on, PA was considered a strong predictor of reading ability among hearing students (Wagner & Torgesen, 1987; Adams, 1990; NRP, 2000; Cunningham et al., 2004; Vellutino et al., 2007; National Early Literacy Panel [NELP], 2008). The situation has not changed during the past decade, as many studies confirm the crucial role of PA in the development of reading skills, since there is a close relationship between PA and learning to read in general (Rakza and AlHammadi, 2017; Alzahrani and Alyami, 2017; Melby-Lervåg et al., 2012). As for the subcategorization of PA, studies vary in dividing

Corresponding Author e-mail: kalshammari@nbu.edu.sa

https://orcid.org/0000-0002-6247-184X

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PA into a number of skills, but researchers generally address a common set of sub-skills such as listening, rhyme, fragmentation, isolation, merging, substitution, and deletion (Al-Dosari & Bedawi, 2021; Fayyad, 2021; Heppner, 2020; Rashid, 2019; Soliman et al., 2018; Atta, 2018; Abdo, 2018; Ragab & Al-Jamal, 2016; Robinson, 2010; Vloedgraven & Verhoeven, 2009).

Concerning SHH, studies show that these students have low PA skills (Fayyad, 2021; Mohammed, et al., 2018; Lund et al., 2015; Miller, 2013; Kyle & Harris, 2011). However, many studies confirm the role of PA in enhancing language in general among this group of students. Abdo (2018) confirmed the impact of PA on the development of auditory perception among elementary school SHH. Al-Ahmad (2011) also found an effect of PA on the development of receptive language among these students at the same stage. Barakat (2017) emphasized the important role of PA in enhancing some expressive language skills among SHH. In addition, Atta (2018) found that training on PA contributes to developing the auditory skills of this group of students in the elementary school. Finally, Abdelhafeez et al., (2019) also emphasized the importance of developing PA to curtail speech disorders in SHH.

Reading Fluency (RF)

RF was recognized early on as an important predictor of reading competence (Anderson et al., 1985). Interest in this skill began towards the end of the last decade, but the defining event was the declaration of the National Reading Panel (NRP, 2000). NRP introduced the notions that this skill is related to reading comprehension, and that it is one of the five components of reading (Rasinski et al., 2019). Definitions of RF vary according to the divergent views of researchers in defining its sub-components. While some classify it into skills of accuracy and automaticity (rate), some add components such as expressive reading and comprehension (Zhao et al., 2019; Paige et al., 2014; Luckner & Urbach, 2012; Courbron, 2012; Levy et al., 2010; NRP, 2000). In this regard, Alfadeed (2020a) confirms that the literature that defined RF agrees on two main components of RF; namely, accuracy and automaticity, but varies in determining expressive or rhythmic reading and comprehension as RF components. In addition, as Alfadeed (2020a) pointed out, Yen (2012) attempted to resolve this disparity in determining RF components by stating that there was broad agreement that spontaneity and accuracy were inherent components of RF, and expressive or rhythmic reading has recently begun to be recognized as one of the important RF components. However, this is more evident in the case of oral reading, while comprehension is used as an RF indicator in silent reading, and is emphasized as the ultimate goal of reading. Accordingly, this study followed the definition by Bursuck & Damer (2006) who argued that RF is often expressed as reading rate; i.e., the number of words read in a specific period, and accuracy; i.e., reading words, phrases, and sentences in a continuous and correct manner.

Despite the importance of RF, it has not received much attention in the field of education of SHH (Zhao et al., 2019). Moreover, most studies in the field of RF among SHH are comparative in nature, often based on comparisons of SHH with their hearing peers (Easterbrooks & Huston, 2007). Nevertheless, it is logical that SHH have a much lower RF level than their hearing peers (Alfadeed, 2020a; Luft, 2019; Emerson, 2010). However, according to Easterbrooks & Huston (2007) for students who are deaf and hard-of-hearing (DHH), RF is closely related to the understanding of words and phrases. Emerson's study (2010) aimed to review the literature on RF among DHH and the role it plays in reading comprehension and concluded that RF is vital for enhancing reading skills in general. However, the study recommended conducting studies to reach a deeper understanding of RF among DHH and its impact on their reading skills. Luckner & Urbach (2012) also investigated research in the field of RF among SDHH between 1970 and 2009. The study concluded that RF is crucial for teaching reading in general, but it has not been sufficiently studied among SDHH, and therefore there is an urgent need to discover this skill among this group of students to ensure they reach good reading levels. Alfadeed (2020a) also reviewed the literature published on RF, focusing on this skill among SHH, and concluded the RF is crucial for enhancing other aspects of linguistic and academic growth, especially reading comprehension skills. The study also found that SHH showed lower levels of RF than their hearing peers. Moreover, the study recommended conducting more studies to describe more deeply the levels of RF among SHH in the different educational stages, and to test the appropriate conditions, tools, and strategies for evaluating and improving this skill.

Relationship between PA and RF

While PA is an important and well-established predictor of reading development, it is still unclear how it relates to RF (Elhassan et al., 2017). These doubts are not recent as Wagner & Torgesen (1987) argued that PA is insufficient to develop RF. Bouregaa (2021) also found a discrepancy in the relationship between PA skills and RF.

On the other hand, Rashid (2019) revealed that students in the elementary school who showed high levels of PA had good reading accuracy and rate. Babli (2009) also concluded that developing PA skills had an effect on the reading speed and comprehension among students with learning

disabilities in elementary school. According to Al-Dosari and Muhammad (2017) there is a positive relationship between PA and RF among children with learning disabilities.

In the field of teaching SHH, this debate has not yet been resolved (Luft, 2018). More broadly, Miller et al., (2011) reported conflicting evidence about the effect of PA on RF skills among DHH. According to Emerson (2010) PA plays a major role in learning RF to SHH. Alzahrani and Alyami (2017) argued that PA played a positive role in improving the reading ability of elementary school female students with cochlear implants. Fayyad's study (2021) also confirmed the effectiveness of developing PA to improve the skills of oral reading among SHH at the elementary school. Luetke-Stahlman and Nielsen (2003) underscore the importance of developing PA skills among SHH to reach good reading levels. Wang et al., (2017) also confirmed the existence of a positive relationship between phonological knowledge, silent RF, and comprehension among SHH.

On the other hand, Izzo (2002) recommended reconsidering the role of PA as a prerequisite for reading. The study noted that PA did not contribute to the reading outcomes of elementary school students who had a hearing impairment of more than 70 decibels. Zhao et al., (2019) confirm that the relationship of PA with RF is complex and depends on many factors. They noted a correlation between PA awareness and RF among SHH in the first grades, but the matter differs in the upper grades, and it is in complete contrast with the hearers. In this regard, Muhammad et al., (2018) Drew a comparison between students with cochlear implants and a moderate relationship among SHH. Miller et al., (2011) reviewed many studies on the role of PA in the reading process and concluded that despite the weakness of PA among DHH, these students often succeed in developing reading strategies that allow them to recognize written words at levels like their hearing peers. Overall, students who have hearing problems are at a disadvantage compared to their hearing in all areas because they cannot implicitly learn the relationship between letters and sounds without direct instruction and access to sound (Emerson, 2010).

It is clear from the literature reviewed that there is an ongoing debate about the nature of the relationship between PA and RF among elementary school SHH. Therefore, this study attempts to contribute to providing a new understanding of the nature of this relationship by studying the relationship between PA and RF in general, and then studying the relationship between the components of these skills. A deeper understanding of this relationship could lead to improved reading levels for SHH, by employing strategies to support reading skills, as PA and RF are key components of reading skills.

Method

Participants and ethics approval

The application of the study was approved by the Institutional Review Board (IRB) of the Northern Border University as per approval letter no. 441014111, dated 11/26/2022. Schools which with SHH programs were identified in Riyadh, Saudi Arabia. The Department of Education in Riyadh was contacted to allow the study to be administered on students. After that, contact was made with school leaders, supervisors, teachers, and parents of students to facilitate the administration of study tools. A number of (26) SHH, who were identified in the fourth to sixth grades, with the age range 9-12 years, were selected. Study tools were explained to school leaders, teachers, and to students and their parents.

The criteria adopted for selecting the participants are as follows: firstly, The Saudi Standard of SHH (hearing impairment ranging from 35-69 Db) is adopted. Secondly, participants receive their education in a normal school. Thirdly, a participant shall have a normal IQ. Fourthly, there have no other disability. Fifthly, there are in grades four through six. Sixth, they use hearing aids. Finally, their age are between 9-12 years. Participants' data were obtained from school records (Table 1).

Table 1: Participants' Data

No.	*Hearing Db*	*IQ*	*Grade*	*Age*	*No.*	*Hearing Db*	*IQ*	*Grade*	*Age*
1.	50	92	6	12	**14.**	55	89	4	9
2.	54	91	6	11	**15.**	45	90	4	9
3.	48	92	6	12	**16.**	45	94	5	10
4.	45	93	5	11	**17.**	50	100	5	10
5.	50	98	5	12	**18.**	55	90	4	10
6.	60	88	6	12	**19.**	55	90	4	9
7.	65	92	6	12	**20.**	45	97	6	12
8.	45	96	6	11	**21.**	65	90	6	11
9.	40	102	5	11	**22.**	55	90	5	10

No.	*Hearing Db*	*IQ*	*Grade*	*Age*	*No.*	*Hearing Db*	*IQ*	*Grade*	*Age*
10.	40	90	5	10	**23.**	55	93	4	9
11.	55	92	5	12	**24.**	60	90	4	10
12.	45	90	4	10	**25.**	45	93	4	9
13.	60	92	6	11	**26.**	45	90	5	11

Research design

The correlational method is employed in this study. The Correlational method is aims to describe the relation between two or more events or characteristics (Hallonen and Santrock, 1999). In this study, the relationship between PA and RF levels among the participants was examined.

Application of the scales

After identifying the students participating in the study, the leaders of the targeted schools were contacted, and the necessary approvals were obtained. After that, participants were interviewed. The scales procedures were explained to them. They were informed that those procedures are voluntary and do not interfere with their academic grades. The days and hours for applying the scales were identified. The RF Scale was applied first, followed by the PA Scale.

Data collection tools

Phonological Awareness Scale

The PA Scale for SHH in elementary school was used. The scale was developed by Matar and El-Gamal (2016). Permission to apply the scale was obtained. The scale measures six dimensions: the division of sentences into words, the division of words into syllables (morphemes), the joining of phonemes (letter sounds), the division of words into phonemes (letter sounds), the assonance, and the identification of the first phoneme (letter sound) of words. The maximum score for each dimension is (5), and therefore the full final score for the scale is (30). The researchers confirm that the scale has strong validity and reliability, as it was presented to a group of independent arbitrators, and concurrent validity was used. It was also re-applied to the rationing sample, and the Pearson correlation coefficient is (0.90), and was calculated between the two applications.

Reading Fluency Scale

The researcher designed the RF Scale, after reviewing the literature, and several measures used by previous studies, such as (Alfadeed, 2020b; Blonder et al., 2019; Falk, 2017; Alamri, 2016; Ari, 2015; Moore, 2012; Krammer, 2007). The scale consists of a reading text, stopwatch, recorder, registration form, and application instructions. The scale measures two variables of RF; namely, reading rate and reading accuracy, and takes (10) minutes to be administered. The scale used standards (Hasbrouck & Tindal, 2017; Brysbaert, 2019) to calculate the rate and accuracy. As shown in Table 2.

Table 2: Reading Fluency Scale Standards

Variables		*Standards*
Reading Rate	4th Grade	> 123 words/minute
	5th Grade	> 139 words/minute
	6th Grade	> 150 words/minute
Reading Accuracy		> 95%

Instrument validity was verified through the following: it was reviewed by a group of independent arbitrators. It was also re-applied to the rationing sample. The Spearman correlation coefficient was calculated between the two tests. Results showed that there was a high degree of correlation between the two measurements.

Table 3: Reliabilities and Validities of the Reading Fluency Scale

Variables	*Spearman's rho*
Reading Rate	.965**
Reading Accuracy	.929**

Statistical analysis

Data were analyzed using IBM SPSS Statistics. Given the number of study participants, nonparametric tests were used to evaluate the study data. The Spearman's correlation coefficient was used to find out the degree of correlation between study variables. The mean performance of participants on the scales was calculated.

Results

Results show low RF and PA skills among SHH. According to Table 2, the mean score of students for the two dimensions of RF were (56.66%) for accuracy and (15.54) words per minute for reading rate. In reading accuracy, only (7) students reached normal levels, representing approximately a quarter of the study community (26.92%). On the other hand, (10) students obtained very weak results, representing (38.4%) of the participants, with an overall mean performance of (56.66%).

Table 4: Students' Performance on the Scales

	RF Scale		*PA* Scale		*RF* Scale		*PA* Scale
No.	Rate	Accuracy		**No.**	Rate	Accuracy	
1.	0	0	11	**14.**	0.19	86.67	16
2.	0	0	11	**15.**	0.00	2.82	8
3.	0	0	7	**16.**	0.61	0.00	12
4.	0	0	13	**17.**	14.38	4.00	10
5.	3.5	83.33	17	**18.**	12.94	96.00	17
6.	14.70	95.59	18	**19.**	14.81	86.09	18
7.	13.2	87.41	18	**20.**	0.14	86.03	21
8.	40.04	94.56	24	**21.**	41.42	0.91	10
9.	54.77	98.18	23	**22.**	53.17	94.26	24
10.	46.47	99.69	28	**23.**	42.82	98.79	22
11.	1.54	84.86	22	**24.**	4.44	99.40	28
12.	4.06	8.76	21	**25.**	33.40	8.16	20
13.	3.97	79.15	24	**26.**	3.50	78.55	23

Table 5. Mean of Students' Performance

		Reading Fluency		*Phonological*
Rate		*Fluency*	*Accuracy*	*Awareness*
N	Valid	26	26	26
	Missing	0	0	0
Mean		15.5412	56.6619	17.9231

Regarding PA, the mean performance was (17.92) (maximum score = 30), which represents (59.73%). This level is far from acceptable scores (Table 5).

According to the results of the Spearman's correlation coefficient, there is a positive correlation between PA and RF. There is a medium correlation between the levels of PA and the reading rate at the level of (0.548), but this correlation is higher in the reading accuracy as it reached the level of (0.731).

Table 6. the Correlation between PA and RF

	PA	*RF*	
Spearman's rho		*Rate*	*Accuracy*
	Correlation Coefficient	.548**	.731**
	Sig. (2-tailed)	.004	.000
	N	26	26

Discussion

In this study, it was observed that the level of RF and PA among SHH were lower than that of their hearing peers. This is consistent with the prevailing opinion in the field that these students have lower language levels than their hearing peers, especially in reading skills and its components (ASHA, 2019; Luft, 2018; Falk, 2017; Al-Manei and Al-Rayes, 2014). Regarding students' performance on the PA Scale, they showed modest performance, which is far from acceptable levels. This is consistent with the findings of published literature (Fayyad, 2021; Mohammed, et al., 2018; Lund et al., 2015; Miller, 2013; Kyle & Harris, 2011). This can be attributed mainly to hearing problems, as well as their poor ability to indirectly learn the relationship between sounds and letters, as they need direct education, and this may not be available in all environments (Emerson, 2010). Further, students were also expected to show low levels on the RF Scale, which many researchers attributed to the lack of teaching and attention to this skill, in addition to the problems left by hearing impairment (Rasinski, et al., 2011; Emerson, 2010; Levy et al., 2010; Trezek et al., 2009). This result is consistent with the findings of (Alfadeed, 2020a; Luft,2019; Emerson, 2010). However, it was noted that students suffered from lower levels of reading rate compared to the accuracy dimension.

On the other hand, this study reinforced the argument that the relationship between PA and RF is complex, and not very clear (Elhassan et al., 2017). Results show that there is

a medium to strong relationship between PA and RF, which is consistent with (Fayyad, 2021; Muhammad et al., 2018; Alzahrani and Alyami, 2017; Wang et al., 2017; Emerson, 2010; Luetke-Stahlman and Nielsen, 2003). This relationship was more pronounced with the reading accuracy dimension, which is consistent with some studies (Muhammad et al., 2018; Wagner & Torgesen, 1987). However, this contradicts the view that the contribution of PA is more evident in the early stages of reading instruction, as well as with lower levels of fluency, and that this contribution decreases in the higher stages, and may even fade when the student reaches good levels of fluency (Elhassan et al., 2017; Ching, et al., 2014; Wagner & Torgesen, 1987). It was noted that there was a stronger correlation of PA with reading accuracy, which is the variable in relation to which students achieved better grades than the other variable (reading rate), while this correlation was weaker with reading rate, the variable in relation to which the students' performance was very poor.

Getting SHH to reading levels of their hearing peers is a major goal in the field, and it is still a critical area of research, but this Goal is not attainable in the short term. Therefore, an initial step involves identifying and investigating the reasons that hinder the achievement of this goal, in addition to a deeper understanding of the nature of linguistic and academic growth of this group of students and identifying the best assessment and teaching strategies to ensure SHH have access to efficient reading.

Recommendations and Implications

Although the results of this study showed a positive relationship between PA and RF, the study was limited to a sample that was not large, and in the city of Riyadh only. The application of the study in more than one school, the different understanding of SHH by school leaders and teachers, and the educational levels of students' families may be variables that have an impact on students' performance. Accordingly, we suggest conducting further studies with larger samples, at the national level, and at different educational stages, in order to reach a greater understanding of the nature of the relationship between PA and RF, taking into account demographic and cultural variables. Moreover, conducting new studies on the relationship between the five components of reading and in different educational environments will be enriching to determine the best teaching strategies for developing the reading skill of SHH.

Data Availability Statement (DAS)

The datasets generated by the scales in research and/or analyzed during the current study are available in OneDrive, https://1drv.ms/b/s!At1rjhtIiHmOg9pUmMF3jSfJQpNGUg?e=7KB5ix. Audio recordings have not been shared in order to preserve the privacy of the participants.

Disclosure statement

No potential conflict of interest was reported by the authors.

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