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A STUDY OF THE DEVELOPMENT OF PHONEME-GRAPHEME CORRESPONDENCE IN ARABIC-SPEAKING PRIMARY SCHOOL CHILDREN OF YEMEN

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ABSTRACT

The acquisition of reading by young learners is affected by different linguistic, educational, and environmental influences. Phoneme-grapheme correspondence (PGC) is considered the one that consistently and effectively predicted reading. The main objective of the current study is to investigate the development of PGC in typically developing Yemeni Arabic-speaking children of grades II to VIII.420 children (TDC) from government and private schools participated in the research, with 30 pupils (15 males and 15 females) from each grade, respectively. The descriptive analysis of the collected data revealed that there was a statistically significant difference between the grades. Grade 2 scores are least and as students moved to upper grades their mean scores also increased; showing a sequential development.

Keywords: Phoneme-grapheme correspondence, Arabic, typically developing children.

1. Introduction

Reading is known as a developmental cognitive process by which meaning can be inferred from a written text (Shaywitz,2003). For reading to materialize, it requires continuous practice, build-out, and refinement. Thus, reading comprehension is a tool that is used to gauge the level of success in reading. It is a requirement for the students to develop foundation skills and to have expertise in reading in primary grades. This is because these skills developed at an early age provide a base for competence and proficiency at later stages. As the children learn to utilize the developed skills, it will subsequently help them to become proficient readers (Lonigan& Shanahan, 2008).

The acquisition of reading by young learners is influenced by different effects like phonological, morphological, syntactic, semantic, vocabulary knowledge, and educational influences (Castles et al., 2018). Phonology is ubiquitous since it is predictive developmental consequences in reading across languages with varying degrees of orthographic transparency (Ziegler & Goswami,2005). Phoneme-grapheme correspondence (PGC) refers to the relationship between the sounds (phonemes) of a language and the written symbols (graphemes) used to represent them. This correspondence plays a critical role in developing reading skills, as it helps learners to decode and recognize written words accurately and efficiently.

Research has consistently demonstrated that PGC is a strong predictor of reading achievement (Ehri, 2005; Goswami & Bryant, 1990; National Reading Panel, 2000). Children who struggle with PGC often experience difficulties with reading acquisition and may be diagnosed with dyslexia, a learning disorder characterized by difficulties in reading accuracy and fluency (Snowling,2001). Moreover, children who receive explicit and systematic instruction in PGC tend to make greater gains in reading compared to those who receive less structured or incidental instruction (Ehri et al., 2001; Torgesen et al., 2001). Therefore, PGC instruction is a crucial component of effective literacy instruction.

In a sample of toddlers who were tracked from preschool through nursery school and first grade, Lonigan et al. (2000) conducted longitudinal research and found that among several different predictors, PGC was the one that consistently and effectively predicted reading. Moreover, studies have shown that the progress learners make in reading is based on their phonological abilities (Goswami & Bryant, 1990). Additionally, studies have demonstrated the importance of PGC in assessing and remediating children with reading difficulties (Ashour, 2011; Ehri et al., 2001). A study conducted in the English language has proven the significance of PGC and its effect on reading development (Goswami & Bryant,1990). Recently, Cross-linguistic research has also sought to look for proof of this effect in other languages. Researchers have investigated the link between PGC and reading acquisition in monolingual and bilingual students. However, fewer studies have investigated this relationship among Arabic-speaking learners.

Worldwide around 420 million people speak Arabic (Gordon, 2005). Furthermore, hundreds of millions of non-Semitic language speakers employ its orthography (Mirdehghan, 2010). Different merits of the Arabic language and its orthography that may affect the development of PGC are discussed below (Saiegh-Haddad & Henkin-Roitfarb, 2014).

An alphabetic system of 28 letters and 34 phonemes is used to write Arabic. Arabic letters have a uniform shape and do not have upper- or lowercase variants (Al-Wabil et al., 2010). Similar to Hebrew, Arabic is classified as a Semitic language with a consonant-based abjad spelling. It includes all consonants and three long vowels (a, u, and I). To indicate the short vowels, additional diacritic-like vowel marks are employed in materials for students in elementary education, up to at least the 5th grade. The grapheme-phoneme relationship is very regular when Arabic writing is completely vowelized, and it has been referred to as a transparent orthography (Abu-Rabia & Siegel, 2002); vowelization is critical for both professional and less competent readers' reading accuracy. Conversely, according to Saiegh-Haddad & Henkin-Roitfarb (2014), Arabic writing that is partially vowelized and so lacks the short vowels has been referred to be non-transparent as "very opaque".

Arabic letters also vary from one another based on the quantity and placement of dots that appear above or below the letter. The Arabic alphabet has 17 base letters, but the additional 11 characters may be created by adding dots, which can vary in size and placement. As a result, dots in Arabic script are crucial for distinguishing between varieties of Arabic characters (Elbeheri, 2004). For instance, the letters (ن, ث, ت, ب) have comparable forms, with the sole distinction being the arrangement and quantity of dots within each letter. Additionally, the glottal stop, or "hamza," is a unique letter in the Arabic alphabet. The Arabic alphabet would thus comprise 29 letters instead of 28 since some linguists treat the hamza as a separate grapheme, while others count it as a diacritical mark (Elbeheri, 2004). Both silent and spoken phonemes are represented by the hamza.

Arabic is a language with a diglossic structure (Ferguson, 1959), which, as several studies have shown, makes it difficult for beginners to learn reading (Saiegh-Haddad, Levin, Hend, &Ziv, 2011). Diglossia is a concept used to describe languages that have two distinct varieties and degrees of formality, like Arabic. Modern Standard Arabic (MSA) is only obtained through official schooling and is exclusively used in official settings such as textbooks, education, newspapers, and formal speech. In casual settings, the Spoken Arabic Vernacular (SAV) is employed as the predominant medium of communication. These two varieties of Arabic work for different purposes (Ferguson, 1959), for instance, when MSA is utilized, the SAV is often not employed, and vice versa. Additionally, there is a significant linguistic gap between MSA and SAV (Taha, 2013), a condition that impairs the learning of language elements like PA, vocabulary, reading, and writing (Abu Rabia & Taha, 2006). This linguistic

gap between the two varieties is not the same throughout all dialects but varies according to the SAV employed. MSA is used for official purposes by all Arabic speakers whatever their SAV was.

Surprisingly, there is very little scientific research on Arabic early reading skills and literacy, especially in the Arabic-speaking region. As per the authors' knowledge, no studies focusing on the development of PGC skills in the Arabic language that too upon school-aged Arabic-speaking Yemeni children have been carried out. As a result, research that strives to address the aforementioned area is desperately required.

The major objective of the present study is to investigate the development of PGC in typically developing, i.e. normal healthy children without any deficits linguistically or/and neurologically; Yemeni Arabic-speaking children of grades II to VIII.

2. Method

A descriptive research design had been adopted to investigate the effect of grades on the development of PGC skills in an attempt to predict the degree and the direction of its influence on the learner's future academic performance.

2.1. Participants

Arabic-speaking Yemeni students between the age range of 8 - 14 years, and who are studying in grades between II to VIII were recruited, for the present study. A total number of 420 typically developing children(TDC) from government and private schools participated in the research, with 30 pupils from each grade (15 males and 15 females) respectively. Each participant was in good health, with no language or neurological deficiencies. Furthermore, none of the participants were suffering from any mental or sensory disorders.

Another critical criterion was that pupils had not altered schools since the start of their education. Additionally, students should not have failed at any grade during their educational years. Pupils should have finished almost six months of the current academic year at the time of conducting the research. The students that participated in this research were drawn from both government and private institutions of Yemen. An overall number of 210 pupils were chosen from the government schools and 210 pupils were chosen from the private schools based on the aforementioned criteria. For homogenous socio-demographic data, children who received education in schools in the same geographical region were chosen.

2.2. Material

This study is based on the section of the Phoneme- grapheme correspondence from the Informal Diagnostic Test of early reading skills proposed by Rae &Potter (1973); 'A Practical Guide for the Classroom Teachers' republished in the year 1981. After obtaining the consent of the authors, the stimulus was conformed and translated to adjust to the cultural identity and language of Arabic. The stimulus included the phoneme-grapheme correspondence (PGC) section which has been tested in two levels:

Level 1: This level assesses the capability to write the correct letter from a word clue. It is divided into three sub-sections:

A. Beginning consonant: It consists of 18 words and the child is asked to recognize the initial consonant sound of words.

B. Ending consonant: It consists of 15 words and the child is asked to recognize a single consonant sound at the end of the words.

C. Vowel sounds: It consists of 20 words. This part tests the child's ability to recognize the vowel sound in the word named by the tester.

Level 2: This level assesses the identification of the initial /final consonant of a word when a target consonant is provided before starting the test. The child is instructed to put a (✓) mark in the box beside the number of the word on the answer sheet if the word said by the tester begins/ ends with the sound of the target consonant. It is divided into three sub-sections:

A. Beginning consonant: It consists of 80 words testing 20 consonants at the initial position.

B. Ending consonant: It consists of 40 words testing 10 consonants at the final position.

C. Vowel sounds: This tests the identification of medial vowels. The examiner says three words, out of which two have the same middle vowel sound. The child is asked to tell the two words which have the same middle vowel sound.

2.3. Procedures

For approximately 30 minutes, each student was exposed to the stimuli alone in a quiet environment. All of the sessions were audio-video recorded, and the stimulus was provided to the student in a certain sequence. A uniform scoring system was used, for each right response i.e. a score of one was assigned. The outcome for each subsection was determined by the number of components in it.

2.4. Statistical Analysis

The statistical analysis of the results was carried out using SPSS version 20. The Shapiro-Wilks test for normality was applied to know whether the data is normally distributed. The test results revealed that the data is significantly deviating from a normal distribution (i.e., $p<0.05$). Kruskal-Wallis test was performed to see the significant difference between grades – including both government and private schools together, and considering government and private schools separately. Further, a post hoc pairwise Mann-Whitney U test was conducted to understand which pairs of grades show a significant difference. The statistical significance values were compared with 0.05 or 0.01 levels of significance. The descriptive statistical analysis for mean, standard deviation, and median were taken out for overall grades.

3. Results

3.1. Effect of grade on the achievement scores of (PGCL1)

Table 1: Comparison of Grades (includes both Government and Private schools together, n=60) – Overall

Variables	Grades	Mean	Median	SD	Kruskal-Wallis Test	
					$\chi^2(6)$	p-value
Beginning consonants	Grade 2	15.28	15.50	2.23	189.550	0.000**
	Grade 3	17.00	17.00	1.10		
	Grade 4	17.45	18.00	0.62		
	Grade 5	17.67	18.00	0.54		
	Grade 6	17.90	18.00	0.30		
	Grade 7	17.97	18.00	0.18		
	Grade 8	18.00	18.00	0.00		
Ending consonants	Grade 2	13.30	14.00	2.06	112.432	0.000**
	Grade 3	14.57	15.00	0.72		
	Grade 4	14.83	15.00	0.38		
	Grade 5	14.88	15.00	0.32		
	Grade 6	14.95	15.00	0.22		
	Grade 7	14.98	15.00	0.13		
	Grade 8	15.00	15.00	0.00		
Vowels	Grade 2	15.35	15.00	2.39	243.822	0.000**
	Grade 3	18.75	19.50	1.57		
	Grade 4	19.10	19.00	1.28		
	Grade 5	19.72	20.00	0.45		

	Grade 6	19.88	20.00	0.32		
	Grade 7	19.93	20.00	0.25		
	Grade 8	20.00	20.00	0.00		
Total	Grade 2	43.93	44.00	4.40	267.972	0.000**
	Grade 3	50.32	51.00	2.37		
	Grade 4	51.38	52.00	1.65		
	Grade 5	52.27	53.00	0.99		
	Grade 6	52.73	53.00	0.61		
	Grade 7	52.88	53.00	0.37		
	Grade 8	53.00	53.00	0.00		

* Indicates significant at P< 0.05 ** Indicates significant at P<0.01

From the above table1, one can observe that the mean scores of beginning consonants, ending consonants, vowels, and total scores for all grades are different. It is observed from the table above that, grade 2 scores are least and as students moved to upper grades their mean scores also increased. Hence, the Kruskal Wallis test showed that there was a statistically significant difference between the grades for – beginning consonants with χ^2 (6) = 189.55, p<0.01; ending consonants with χ^2 (6) = 112.432, p<0.01; vowels with χ^2 (6) = 243.822, p<0.01; total scores with χ^2 (6) = 267.972, p<0.01.

To understand which pairs of grades shows significant difference further, a post hoc pairwise Mann-Whitney U test was performed and represented in table 2.

Table 2: Pair-wise comparison between Grades for all variables – Overall

Pairs	Beginning consonants (n=60)		Ending consonants (n=60)		Vowels (n=60)		Total (n=60)	
	|Z|	p-value	|Z|	p-value	|Z|	p-value	|Z|	p-value
Grade 2 Vs Grade 3	4.890	0.000**	3.838	0.000**	7.397	0.000**	7.654	0.000**
Grade 2 Vs Grade 4	6.361	0.000**	5.176	0.000**	8.427	0.000**	8.649	0.000**
Grade 2 Vs Grade 5	7.169	0.000**	5.570	0.000**	9.618	0.000**	9.287	0.000**
Grade 2 Vs Grade 6	8.228	0.000**	6.142	0.000**	9.865	0.000**	9.709	0.000**
Grade 2 Vs Grade 7	8.606	0.000**	6.452	0.000**	9.965	0.000**	9.888	0.000**
Grade 2 Vs Grade 8	8.810	0.000**	6.615	0.000**	10.119	0.000**	10.105	0.000**
Grade 3 Vs Grade 4	2.368	0.000**	2.110	0.000**	0.976	0.000**	2.640	0.000**
Grade 3 Vs Grade 5	4.009	0.000**	2.787	0.005**	3.611	0.000**	5.243	0.000**
Grade 3 Vs Grade 6	6.052	0.000**	3.814	0.000**	5.000	0.000**	7.004	0.000**
Grade 3 Vs Grade 7	6.770	0.000**	4.399	0.000**	5.491	0.000**	7.639	0.000**
Grade 3 Vs Grade 8	7.157	0.000**	4.716	0.000**	6.224	0.000**	8.290	0.000**
Grade 4 Vs Grade 5	2.063	0.039*	0.782	0.434	3.224	0.001**	3.301	0.001**
Grade 4 Vs Grade 6	4.652	0.000**	2.047	0.041*	5.003	0.000**	5.856	0.000**
Grade 4 Vs Grade 7	5.607	0.000**	2.835	0.005**	5.613	0.000**	6.827	0.000**
Grade 4 Vs Grade 8	6.130	0.000**	3.289	0.001**	6.508	0.000**	7.784	0.000**
Grade 5 Vs Grade 6	2.767	0.006**	1.316	0.188	2.273	0.023*	3.021	0.003**

Grade 5 Vs Grade 7	3.913	0.000**	2.187	0.029*	3.110	0.002**	4.252	0.000**
Grade 5 Vs Grade 8	4.577	0.000**	2.715	0.007**	4.432	0.000**	5.690	0.000**
Grade 6 Vs Grade 7	1.458	0.145	1.013	0.311	0.945	0.345	1.382	0.167
Grade 6 Vs Grade 8	2.503	0.012*	1.747	0.081	2.715	0.007**	3.461	0.000**
Grade 7 Vs Grade 8	1.420	0.156	1.000	0.317	2.026	0.043*	2.502	0.012*

* Indicates significant at P< 0.05 ** Indicates significant at P<0.01

Table 2 shows, there was a statistically significant difference between grade 2 paired with all other grades for beginning consonants (p<0.01). There was a statistically significant difference between grade 3 paired with all other grades (p<0.01) for beginning consonants. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01) and grade 4 paired with grade 5 with p<0.05 for beginning consonants. Additionally, there was a statistically significant difference between grade 5 paired with all other grades (p<0.01) for beginning consonants. There was a statistically significant difference between grade 6 paired with grade 8 (p<0.05) except grade 6 paired with grade 7 (p>0.05) for beginning consonants. There was no statistically significant difference between grade 7 paired with grade 8 (p>0.05) for beginning consonants.

There was a statistically significant difference between grade 2 paired with all other grades (p<0.01) for ending consonants. Additionally, there was a statistically significant difference between grade 3 paired with all other grades (p<0.01) for ending consonants. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01) and grade 4 paired with grade 6 with p<0.05, though there was no statistically significant difference between grade 4 paired with grade 5 (p>0.05) for ending consonants with (p>0.05). There was a statistically significant difference between grade 5 paired with grade 8 with p<0.01 and grade 5 paired with grade 7 with p<0.05, except grade 5 paired with grade 6 (p>0.05) for ending consonants. There was no statistically significant difference between grade 6, and grade 7 paired with other grades (p>0.05) for ending consonants.

There was a statistically significant difference between grade 2 paired with all other grades (p<0.01) for vowels. Additionally, there was a statistically significant difference between grade 3 paired with all other grades (p<0.01) for vowels. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01) for vowels. Furthermore, there was a statistically significant difference between grade 5 paired with all other grades (p<0.01) and grade 5 paired with grade 6 (p<0.05) for vowels. However, there was a statistically significant difference between grade 6 paired with grade 8 (p<0.01) and grade 7 paired with grade 8 (p<0.05) and there was no significant difference between grade 6 paired with grade 7 (p>0.05) for vowels.

Likewise, there was a statistically significant difference between grade 2 paired with all other grades for total scores (p<0.01). Additionally, there was a statistically significant difference between grade 3 paired with all other grades for total scores (p<0.01). Further, there was a statistically significant difference between grade 4 paired with all other grades for total scores (p<0.01). Furthermore, there was a statistically significant difference between grade 5 paired with all other grades (p<0.01) for total scores. However, there was a statistically significant difference between grade 6 paired with grade 8 (p<0.01) and grade 7 paired with grade 8 (p<0.05) and there was no significant difference between grade 6 paired with grade 7 (p>0.05) for total scores.

3.2. Effect of grade on the achievement scores of (PGCL2)

Table 3: Comparison of Grades (includes both Government and Private schools together, n=60) – Overall

Variables	**Grades**	**Mean**	**Median**	**SD**	**Kruskal-Wallis Test**	
					$\chi^2(6)$	p-value
Beginning consonants	Grade 2	17.32	17.50	1.66	229.914	0.000**
	Grade 3	18.88	20.00	2.11		
	Grade 4	19.63	20.00	1.40		

	Grade 5	19.90	20.00	0.35		
	Grade 6	19.95	20.00	0.22		
	Grade 7	20.00	20.00	0.00		
	Grade 8	20.00	20.00	0.00		
	Grade 2	8.07	8.00	1.69		
	Grade 3	9.43	10.00	0.87		
	Grade 4	9.82	10.00	0.43		
Ending consonants	Grade 5	9.88	10.00	0.42	177.569	0.000**
	Grade 6	9.93	10.00	0.25		
	Grade 7	9.98	10.00	0.13		
	Grade 8	10.00	10.00	0.00		
	Grade 2	6.83	7.00	1.46		
	Grade 3	8.40	9.00	1.56		
	Grade 4	8.68	9.00	1.23		
Vowels	Grade 5	9.20	10.00	1.04	223.590	0.000**
	Grade 6	9.73	10.00	0.52		
	Grade 7	9.90	10.00	0.30		
	Grade 8	10.00	10.00	0.00		
	Grade 2	32.22	33.00	3.17		
	Grade 3	36.72	38.00	2.89		
	Grade 4	38.13	39.00	2.12		
Total	Grade 5	38.98	39.50	1.38	267.376	0.000**
	Grade 6	39.62	40.00	0.80		
	Grade 7	39.88	40.00	0.32		
	Grade 8	40.00	40.00	0.00		

From above table 3, one can perceive that the mean scores of beginning consonants, ending consonants, vowels, and total scores for all grades are different. It is observed from the table above that, grade 2 scores are least and as students moved to upper grades their mean scores also increased. Hence, the Kruskal Wallis test showed that there was a statistically significant difference between the grades for – beginning consonants with χ^2 (6) = 229.914, p<0.01; ending consonants with χ^2 (6) = 177.569, p<0.01; vowels with χ^2 (6) = 223.59, p<0.01; total scores with χ^2 (6) = 267.376, p<0.01.

To understand which pairs of grades, show significant differences further, the post hoc pairwise Mann-Whitney U test was performed and represented in table 4.

Table 4: Pair-wise comparison between Grades for all variables – Overall

Pairs	Beginning consonants (n=60)		Ending consonants (n=60)		Vowels (n=60)		Total (n=60)	
	|Z|	p-value	|Z|	p-value	|Z|	p-value	|Z|	p-value
Grade 2 Vs Grade 3	5.601	0.000**	5.098	0.000**	5.212	0.000**	6.632	0.000**
Grade 2 Vs Grade 4	8.115	0.000**	7.052	0.000**	6.193	0.000**	8.539	0.000**
Grade 2 Vs Grade 5	8.871	0.000**	7.517	0.000**	7.679	0.000**	9.218	0.000**

Grade 2 Vs Grade 6	9.090	0.000**	7.799	0.000**	9.256	0.000**	9.640	0.000**
Grade 2 Vs Grade 7	9.335	0.000**	8.169	0.000**	9.769	0.000**	9.895	0.000**
Grade 2 Vs Grade 8	9.335	0.000**	8.298	0.000**	10.132	0.000**	10.112	0.000**
Grade 3 Vs Grade 4	2.703	0.007**	2.571	0.010*	0.682	0.495	2.805	0.005**
Grade 3 Vs Grade 5	3.873	0.000**	3.565	0.000**	3.033	0.000**	4.999	0.000**
Grade 3 Vs Grade 6	4.374	0.000**	3.942	0.000**	5.880	0.000**	7.046	0.000**
Grade 3 Vs Grade 7	5.136	0.000**	4.716	0.000**	7.716	0.000**	8.117	0.000**
Grade 3 Vs Grade 8	5.136	0.000**	4.999	0.000**	8.057	0.000**	8.804	0.000**
Grade 4 Vs Grade 5	1.382	0.167	1.304	0.192	2.488	0.013*	2.869	0.004**
Grade 4 Vs Grade 6	2.075	0.038*	1.717	0.086	5.442	0.000**	5.625	0.000**
Grade 4 Vs Grade 7	3.287	0.001**	2.840	0.005**	6.712	0.000**	7.099	0.000**
Grade 4 Vs Grade 8	3.287	0.001**	3.288	0.001**	7.661	0.000**	8.040	0.000**
Grade 5 Vs Grade 6	0.747	0.455	0.391	0.696	3.187	0.001**	3.011	0.003**
Grade 5 Vs Grade 7	2.274	0.023*	1.682	0.093	4.790	0.000**	4.787	0.000**
Grade 5 Vs Grade 8	2.274	0.023*	2.274	0.023*	6.096	0.000**	6.224	0.000**
Grade 6 Vs Grade 7	1.747	0.081	1.365	0.172	1.997	0.046*	2.009	0.045*
Grade 6 Vs Grade 8	1.747	0.081	2.026	0.043*	3.961	0.000**	4.115	0.000**
Grade 7 Vs Grade 8	0.000	1.000	1.000	0.317	2.503	0.012*	2.715	0.007**

* Indicates significant at P< 0.05 ** Indicates significant at P<0.01

Table 4 shows, there was a statistically significant difference between grade 2 paired with all other grades for beginning consonants (p<0.01). There was a statistically significant difference between grade 3 paired with all other grades (p<0.01) for beginning consonants. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01) and grade 4 paired with grade 6 with p<0.05 for beginning consonants. But there was no statistically significant difference between grade 4 paired with grade 5 (p>0.05). Additionally, there was a statistically significant difference between grade 5 paired with all other grades (p<0.05) for beginning consonants except for grade 5 paired with grade 6 (p>0.05). There was no statistically significant difference between grade 6, and grade 7 paired with other grades (p>0.05) for beginning consonants.

There was a statistically significant difference between grade 2 paired with all other grades (p<0.01) for ending consonants. Additionally, there was a statistically significant difference between grade 3 paired with all other grades (p<0.01) and grade 3 paired with grade 4 (p<0.05) for ending consonants. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01), though there was no statistically significant difference between grade 4 paired with grade 5 and grade 4 paired with grade 6 (p>0.05) for ending consonants. There was a statistically significant difference between grade 5 paired with grade 8 with p<0.05, but there was no statistically significant difference between grade 5 paired with other grades (p>0.05). There was a statistically significant difference between grade 6 paired with grade 8 with p<0.05, except grade 6 paired with grade 7 (p>0.05) for ending consonants. There was no statistically significant difference between grade 7 paired with grade 8 (p>0.05) for ending consonants.

There was a statistically significant difference between grade 2 paired with all other grades (p<0.01) for vowels. Additionally, there was a statistically significant difference between grade 3 paired with all other grades (p<0.01) except grade 3 paired with grade 4 (p>0.05) for vowels. Further, there was a statistically significant difference between grade 4 paired with all other grades (p<0.01) and grade 4 paired with grade 5 (p<0.05) for

vowels. Furthermore, there was a statistically significant difference between grade 5 paired with all other grades ($p<0.01$) for vowels. However, there was a statistically significant difference between grade 6 paired with grade 8 ($p<0.01$) and grade 6 paired with grade 7 ($p<0.05$). Also, there was a significant difference between grade 7 paired with grade 8 ($p>0.05$) for vowels.

Likewise, there was a statistically significant difference between grade 2 paired with all other grades for total scores ($p<0.01$). Additionally, there was a statistically significant difference between grade 3 paired with all other grades for total scores ($p<0.01$). Further, there was a statistically significant difference between grade 4 paired with all other grades for total scores ($p<0.01$). Furthermore, there was a statistically significant difference between grade 5 paired with all other grades ($p<0.01$) for total scores. Also, there was a statistically significant difference between grade 6 paired with grade 8 ($p<0.01$) and grade 6 paired with grade 7 ($p<0.05$), and grade 7 paired with grade 8 ($p<0.01$) for total scores.

4. Discussion

The descriptive analyses of the data set showed that the mean scores of beginning consonants, ending consonants, vowels, and total scores for all grades are different. It was observed that grade 2 scores are least and as students move to upper grades their mean scores also increased, showing a developmental pattern in the performance of children across all parameters of PGC. Hence, the Kruskal Wallis test showed that there was a statistically significant difference between the grades for – beginning consonants, ending consonants, vowels, and total scores with $p<0.01$. The progressive increase pattern across all grades of all private and government schools reaching nearly similar scores in the higher grades noticed in the current study aligns with other works conducted by Abou-Elsaad et al.(2016) who investigated the connections between Arabic PGC skills and reading skills in Arabic-speaking children. They concluded the developmental trend of Arabic PGC. López (2012) investigated the developmental evolution of PGC in Spanish-English bilingual kindergarteners and discovered a progressive trend in achievement across languages when children join the school. Further, a study conducted by Duranovic et al. (2012) revealed that students' letter knowledge increased with age. Further, the current study's findings are in line with other studies' findings, which concluded a considerable improvement in the achievement of children on the phonological processing skills, prior to and after they begin learning to read formally (Mohamed et al., 2021). The progressive increase in the learners' achievement noticed in the PGC skills can be attributed to their ages and years of schooling.

5. Limitations

This study had some limitations. Firstly, it has a limited sample size. A study with a broader and more distinctive sample is thought to enhance the likelihood of obtaining a more representative distribution of the target population. Secondly, the current findings are confined to Arabic-speaking school-aged children in Yemen and may not be generalizable to other Arabic-speaking communities.

6. Implications

This current research's findings emphasize the necessity of addressing reading skill gaps in children's lives as early as possible. Therefore, before joining formal education, children should undergo comprehensive and clear PGC training that may help to lessen the deficiency in PGC abilities, which is certainly an impediment to learning to read.

7. Conclusion

In summary, phoneme-grapheme correspondence is a critical aspect of reading acquisition, particularly for learners of alphabetic writing systems. Explicit instruction in this correspondence can help learners to read more accurately and efficiently and may be particularly beneficial for struggling readers.

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