

Mediational Role of Phonological Awareness Skills in Phonological Working Memory, IQ and Reading Ability among Kindergarten Children's

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Abstract

The present study was designed to examine the relationship between phonological working memory, IQ and reading ability, through the mediation phonological awareness skills. Two hundred kindergarten children's (100 boys & 100 girls; age ranged between 4 and 5 years) (M age =4.38), from 23 kindergartens attached to private schools in Muscat Governorate, Oman. The Phonological awareness skills was measured with "Phonological Awareness Test- Second Edition (PAT-2)" [34], the "Comprehensive Test of Phonological Processing (CTOPP-2)" and phonological working memory [35]. The IQ was measured by Otis Lennon [36]. Mediational path analysis supported our hypothesized model. Result indicate that phonological working memory indirectly links to the reading ability of children, through phonological awareness skills, there was no direct effect of intelligence on phonological awareness, It was conclude that Memory, who have higher use more phonological awareness skills and their children show higher reading ability.

Keywords: phonological awareness; phonological working memory; IQ; reading ability.

1. Introduction

The kindergarten stage is one of the important stages in the child's life. It provides opportunity to acquire necessary experiences to develop the children skills and readiness for learning. Phonemic awareness skills greatly contribute to develop children ability in kindergarten to learn. Some studies proved that the child acquisition of phonemic awareness skills in kindergarten can be sound indicator of future children ability to have reading skills [e.g. 1,2,3].

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This ability can be demonstrated in children whose age is 3 years old [4]. At the age of four, children demonstrate the same abilities of phonemic awareness [5, 6]. However, Ukraintez, Nuspl, Wilkerson, & Beddes noted that pre-school children can acquire and develop phonemic awareness of associated syllables [7]. Related literature revealed that children who don't have sufficient level of phonemic awareness will more likely experience reading difficulties at higher education levels [8]. The research conducted on the early development of phonemic awareness mainly focused on two points: Firstly, correlational relationships between phonemic awareness and letter recognition [9,10], secondly, the language reorganization model [11]. Current research studies attempted to investigate the extent to which phonemic awareness plays an important role in developing and improving reading skills in children in kindergarten [12,13]. However, decoding skills such as phonemic awareness is considered foundational reading skills. Al Mannai & Everatt stated that phonological awareness skills were the best predictors of reading and spelling. Their study focused on reading and spelling skills of in children of grades 1-3 in Bahrain. Participants were tested in their literacy skills in Arabic language (reading and spelling), their ability to decode letter stresses, and measures of phonological awareness, short-term memory, speed of processing and non-verbal ability [14]. Researchers used these tests to identify the best predictors of literacy skills amongst Arabic young readers. Tibi was interested in investigating the relationship between phonological awareness and success in reading, she conducted study to examine developmental hierarchy of four Arabic phonological awareness tasks, the participants were 140 native Arabic speaking students from elementary grades (1-3), A scale on four phonological awareness tasks was administered to the participants, results indicated that the four phonological awareness tasks ranged from easy to difficult in the following; rhyme, initial sound identification, syllable deletion, and phoneme segmentation. Significant differences were found in two tasks, identifying the initial sound of the word in favor of grade two and syllable deletion in favor of grade three [15]. These findings highlighted the benefits of explicitly teaching phonological awareness skills. Related studies proved that there was relationship between lack of phonemic awareness and low expression and receptive language skills, as well as they revealed that interventions used to develop phonemic awareness resulted in improving understanding and pronunciation of language, and developing verbal expression and fluency [16,17,18,19]. To understand the role of age in developing phonemic awareness. Lonigan and his colleagues conducted study to a sample of children aged 2 to 5 years. The results of the study indicated that children aged 4 and 5 years were higher than young children (age 2 and 3 years) in all measures. In addition to age, there were other factors associated with differences in the development of phonemic awareness in other children [20]. Current research studies Suortti and Lipponen examined phonemic awareness skills in children aged 3 to 5 years within six months. The study sample consisted of 114 children from special childcare centers of child care centers, using the Montessori entrance in Helsinki, Finland, the study found that age has an important role of age in the growth of phonemic awareness [21]. The manifestations of linguistic is characterized by limitations in the use of language, which hinders the proper linguistic development of children, especially during the early stages of life. Language deficits occur when children appear to be deficient in their reading abilities compared to their peers, or autism, and the absence of emotional and mental disorders. However, the underlying causes of the language deficits are still unknown, and researchers in this field specified basic requirements when diagnosing this category: their scores in nonverbal intelligence tests indicated that they have disorders in grammar and use of language dictionary [22]. On the other hand, the children demonstrated deficiency in linguistic use due to dysfunction of verbal memory working. Study of Montgomery, Ellis-Weismer

and his colleagues [23,24], Ramachandra, Hewitt, Brackenbury found that children with language deficits had a clear short-term memory capacity due to lack of knowledge building, clearly in their reading abilities weakness [25]. Leonard and his colleagues added to the storage capacity of short-term memory, the efficiency of the central processor of verbal memory, and phonemic awareness skills [26]. Memory is essential for language development and learning. Short-term memory enables us to keep in mind what our senses are telling us [27]. Meta-analysis of Studies conducted on both phonemic awareness and short-term memory, Melby-Lervag, Lyster & Hulme, analyzed 325 studies on the correlation between word coding, phoneme awareness, rhyme awareness, and short-term verbal memory in samples of the average and learning disabled, the results indicated that children with dyslexia showed weakness in the phonemic awareness of the law and verbal memory, compared to ordinary children [28].

2. Rational for the study

Preschool is not yet listed in the basic education system in the Ministry of Education (MOE) in Oman. Mostly, children go to private (bilingual) or international schools to access preschool education. Curriculum in these schools is different and it does not follow unified standards. Some private schools are affiliated to certain nationalities or communities (India, Egyptian, and etc.). In these private and international schools, children join two levels, KG1 and KG2. These schools usually accept children starting from three or four to six years old. The MOE supervises these schools via the department of Private Education. Supervisors from this department conduct regular visits to these schools to monitor teaching and evaluate teachers. Sometimes, training workshops are organized for teachers in these schools. Teachers working in these schools have credentials ranging from high school to university degrees. Although there is an early childhood department at the main public university in the country, Sultan Qaboos University, graduates generally do not find employment opportunities because the preschool is not available in general education classrooms. Numbers of children in preschool classrooms range from 13 to 25 children with one teacher working with them. The classrooms are usually equipped with sufficient learning resources and center's in addition to playgrounds or play courts. This study is important for several reasons. The study of phonological awareness of preschool children is vital as it is closely related to emergent literacy. Despite increasing awareness of the importance of the role of PA in the development of reading, less is currently known about the PA skills of Omani preschoolers. Up to the knowledge of the researchers in this study, very few research studies about phonological awareness of Omani preschoolers have been published in the Arabic region. Moreover, no cited studies about PA in Omani preschoolers exist in international journals. As preschool is not yet listed as a stage in basic education in the country, more studies are needed to alienate the PA skills of preschoolers in Oman. The purpose of this study was to explore the developmental trend in preschoolers' PA. A related purpose was to phonological awareness predicts the relationship between phonological working memory, IQ and reading ability of their children.

3. Statement of problem

Most studies establish a linear relationship between phonological awareness skills and early acquiring reading ability in children [e.g.,29,15,30]. However, there is little supportive evidence that short-term memory determines differential phonological awareness skills and reading ability in children [31,32]. Given this

background, we constructed the following hypotheses:

H1: There are significant relationships between phonological working memory and their phonological awareness skills.

H2: There are significant relationships between IQ and their phonological awareness skills.

H3: There is a significant relationship between phonological working memory and reading ability of their children.

H4: There are significant relationships between IQ and reading ability of their children.

H5: There are significant relationships between phonological awareness skills and reading ability of their children.

H6: phonological awareness predicts the relationship between phonological working memory, IQ and reading ability of their children.

The first Five hypotheses were constructed to conduct the requirements of mediational analysis [33].

4. Method

4.1 Participants

The sample consisted of 200 children and first and second levels (KG, KG1 (100 boys & 100 girls), whose age ranged between 4 and 5 years ($M_{age} = 4.38$), they were selected using a simple randomized method of 23 kindergartens attached to private schools in Muscat Governorate, Oman. Children generally came from middle-class families with a medium socioeconomic status. Children's IQs were assessed using the Otis- Lennon Mental Ability Test (OLMAT), Elementary Level, from (K), in Muscat region and ranged from 92 to 130 with an average IQ of 109 and a standard deviation of 12.15.

4.2 Instruments

1. Phonological awareness skills was measured with "Phonological Awareness Test- Second Edition (PAT-2)" [34] and "Comprehensive Test of Phonological Processing (CTOPP-2)" [35]:

A. Phonological awareness skills was measured with "Phonological Awareness Test- Second Edition (PAT-2)" which comprises 130 items answered on a 2-point Likert scale. The test was designed to measure six's dispositional dimensions of Rhyming (20 items: 10 rhyming discrimination, 10 rhyming production), Segmentation (30 items: Fragmentation of sentences 10, sections 10, and phonemes 10), Isolation (30 items: first sound 10, second sound 10, third sound 10) and Deletion (20 items: compound words 10, phonemes 10), Substitution with manipulative (10 items) and Blending (20 items: syllables 10, phonemes 10). The content validity of the PA test was explored by consulting a group of 11 faculty members in teaching Arabic, early

childhood teachers, school teachers, and supervisors whose major is teaching Arabic. These experts were asked to check the wording of all the test items and whether any subtest needs any kind of change. A few rewording issues have been resolved and the revised test was shown again to the experts who approved the changes. To verify the concurrent validity of the test, the correlation between children's grades was calculated on the Phonological awareness tests and the preschool Literacy Practices Checklist (Burgess, Lundgren, Lloyd & Piñata, 2001), all correlations were function at level.001. The reliability values using Cronbach's Alpha for all the PA subtests were acceptable. Cronbach's alphas were .78, .90,.72,.84,.77,.82,.79, .77,.74,.84, .82,.73,.86,.80,.78.

B. Phonological awareness skills was measured with "Comprehensive Test of Phonological Processing (CTOPP-2)" which comprises 25 items answered on a 2-point Likert scale. The test was designed to measure two dimensions of Sound matching (10 items of initial sound, 15 items final sound). The reliability values using Cronbach's Alpha method and were .82, .87.

C. Phonological Working Memory with "Comprehensive Test of Phonological Processing (CTOPP-2)" which comprises 20 items answered on a 2-point Likert scale. The test was designed to measure dimensions of working memory. The reliability values using Cronbach's Alpha method and were .77.

D. Nonverbal intelligence tests was measured with "Otis- Lennon Mental Ability Test (OLMAT), Elementary Level, From (K), in Muscat region. This level is one of the Six levels in (OLMAT) series, and consists of (80) items [36]. The reliability values using Cronbach's Alpha method and were .81.

4.3 Procedure

After institutional approval, permission to translate and use the questionnaires was taken from the authors. And to verify its validity and reliability, and to take it out in its final form, the following steps were followed in application process: Obtain the official approval from the competent authorities represented in the technical office for studies and development in the Ministry of Education and Department Special education, in order to facilitate the task of the researcher in the tests by addressing the principals of schools and kindergartens Muscat Governorate, and application of the battery of voice awareness tests with the assistance of 7 kindergarten supervisors in Muscat Governorate, application of various tests through the holding of training workshops at the university on how to apply and assess the degree of awareness skills tests Voice of kindergarten children.

5. Analyses and Results

Before running meditational analysis, correlations were calculated among variables. Initial correlation analysis of research sample scores revealed that memory, IQ and phonological awareness skills scores were positively correlated on the seven subscales of the phonological awareness skills and memory, intelligence test, that is this correlation was significant. means of highly correlated scores of phonological awareness skills were used in further analyses.

5.1 Mediation analysis

The Baron and Kenny (1986) steps to run meditational analysis were followed. Most of the correlations among study variables were significant, and thereby supported meditational analysis. Structural equation modeling was used to run meditational analysis. The final meditational model and reading ability. Overall, the model provided an excellent fit to the data. $\chi^2 = 179.001$, $df = 66$, $p = .903$, $CFI = .903$, $IFI = .905$, $RMR = .079$ and $RMSEA = .107$. The results show that the incidence of appropriate indicators in the acceptable range is good [37,38,39].

5.2 Mediation effect

Sobel (1990) test was carried out to examine whether the indirect effect of the independent variable (IV) on the dependent variable (DV) via the mediator is significant for one variable (Table 1).

Table 1: Sobel’s test to determine significance of meditational paths

Mediation Paths	t-Value	SE	p-Value
Memory ---> Aware ---> Read	2.464	0.093	0.014
IQ ---> Aware ---> Read	0.443	0.001	0.657

The results show that the indirect effects of IV (on the DV (reading ability) of children via the mediators were significantly different from 0.014, with the exceptions of the path from IQ to reading ability via phonological awareness skills. We may conclude that phonological awareness skills are mediators in our model, as they carry the influence of Memory to their child’s reading ability, there is a direct effect of memory on phonological awareness, where the standard regression weight is 0.568, which is statistically significant at 0.01. There was no direct effect of intelligence on phonological awareness, with a standard regression weight of 0.034, which was not statistically significant, while intelligence had a direct effect on reading ability, with a regression weight of .527, which was statistically less than 0.01.

6. Discussion

The mediational model in the study was evolved from work on the study variables (Memory, IQ, phonological awareness and children’s reading ability), which was formerly carried out to examine simple linear relationships. The results lent support to previous work, as significant linear correlations emerged among Memory, IQ, phonological awareness and children’s reading ability [e.g., 29, 30, 12]. The correlations between memory, IQ and phonological awareness skills scores, were significant (see Table 1). However, these correlations became insignificant when we add a mediator (phonological awareness skills) in meditational analysis (see Figure 1).

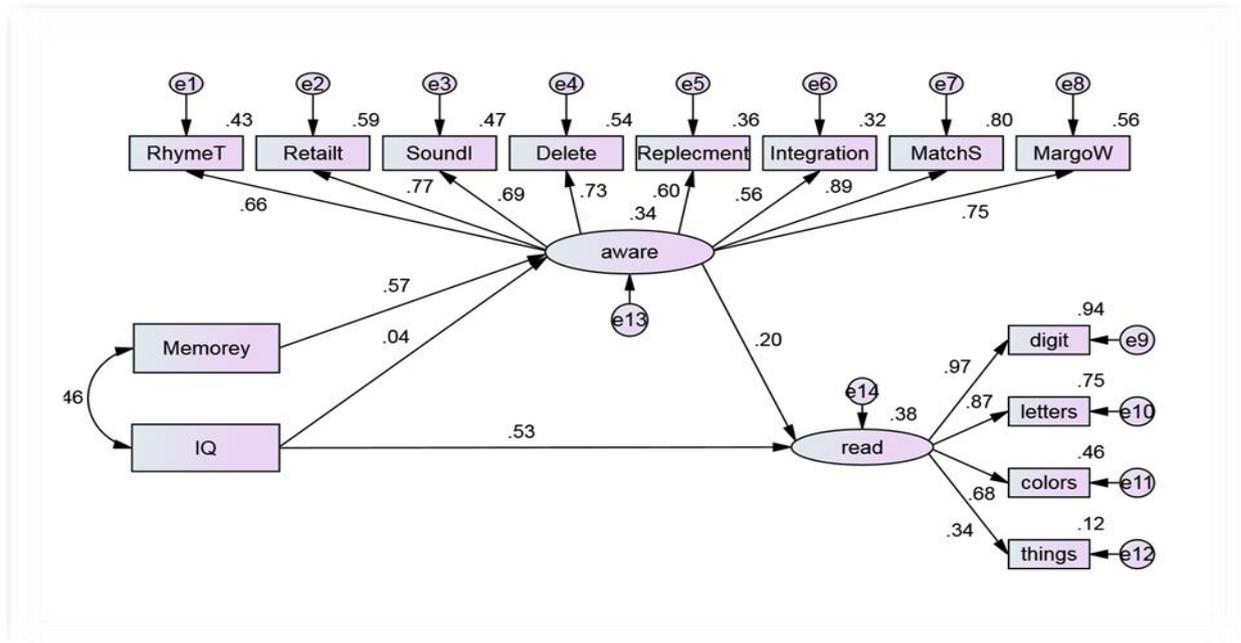


Figure 1: Final mediational model representing relationship between Memory, IQ and four Reading Ability (Digit, Letters, Colors, Things) in children’s mediated by phonological awareness skills.

Mediational analysis demonstrates that Memory does not have direct link to a children’s reading ability; however, this relationship is mediated through phonological awareness skills. It appeared that Memory influences phonological awareness skills and is indirectly associated with reading ability in their offspring (see Figure 1). Memory, who have higher use more phonological awareness skills and their children show higher reading ability; while the children, who have higher IQ, appear to use lesser phonological awareness and their children show intelligence had a direct effect on reading ability. The reason, from the researcher’s point of view, is that all sounds are taught with a reference word. Objects are placed alongside their equivalent picture and the child is initially taught this vocabulary. For example, the reference words for the first list are as follows: sun, moon, ball, hand, tiger, rock, fish, cat, watch, pin, leaf, and juice. Once the child has mastered the vocabulary, he or she is asked to extract the initial sound (and occasionally medial or final sound) of each word. Sometimes, it is necessary to emphasize the initial sound to aid this process. The pictures are replaced by sound lower case letter symbols and the child is asked to point to the object and name it and then to the letter sound and to say it, for example, ‘sun’, ‘s’. Only lower case letter symbols are introduced initially and the only letter sounds, not names. The objects and sounds are placed in the order specified above until the first batch has been mastered. The objects are then removed and the child is required to remember the reference word and to say it and then point to the lower case letter symbol and to articulate it. The results of the current study agreed with a study Bandini, Santos, Souza [41] suggesting that phonological working memory may have direct effects on lexical knowledge. These results contribute to the understanding of the relationships investigated in this study and have important implications for planning teaching strategies. but instead Memory determines their phonological awareness skills [14], and phonological awareness skills determine reading ability in children [15], Fletcher and his colleagues found a relationship between literacy abilities and phonological awareness, and this was done when the effect of IQ and working memory was excluded [40]. And since kindergarten education is not yet

mandatory in Oman, it would be very interesting to see whether economically and socially less fortunate learners can compensate for the gap between them and their peers who had received kindergarten education. The kindergarten stage is one of the important stages in the child's life. It gives him the opportunity to acquire many of the necessary experiences to develop the child's skills and readiness to learn, and voice awareness is one of the important skills that the kindergarten contributes to giving the child [42,43].

7. Conclusion

Some conclusions can be drawn from this study. First, the findings are generally consistent with existing research in the field of PA in preschool children. The study found a consistent developmental trajectory in most of the PA tasks in favor of KG2 children. Also, Memory determines their phonological awareness skills, and phonological awareness skills determine reading ability in children. There is a need to train preschoolers on PA tasks in order to rule out challenges that they might encounter when they access formal schooling.

8. Limitations

This study has some limitations. The main limitation is that the sample was drawn from Muscat, the capital of Oman. Different dialects of Arabic language are spoken in Oman. Generally, MSA is used in preschools. However, in other areas in the country there are different dialects in some governorates. Children belonging to families speaking in these dialects might have difficulty understanding MSA. Since the PA subtests used in this study were written in MSA, it is not easy for preschool children speaking in different dialects to fully understand the content. Therefore, the content of the PA subtests should be used with caution with other preschoolers whose dialect is not colloquial Arabic or those who struggle in understanding MSA. Also, the results of this study should be interpreted with caution as it just represents one governorate in the country. However, Muscat is considered the biggest in the country in terms of population and the largest in the cultural and indigenous representation of spoken dialects.

9. Recommendations

Making use of the results presented in this study when preparing training and rehabilitation programs for kindergarten teachers and speech and language orthodontists., make use of the results presented in this study when preparing programs for prevention, detection and early intervention.

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