



Original Article



Impact of Speech Sound Disorders on the Academic Performance of Children

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ABSTRACT

Speech sound disorders (SSD) have a high prevalence and impact an individual's capability to make and produce speech sounds, essential for humans to communicate. Children's participation in the educational environment may be restricted in children with SSD.

Objectives: To determine the impact of Speech Sound Disorders on the Academic Performance of children. **Methods:** This Cross-Sectional study was conducted at Riphah International University, Islamabad, from 1st June 2024 to 30th November 2024. The study recruited a sample of n=67 children of both genders, aged 5 to 11 years, diagnosed with SSD by qualified Speech-Language pathologists (SLPs), who used standardized and clinical evaluation processes to make the diagnosis. Children of The Spirit School, The Thinking School, and ASAS International School were recruited. Their academic performance was assessed utilizing the APRS, and previous academic grades of students were also noted. The Academic Performance Rating Scale was used for data collection. SPSS version 23.0 was used for data collection. **Results:** Students with mild SSD demonstrated performance in higher grade ranges (51-70%), indicating negligible academic influence. Conversely, individuals with moderate SSD predominantly scored in the mid-range (41-50%), but students with severe SSD were primarily situated in the lowest grade range (30-40%). **Conclusions:** The conclusion shows a direct and significant correlation between children's academic achievement and the severity of speech sound disorder. Academic achievement tends to decrease with increasing SSD severity, as seen by instructors' observations in the classroom and lower annual grades.

INTRODUCTION

Spoken communication facilitates humans to communicate and exchange ideas; however, the correct production of speech sounds needs both motor control and knowledge of the language system. The correct speech sound production is assumed if sounds are generated correctly by 75 to 90% by the children [1]. The development of plosives, approximants, fricatives, and nasals occurs before affricates and pre-nasalized consonants. Similarly, short syllable strings develop before the longer ones. Also, phonetically more complex sounds and syllables are more commonly produced by older children, indicating developmental progress [2]. A speech sound disorder (SSD) is a disorder of communication that impacts an individual's capability to make and produce speech sounds, and SSD includes issues in articulation, i.e., to make

sounds, and phonological process ie, sound patterns [3]. SSD is highly prevalent, with 2.1 to 23 percent of 4-6-year-old kids and 3.6 percent of 8-year-old children suffering from SSD, with higher prevalence in boys compared to girls 2:1 [4]. The prevalence of Speech Sound Disorders in primary school children of Pakistan is low at 1.3%, with a slightly greater incidence in males aged 5-6 years [5]. Both organic etiologies, like neurological or anatomical issues, and functional issues can result in SSD. It can also result from motor disorders; structural anomalies like clefts; sensory issues like reduced hearing, and may also be idiopathic [4]. In children with SSD, there may be additions, omissions, or substitutions of sounds in word strings [6]. Phonological issues of moderate to severe level may result in incomprehensible speech, thus affecting social

interactions as well as communication [7]. Impairment of motor skills can result in phonetic problems characterized by incorrect motor production of speech sounds, which may include airflow release laterally on /s/. Less developed cognitive-linguistic skills can also result in phonological problems, which may include a lack of meaningful contrasts in words, resulting in a consistent pattern of errors like velar fronting, causing the substitution of [t] for /k/, [d] for /g/, and [n] for /ŋ/ [8]. Phonological impairments refer to a reduction of the ability to acquire the speech-sound distinctions to differentiate between words and the rules dictating the permissible combinations of those sounds [6]. Lower literacy has also been reported in kindergarten kids who suffer speech sound disorders [4]. Teachers are crucial in helping kids grow academically, socially, and emotionally, but they might not be equipped to help kids with speech sound abnormalities [9]. Even while having an SSD is crippling in itself, the disorder is linked to poor literacy acquisition and reading mastery, which has serious consequences for academic performance and preparedness for school [10]. The child's views, emotions, and attitudes regarding how other people perceive their communication, as well as the opinions, feelings, and attitudes of those who engage with the child, are all part of the social impact of an SSD. Children's participation in the educational environment may be restricted as a result of these views, which may also restrict their access to normal social relationships in the school environment [11]. The study may be beneficial for academia and professional domains, advocating for evidence-based strategies that can improve the overall quality of care for children with speech sound problems and phonological difficulties. Hence, keeping in view the high prevalence of SSD and the fact that it may affect schooling, the current study aimed to determine the impact of speech sound disorders on the academic performance of children.

METHODS

This Cross-Sectional study was conducted at Riphah International University, Islamabad, from 1st June 2024 to 30th November 2024, using a purposive sampling. This study was initiated following ethical approval of the research proposal from the Research Ethical Committee, Riphah International University vide Reference # Riphah/RCRAHS-ISB/REC/MS-SLP/01974 approved on 6th May 2024, permission from the relevant school/ clinic, and informed consent of the participants/ parents of children. A sample size of n=67 was determined by the Open Epi tool with a confidence interval of 95% with 5% of margin of error. Children of both genders, aged 5 to 11 years, diagnosed with speech Sound Disorders (SSD) by qualified Speech-Language pathologists (SLPs). Children with language difficulties, who are not diagnosed with SSD and

who are not going to school, were excluded. The sample was obtained from inclusive schools in Islamabad, including The Spirit School, The Thinking School, and ASAS International School Pakistan. These children had reduced intelligibility and frequent speech sound problems, which hindered their ability to participate in class and communicate effectively. In order to accurately identify SSD for study inclusion, qualified speech-language pathologists used standardized and clinical evaluation processes to make the diagnosis. Teachers who had been teaching the participating children for a minimum duration of one academic year were utilized, since they were better aware of the children with learning difficulties, the effect of bullying, if any, the child's personal interests, etc., making it easier to exclude the effect of such conditions. Tools utilized for the study included basic demographic information and the Academic Performance Rating Scale (APRS). APRS is a 19-item scale, and every item has a 5-point Likert scale rating on a 1-5 scale, and the score ranges from a minimum of 19 to a maximum of 95. While lower scores show greater academic challenges, higher scores indicate better classroom functioning and academic accomplishment. The rating form assesses several aspects of classroom performance, such as accuracy, attention, task completion, and neatness. The raw score is averaged across items, and it tends to range from 1-5 or 1-6 for a good global estimation of student performance. The APRS is developed to be used with children between 6 and 12 years old, to assess teachers' perceptions of students' academic progress, to identify academic skills weaknesses, and to monitor progress after intervention. These children were recruited from The Spirit School, The Thinking School, and ASAS. Their academic performance was assessed utilizing the APRS, and previous academic grades of students were noted.

Following data collection, it was analyzed utilizing SPSS version 23.0. Descriptive statistics were utilized for demographic data and responses, while the chi-square test was used to determine the association between academic performance and SSD.

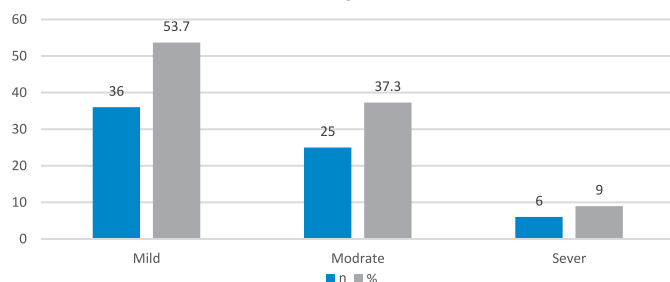
RESULTS

The current study sample (N=67) revealed that the largest age group, 30(44.8%), was 5 to 6.11 years of age with nearly equal gender distribution. Most children, 37(55.2%), were studying in KG, Adv, or Prep class. The annual grades obtained by students in the previous year were somewhat similar, 18(26.9%) each achieved grades 41-50%, 51-60%, and 61-70%, and only 13(19.4%) obtained grades 30-40% (Table 1).

Table 1: Demographic Characteristics of Sample (n=67)

Variables	Group	n (%)
Age Group (Years)	5 -6.11	30 (44.8%)
	7 -8.11	22 (32.8%)
	9 to 11	15 (22.4%)
Gender	Male	34 (50.7%)
	Female	33 (49.3%)
Grades	KG, Adv and Prep	37 (55.2%)
	Class 1	9 (13.4%)
	Class 2	7 (10.4%)
	Class 3	6 (9%)
	Class 4	7 (10.4%)
Previous Grades	Class 5	1 (1.5%)
	30-40	13 (19.3%)
	41-50	18 (26.9%)
	51-60	18 (26.9%)
	61-70	18 (26.9%)

Study revealed that mild 36(53.7%) SSD was predominant and severe was least 6(9%)(Figure 1).

**Figure 1:** Severity of Symptoms (Errors and Intelligibility) of the Sample (n=67)

The cross-tabulation and chi-square association revealed a significant difference in annual grades ($p < 0.001$) with majority i.e., 36 participants with mild SSD received grades 51-60 and 61-70% grades, while of the moderate SSD cases most i.e., 18 received grades 41-50% and 6 cases with severe SSD received low grades of 30-40% revealed a significant association ($p < 0.001$) between APRS based on observation of teachers and SSD with 13 students of SSD with performance score range of 41-60 and 23 in 61-80, while the 6 students achieved low APRS score of 20-40 only indicating worsening performance with increasing severity of SSD (Table 2).

Table 2: Cross Tabulation b/w severity of Speech Sound Disorder and Annual Grades: Chi-Square Association

Diagnosis, n (%)	Annual Grades			
	30-40%	41-50%	51-60%	61-70%
Mild, 36 (54%)	0	0	18	18
Moderate, 25 (37%)	7	18	0	0
Severe, 6 (9%)	6	0	0	0
Chi-Square Test	Value	df	p-value	
Pearson Chi-Square	89.266	6	<0.001	
Likelihood Ratio	105.026	6		

Linear By Linear Association	51.421	1	
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Results revealed a significant association ($p < 0.001$) between APRS based on observation of teachers and SSD, with 13 students of SSD with a performance score range of 41-60 and 23 in 61-80, while the 6 students achieved a low APRS score of 20-40, only indicating worsening performance with increasing severity of SSD (Table 3).

Table 3: Cross Tabulation b/w APRS Scoring and SSD: Chi-Square Association

Diagnosis	APRS Scoring		
	20-40	41-60	61-80
Mild (n=36)	0	13	23
Moderate (n=25)	3	18	4
Severe (n=6)	6	0	0
Chi-Square Test	Value	Df	p-value
Pearson Chi-Square	56.555	4	<0.001
Likelihood Ratio	46.696	4	
Linear-by-	32.508	1	

DISCUSSION

This study looked at how children's academic performance was affected by Speech Sound Disorder (SSD) and discovered a significant inverse link ($p < 0.001$) between academic accomplishment and SSD severity. Academic performance decreased as SSD severity grew, suggesting that speech issues affect overall academic results and go beyond communication deficiencies. An obvious inverse association was found when academic performance was examined in relation to annual grades. The majority of children with mild SSD scored between 51 and 70%, indicating minimal academic impairment. On the other hand, those with mild SSD were mostly found in the 41-50% range, indicating a discernible compromise in academic performance. Significant academic underachievement was indicated by the fact that children with severe SSD were mostly found in the 30-40% grade range. These results imply that classroom participation, oral replies, reading development, and general academic engagement are adversely impacted as speech intelligibility declines and phonological errors rise. The findings are in line with those of Gonzales, who found that children with moderate to severe SSD outperformed their peers without speech issues on standardized academic tests [12]. The link between SSD severity and academic performance did not significantly differ by gender, suggesting that severity rather than gender is the main factor influencing academic impact. Research by Hitchcock ER et al. who surveyed the residual speech errors, found that while children may experience social and emotional challenges, the extent of academic impact varies widely, and not all children with severe speech difficulties necessarily struggle academically [13]. In contrast, the current study found that children with severe SSD encountered more academic

difficulties at higher class levels, according to a class-wise comparison. Students with more severe speech impairments had trouble keeping up with classroom expectations as curriculum demands got more linguistically and intellectually rigorous. These results are consistent with those of Foster *et al.* and Wren *et al.* [14, 15]. The children with persistent speech impairments at age 8 had significantly worse scores in math and English at later academic stages (10-14 years) [15]. This suggests that if early speech issues are not adequately handled, they may persist throughout later schooling. Hitchcock *et al.* who noted that children with SSD have social, emotional, and academic difficulties even in milder cases with just one or two sound abnormalities, support the current findings [13]. Even though the current study's moderate SSD participants had comparatively higher academic results, research suggests that even minor speech errors might have an impact on more general developmental areas. Additionally, children with SSD are more likely to experience ongoing reading difficulties, which could further contribute to academic underachievement [16-18]. This validates the current study's conclusion that poorer academic grades are closely linked to severe SSD [19, 20]. The relatively small sample size and purposive sampling of the selected schools are also limitations of this study, as they can reduce the extrapolation of the results to the wider population. Also, there is the risk of subjective bias due to the use of teacher-reported measures (APRS). The cross-sectional study design also limits the causal inferences between academic performance and the severity of SSD. Future studies should involve larger, multi-centered samples, a longitudinal design, inclusion of objective academic measures, and standardized diagnostic measures to gain more insight into long-term effects and results of intervention.

CONCLUSIONS

This study's findings indicate a substantial correlation between the severity of Speech Sound Disorder (SSD) and children's academic achievement, as assessed by their annual grades and observation of their class teachers. The results underscore the significance of early diagnosis and intervention for children with SSD, especially those with moderate to severe symptoms, to alleviate academic difficulties and enhance educational outcomes.

Authors' Contribution

Conceptualization: HM

Methodology: HM

Formal analysis: MH

Writing and Drafting: TY, MF, GS

Review and Editing: HM, TY, MF, GS

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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