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Original Article

Parental knowledge of mobile applications for improving literacy among children with hearing impairment

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Abstract

Mobile phone applications have increasingly been used as tools for literacy development in children with hearing impairment. This cross-sectional study determined parental knowledge of mobile applications and explored how demographic factors relate to that knowledge; and included 376 parents of children with hearing impairment. The study used a structured questionnaire and a purposive sampling technique for data collection. Results of the study highlighted that most parents showed a moderate level of knowledge (67.55%), while 21.81% had high knowledge and 10.64% had low knowledge. Many parents felt that mobile applications helped their children's learning activities, including communication, vocabulary development, problem solving, and understanding of educational content. Parental knowledge was significantly associated with parent or guardian gender ($\chi^2 = 7.605$; $p = 0.022$), parent or guardian education ($\chi^2 = 20.572$; $p = 0.008$), and child's academic grade ($\chi^2 = 39.361$; $p < 0.001$). Our study found that parents or guardians generally had a moderate level of knowledge about using mobile applications to support literacy which varies by gender, educational level, and child's academic grade suggesting digital awareness is not evenly distributed across different parent groups. These findings suggest a need for targeted educational intervention in order to strengthen digital literacy, especially among parents with lower educational attainment. Such interventions could help these parents better support their children's literacy development.

Keywords

Assistive mobile technology; Digital literacy; Literacy development; Mobile applications, Children with hearing impairment

1. Introduction

Literacy development is a major challenge among children with hearing impairment, and they usually struggle with phonemic awareness and acquisition of language [1,2]. Limited access to auditory cues can affect their reading and writing abilities, making alternative learning strategies compulsory [3]. Mobile phone technology has become a favorable tool in special education of children in recent years, with assistive applications that offers features including but not limited to sign language support, speech-to-text conversion, and interactive learning for people with special needs [4,5].

Scientific evidence has highlighted those digital tools, like word prediction software, mobile dictionaries, and sign language translation applications, can improve vocabulary

and reading proficiency in children with hearing impairment [6,7]. These advances in mobile technology have led to a range of assistive soft tools with an aim to address educational needs of special population [8]. Moreover, mobile phone applications that combine speech-to-text capabilities, interactive visual aids, and gamified literacy exercises usually are engaging, and an accessible way to build reading and writing skills [9].

These mobile phone applications have demonstrated to improve comprehension, support acquisition of vocabulary, and contribute to overall language development in special needs children [10]. However, use of these soft tools in an effective and efficient manner depends on active parental engagement and support [11]. Parents who understand mobile applications well and integrate them into their educational routine of children to help to address gaps in language comprehension, which in turn supports their communication and literacy skills among special needs children [12,13,14,15]. Attitudes, beliefs, and level of engagement of parents also play an important role in shaping learning outcomes; those parents who recognize the educational value of these mobile applications are more likely to use and incorporate them as part of daily learning of special needs children [16,17,18].

Despite these advancements of mobile phone applications for learning, many parents may not be aware of available resources or may not fully understand their potential benefits [19]. Moreover, disparities in parental knowledge and adoption of mobile applications may exist, especially in communities with limited access to technology or inadequate digital literacy training [20,21,22]. Understanding the extent of parental awareness and knowledge regarding mobile applications for literacy development is essential for optimizing their use in special education [23,24]. Therefore, this study was conducted to assess parental knowledge of mobile applications for improving literacy among children with hearing impairment and to explore the association between demographic factors and the level of knowledge regarding these applications.

2. Methodology

2.1. Study design and duration

This cross-sectional study was conducted for a period of six months between February and July 2024.

2.2. Ethical considerations

Ethical approval was obtained from the Research and Ethics Committee of Riphah International University (No. REC/RCR&AHS/23/0631). Written informed consent was obtained from the parents or legal guardians of the children with hearing impairment who participated in the study.

2.3. Study settings

Data were collected from various educational and rehabilitation institutions serving children with hearing impairment in Lahore, Punjab, Pakistan, including the Hamza Foundation Academy for the Deaf, Deaf Reach School, Innayat Foundation Academy for the Deaf, Badar Care School, Lahore Residency and Rehabilitation Center, and Riphah Rehabilitation Center.

2.4. Participant recruitment

The study targeted parents of children aged 9 to 15 years who had been diagnosed with moderate to profound hearing impairment and were actively utilizing mobile applications for literacy improvement. However, parents of children with additional co-mor-

bid conditions such as intellectual disabilities, autism spectrum disorder, or neurological impairments were not included in the study.

2.5. Sample size and sampling technique

The sample size was calculated using OpenEpi (version 3.00) by taking the expected proportion of parental knowledge about educational applications as 60.4% on the basis of a previous study, with a 95% confidence level and a 5% margin of error [25]. The calculated sample size was 368, which was further increased to 400 to account for potential nonresponse and incomplete questionnaires. A purposive sampling technique was used for the selection of participants.

2.6. Study tool development

A structured questionnaire was adopted from previous studies conducted by Achouche et al. and Cheadle [26,27]. The final questionnaire was sent to two field experts for review, including a PhD-qualified medical educationist and a senior special childcare professional with over 10 years of clinical experience, to assess its content validity regarding relevance, clarity, as well as appropriateness of the items. The revised questionnaire was subsequently pretested on five study participants to assess its face validity and comprehensibility. The reliability of the questionnaire was tested using Cronbach's alpha. The internal consistency of the Likert-scale items used to assess parental knowledge was high, with a Cronbach's alpha value of 0.897. The results of the pretest survey were not included in the final analysis of the study.

2.7. Study measures

The questionnaire consisted of two sections. The first section included demographic information, such as the parent's or guardian's sex, their qualifications, monthly income, and the child's age, sex, and academic grade. The second section consisted of sixteen questions answered on a 5-point Likert scale (ranging from strongly disagree to strongly agree, scored from 1 to 5), which were designed to assess parents' knowledge as operationalized through their awareness, familiarity, perceived educational value, and reported use of mobile applications that support literacy development among children with hearing impairment. The overall minimum score was 16, and the maximum score was 80; parents' knowledge was categorized as low for scores from 16 to less than 40 points (< 50%), moderate for scores from 40 to < 64 points (50– < 80%), and high for scores from 64 to 80 points (80–100%) using the modified Bloom's cutoff points [28].

2.8. Data collection

Permission for data collection was obtained from the concerned authorities of the targeted institutions prior to conducting face-to-face interviews in local languages with study participants in a separate room designated by the administration, with each interview lasting between 10 and 15 minutes.

2.9. Data analysis

Data was analyzed using SPSS version 25.00, and descriptive statistics were calculated for the study variables. Furthermore, the chi-square test was used to assess the association between parents' level of knowledge and sociodemographic characteristics.

3. Results

Of 400 parents/guardians approached, 376 completed the interview, yielding a response rate of 94.0%. More than half of the parents/guardians were male (57.71%), whereas 42.29% were female (Table 1). Most parents/guardians had a bachelor's degree (34.31%), followed by a master's degree or above (22.07%). The mean age of the children was 11.87 ± 1.92 years, with a slightly greater percentage of male children (52.66%). Most of the children were in grades 4–5 (36.20%), followed by grades 6–8 (33.80%).

Table 1. Sociodemographic characteristics of the study participants and their children with hearing impairment.

Variables		Frequency (%)
Parent/guardian gender	Male	217 (57.71)
	Female	159 (42.29)
Parent/guardian education	Illiterate	41 (10.90)
	Matriculation	51 (13.56)
	Intermediate	72 (19.15)
	Bachelor's degree	129 (34.31)
	Master's degree or above	83 (22.07)
Monthly household income (in PKR)	≤ 20,000 PKR	30 (7.98)
	20,001–40,000 PKR	86 (22.87)
	40,001–60,000 PKR	73 (19.41)
	60,001–80,000 PKR	94 (25.00)
	> 80,000 PKR	93 (24.73)
Child's age (in years), Mean ± SD		11.870 ± 1.919
Child's gender	Male	198 (52.66)
	Female	178 (47.34)
Child's academic grade	Grades 1–3 (primary)	75 (19.90)
	Grades 4–5 (upper primary)	136 (36.20)
	Grades 6–8 (middle school)	127 (33.80)
	Grades 9–10 (matriculation level)	38 (10.10)

As shown in Table 2, a considerable proportion of parents/guardians agreed that their children used mobile applications for educational and literacy-related purposes. In particular, many respondents reported that mobile applications supported study activities, problem solving, vocabulary improvement, and understanding of learning content.

Table 2. Parental responses to statements regarding the use of mobile applications for literacy development among children with hearing impairment.

Variables	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N (%)	N (%)	N (%)	N (%)	N (%)
Daily use of a mobile device	53 (14.10)	31 (8.24)	49 (13.03)	182 (48.40)	61 (16.22)
Use of mobile applications for study	20 (5.30)	52 (13.80)	59 (15.70)	180 (47.90)	65 (17.30)
Mobile applications help solve study problems	28 (7.40)	36 (9.60)	88 (23.40)	182 (48.40)	42 (11.20)
Use of Google Live Transcribe to convert speech into text	22 (5.90)	90 (23.90)	126 (33.50)	106 (28.20)	32 (8.50)
Use of sign language translation applications	26 (6.90)	48 (12.80)	105 (27.90)	178 (47.30)	19 (5.10)
Use of social media to connect with friends	21 (5.60)	49 (13.00)	52 (13.80)	196 (52.10)	58 (15.40)
Texting with friends helps improve vocabulary	18 (4.80)	58 (15.40)	56 (14.90)	220 (58.50)	24 (6.40)
Understands social media content without sign language	8 (2.10)	43 (11.40)	84 (22.30)	197 (52.40)	44 (11.70)
Use of a word prediction tool on the keyboard	19 (5.10)	52 (13.80)	78 (20.70)	193 (51.30)	34 (9.00)

Variables	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	N (%)	N (%)	N (%)	N (%)	N (%)
Word prediction tools help memorize or learn new words	11 (2.90)	47 (12.50)	69 (18.40)	172 (45.70)	77 (20.50)
Use of mobile dictionaries to search for meanings of new words	35 (9.30)	58 (15.40)	49 (13.00)	158 (42.00)	76 (20.20)
Parental support in mobile application use for academic purposes	17 (4.50)	25 (6.60)	57 (15.20)	222 (59.00)	55 (14.60)
Asks about new applications or games to enhance literacy	9 (2.40)	95 (25.30)	46 (12.20)	212 (56.40)	14 (3.70)
Mobile applications have improved the child's learning	10 (2.70)	53 (14.10)	43 (11.40)	216 (57.40)	54 (14.40)
Searches difficult study topics using a mobile device	20 (5.32)	55 (14.63)	39 (10.37)	228 (60.64)	34 (9.04)
Videos with subtitles help understand content more quickly	14 (3.70)	45 (12.00)	68 (18.10)	174 (46.30)	75 (19.90)

The majority of the parents/guardians had a moderate level of knowledge (67.55%) regarding mobile applications for improving literacy among children with hearing impairment (Table 3). In contrast, 21.81% had high knowledge, while 10.64% had low knowledge.

Table 3. Distribution of parents according to the level of knowledge regarding mobile applications for improving literacy among children with hearing impairment.

Variables		Frequency (%)
Level of parental knowledge	Low knowledge (< 50%)	40 (10.64)
	Moderate knowledge (50– < 80%)	254 (67.55)
	High knowledge (80–100%)	82 (21.81)

As shown in Table 4, parent/guardian gender was significantly associated with the level of parental knowledge ($\chi^2 = 7.605$, $p = 0.022$). A statistically significant association was also found between parent/guardian education and the level of parental knowledge ($\chi^2 = 20.572$, $p = 0.008$). Similarly, the child's academic grade was significantly associated with the level of parental knowledge ($\chi^2 = 39.361$, $p < 0.001$).

Table 4. Association between sociodemographic factors of parents and their level of knowledge regarding mobile applications for improving literacy among children with hearing impairment.

Variables		Level of Parental Knowledge			Chi-Square Value	Degree of Freedom (df)	*p* Value
		Low Knowledge	Moderate Knowledge	High Knowledge			
		Frequency (%)	Frequency (%)	Frequency (%)			
Parent/guardian gender	Male	15 (37.50)	154 (60.63)	48 (58.54)	7.605	2	0.022 *
	Female	25 (62.50)	100 (39.37)	34 (41.46)			
Parent/guardian education	Illiterate	8 (20.00)	28 (11.02)	5 (6.10)	20.572	8	0.008 *
	Matriculation	10 (25.00)	34 (13.39)	7 (8.54)			
	Intermediate	11 (27.50)	47 (18.50)	14 (17.07)			
	Bachelor's degree	6 (15.00)	91 (35.83)	32 (39.02)			
	Master's degree or above	5 (12.50)	54 (21.26)	24 (29.27)			
Child's academic grade	Grades 1–3	6 (15.00)	61 (24.02)	8 (9.76)	39.361	6	< 0.001 *
	Grades 4–5	5 (12.50)	107 (42.13)	24 (29.27)			
	Grades 6–8	19 (47.50)	69 (27.17)	39 (47.56)			
	Grades 9–10	10 (25.00)	17 (6.69)	11 (13.41)			

* Chi-square test of association. ** Significance at $p < 0.05$.

4. Discussion

The present study examined parental knowledge regarding the use of mobile applications for improving literacy among children with hearing impairment and assessed its

association with selected sociodemographic factors. The findings showed that most parents demonstrated a moderate level of knowledge regarding the use of mobile applications for literacy development. Parents reported various forms of mobile application use by their children for learning-related activities, including communication, vocabulary development, and access to educational content. In addition, significant associations were observed between the level of parental knowledge and certain sociodemographic characteristics, including parent/guardian gender, parent/guardian education, and the child's academic grade, with higher levels of knowledge more common among male parents/guardians, those with higher educational attainment, and parents of children in higher academic grades.

The results of our study are in line with those of a mixed-method study conducted on school children and highlight that parents moderately agree that mobile phone applications are helpful in improving children's literacy [29]. Furthermore, in support of the results of the current study, the scientific literature highlights that the use of mobile applications for learning improves children's world learning, language learning and communication capabilities [30]. Another study highlighted mobile applications as effective tools for improving children's knowledge [31].

A Greek study reported better awareness among parents of the use of mobile phone applications to enhance learning among children. Parents usually have better knowledge and prefer mobile applications for learning because they are economical, easily accessible and convenient to use [32,33]. Although parental knowledge about mobile applications for learning depends upon several factors, it can also vary based on the scientific scale used for measurement [34]. Furthermore, the language of the application and user interface may hinder the use of mobile applications in learning [35,36].

Parents' sociodemographic characteristics, mainly age and level of education, play a vital role in obtaining the true benefits of the applications for children's learning and literacy development. However, the choice of mobile application may hamper learning among children [37]. Another study conducted in Greece highlighted the association of the use of mobile applications for children's learning with the age of parents, number of children at home, knowledge of the application and frequency of usage [38]. A French qualitative study also revealed that the literacy level of parents and culture may impact the learning of children through the use of digital tools [39]. Another study revealed that the digital literacy of parents also positively influences the digital learning of children and vocabulary enhancement [40]. However, a study conducted in the Philippines revealed that learning among children through the use of digital media is not related to parental level of education, the environment at home or the use of electronic devices at home, suggesting that all children can benefit positively from digital learning tools [41].

Studies have shown that mobile devices and applications are effective at learning children with special needs but are influenced by the mobile phone usage behaviors of parents [42,43]. Furthermore, parents with higher levels of education and technical background and with frequent use of electronic gadgets are more inclined to use mobile applications for children's learning [44,45]. Marketing of mobile phone applications may influence the knowledge of parents, and it may impact their choices for the selection of applications as well among different cultural settings [46].

The study used a standardized tool, furnished scientific evidence from the local context and gathered samples from a diverse range of sociodemographic parameters, highlighting the strengths of the study. However, the study did not take into consideration the qualitative factors responsible for parental attributes in the use of mobile applications for special needs children's learning. Furthermore, knowledge was self-reported and may contain bias, and findings of the study cannot be generalized, which remains a weak-

ness of the study. Although questionnaire was designed to capture knowledge of parents through awareness and self-reported engagement with mobile applications, some items also reflected practices and perceptions, which should be considered when interpreting the findings.

5. Conclusions

The study highlighted that parents or guardians generally had a moderate level of knowledge about use of mobile phone applications to support literacy, which varies by gender, educational level, and academic grade of children. These findings suggest a need for targeted educational intervention to strengthen digital literacy, especially among parents with lower education.

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Consent to participate: Not applicable.

Data availability: The data supporting this study's findings are available from Iram Areej Zaman upon reasonable request.

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