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FULL PAPER

Advancing Inclusive University Libraries: Academic Librarians' Perspectives on Serving Deaf and Hard-of-Hearing Students

تعزيز المكتبات الأكاديمية الشاملة: وجهات نظر أمناء المكتبات الأكاديمية حول خدمة الطلاب الصم وضعاف السمع

Abstract

. This study examined academic librarians' attitudes toward serving Deaf and hard-of-hearing (DHH) students in Saudi universities, guided by Universal Design for Learning (UDL) principles and the Socio-Ecological Model (SEM). A quantitative survey of 63 librarians assessed perceptions, challenges, and service needs. Findings indicated generally positive attitudes and strong professional commitment, with no significant differences across gender, educational qualification, experience, or prior training. However, gaps were observed in systematic evaluation and applied training, highlighting that positive attitudes alone do not guarantee effective service delivery. Interpreted through UDL and SEM, results emphasize the need for integrated skill development, structured professional training, and supportive institutional policies. Implementing these strategies can enhance library accessibility, foster inclusive practices, and improve academic experiences for DHH students in Saudi universities.

Keywords: Deaf and hard-of-hearing, academic librarians, Universal Design for Learning, Socio-Ecological Model, inclusive services.

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المستخلص:

هدفت هذه الدراسة إلى فحص تصورات أمناء المكتبات الأكاديمية نحو خدمة الطلاب الصم وضعاف السمع في الجامعات السعودية، وذلك في إطار مبادئ التصميم الشامل للتعليم (UDL) ونموذج البيئة الاجتماعية (SEM). استخدمت الدراسة منهجاً كمياً من خلال استطلاع شمل 63 أمين مكتبة لقياس تصوراتهم والتحديات التي يواجهونها واحتياجات الخدمات المقدمة. وأظهرت النتائج تصورات إيجابية بشكل عام والتزاماً مهنيًا مرتفعاً، دون وجود فروق ذات دلالة إحصائية تعزى إلى الجنس أو المؤهل العلمي أو الخبرة أو التدريب السابق. ومع ذلك، كشفت النتائج عن فجوات في التقييم المنهجي والتدريب التطبيقي، مما يشير إلى أن التصورات الإيجابية وحدها لا تكفي لضمان تقديم خدمات فعالة. وبالاستناد إلى UDL و SEM، تؤكد النتائج ضرورة تنمية المهارات بشكل متكامل، وتوفير برامج تدريب مهني منظمة، ووضع سياسات مؤسسية داعمة. إن تطبيق هذه الاستراتيجيات من شأنه تحسين إتاحة خدمات المكتبات، وتعزيز الممارسات الشاملة، والارتقاء بالتجربة الأكاديمية للطلاب الصم وضعاف السمع في الجامعات السعودية.

الكلمات المفتاحية: الصم وضعاف السمع، أمناء المكتبات الأكاديمية، التصميم الشامل للتعليم، نموذج البيئة الاجتماعية، الخدمات الشاملة.

Introduction

University libraries serve as central hubs for knowledge and inclusive learning, providing vital support for all students, including those with disabilities. Librarians play a key role in ensuring these services are accessible and effective, by organizing resources, offering guidance, and facilitating information access (Saleh, 2021). Despite their central role, librarians often face challenges in meeting the needs of DHH students, including insufficient training, lack of sign-language expertise, and limited supportive policies (Namuleme et al. 2024; Chettri & Bordoloi, 2021).

Librarians encounter multiple barriers when serving DHH students, such as difficulties in communication, navigating complex library systems, and the scarcity of dedicated resources (Hamad, 2023; Bala, 2025). These limitations underscore the need for more specialized preparation and institutional investment to enable librarians to implement inclusive practices effectively. Such challenges directly affect DHH students' ability to benefit from library services, placing significant responsibility on librarians to develop innovative and inclusive solutions (Purnomo et al., 2025).

Additionally, DHH students often experience academic and reading comprehension challenges (Rodríguez-Ortiz et al., 2025; Basonbul, 2018), which makes the guidance role of librarians critical. Providing accessible content, interactive support, and strategies that enhance students' academic independence is essential for meaningful inclusion. Consequently, assessing librarians' perceptions and experiences in serving DHH students becomes fundamental for understanding the current state of library services.

This research adopts a quantitative design and utilizes a structured survey instrument as the main source of data, administered to academic librarians working in Saudi universities. It is grounded in a conceptual framework that integrates UDL principles and the SEM of disability, offering a comprehensive view of how individual, institutional, and societal factors interact to provide an inclusive library environment. The findings are expected to provide practical insights for librarians on improving delivery service, enhancing accessibility, and designing more effective library programs that meet the needs of all students, including those who are deaf or hard of hearing.

Literature review

Cognitive and communicative needs of DHH students

DHH students constitute a distinct population whose academic and social development is shaped significantly by hearing loss. Research shows that auditory impairment can influence executive functioning, communication abilities, and students' integration within traditional learning environments (Pan & Xiao, 2024; Xiong et al., 2024). These students rely heavily on nonverbal communication—sign language, facial expressions, writing, and visual cues—requiring access to visually oriented instructional materials (Al-Enazi & Turkestani, 2024; Mann et al., 2023; Yu et al., 2023). Accordingly, adapting academic library services to align with these cognitive and communicative characteristics is essential for equitable education.

Librarians' perceptions and inclusive service provision

The literature consistently underscores that academic librarians' perceptions are a pivotal determinant of the quality and inclusivity of services for DHH students. While studies such as Bala (2025) show that librarians express positive intentions toward supporting students with disabilities, these intentions often face constraints such as insufficient training, limited resources, and institutional barriers. This aligns directly with the research question concerning the gap between librarians' motivation and their institutional capacity.

Empirical evidence shows that librarians with prior exposure to Deaf culture or training in UDL principles demonstrate more favorable attitudes and professional efficacy. Yu et al. (2023) found that Deaf individuals allocate greater attention to visual cues, suggesting that librarians must

be attuned to visual communication norms. Mann et al. (2023) demonstrated that Deaf students rely heavily on visual reading strategies when navigating digital environments, emphasizing the need for visual literacy among library staff.

Differences in perception also arise from institutional culture, years of experience, and professional development opportunities (Purnomo, et al., 2025; Phinney, 2024). These findings align with Bronfenbrenner's SEM framework, which posits that organizational ecosystems shape individual attitudes and readiness to support inclusive practices.

Moreover, recent evidence shows that librarians' perceptions toward serving DHH students are not fixed; rather, they evolve based on their professional preparation, accumulated experience, and prior interactions with Deaf individuals. Studies indicate that personnel who have received disability-focused training or previously worked with DHH students tend to demonstrate more inclusive attitudes and greater confidence in delivering accessible services (Bala, 2025). These findings reinforce the view that librarians' beliefs and competencies are shaped by experiential and developmental factors, rather than being purely attitudinal or intrinsic dispositions. This dynamic orientation directly aligns with the second research question, which examines how demographic and professional characteristics influence librarians' attitudes toward DHH accessibility in academic libraries.

Despite the growing advancement of educational and library services both globally and locally, DHH students continue to face significant challenges in accessing information within university settings, particularly with regard to communication channels, the suitability of learning materials, and the shortage of staff trained to address their specific needs (Pionke, 2019). In the Saudi context, these challenges are further amplified within the ongoing digital transformation and Vision 2030 initiatives, emphasizing the need for studies that examine librarians' attitudes toward this population and their role in fostering an inclusive and accessible knowledge environment.

Structural and operational barriers limiting library services for DHH students

Despite advances in inclusive education, university libraries continue to face structural constraints that hinder their ability to provide effective services for DHH students.

One of the most pressing barriers concerns the inconsistency of communication support, particularly the limited availability of sign-language interpreters and real-time captioning. Recent evidence shows that sporadic access to interpreters or captioning creates substantial academic and informational gaps for DHH students, affecting their ability to benefit from reference services, instructional workshops, or routine interactions with library staff. Namuleme's et al. (2024) study demonstrated that inconsistent access to communication support is one of the major obstacles undermining academic participation and access to library resources for DHH learners.

Beyond communication barriers, many academic libraries and digital learning systems lack visually accessible materials for DHH students. Online and blended learning environments often fail to provide sign-language videos, high-quality captioning, or visually structured resources, reducing comprehension and engagement (Weber et al., 2025). Similarly, Jolly et al (2024) note that inconsistent or inaccurate captioning restricts access to essential academic content. Additionally, platforms lacking visually oriented layouts or sign-language support result in lower satisfaction and cognitive engagement, highlighting the need for visually inclusive digital content (Niksiar et al., 2025).

Recent literature highlights that many universities still lack clear and enforceable institutional accessibility policies for DHH students. Oswal's et al. (2025) and Madhesh's (2024) report that higher education institutions in several Arab countries rely on general or symbolic accessibility statements that are not operationalized through actionable plans or systematic monitoring.

In the Saudi context, Al-Fadeed (2024) similarly reports insufficient structural supports and monitoring systems, leading to a persistent gap between policy rhetoric and lived experience. This institutional mismatch is further reinforced by findings from Percival et al. (2025), whose study on university students who are deaf or hard of hearing shows that limited environmental and institutional accommodations—particularly the lack of sign-language facilitation, insufficient assistive infrastructure, and inadequate academic adjustments—directly hinder students' academic integration and active participation. Together, these studies emphasize that without strong, enforceable institutional systems, accessibility policies remain symbolic rather than transformative.

An equally significant barrier to providing effective library services for people with disabilities is the lack of specialized training for librarians. Recent empirical evidence reveals that even when libraries invest in assistive technologies and accessible infrastructures, the absence of well-trained staff severely limits the potential benefit of these resources. For instance, Purnomo, et al. (2025) demonstrated that accessible facilities and assistive technologies alone did not significantly enhance educational access unless they were paired with comprehensive staff training and robust institutional policies. Similarly, a recent qualitative study conducted in Lanao del Norte, Philippines, by Bala (2025) found that librarians consistently reported limited professional preparation and a strong need for additional training to serve students with disabilities effectively. Participants emphasized gaps in disability awareness, accessible service design, and the use of assistive technologies. Despite expressing strong support for inclusive access, librarians indicated that inadequate training, scarce resources, and insufficient institutional investment significantly restricted their ability to provide equitable and specialized library services. Without such training and professional development, captioning systems, accessible formats, or adaptive technologies often remain underutilized or misapplied, undermining the libraries' inclusive mission and limiting DHH students' access to information and learning.

Taken together, these findings illustrate that the challenges facing DHH inclusion in university libraries are not merely technological but institutional and structural. Addressing them requires a holistic and sustained strategic approach that includes formal accessibility policies, investment in visual and communication infrastructure, and systematic professional training for librarians. Only through such integrated efforts can university libraries evolve into genuinely inclusive knowledge spaces that ensure equitable access for all learners.

Study delimitations

Spatial Delimitations: The study targeted four public university libraries in Saudi Arabia that provide services to DHH students.

Temporal Delimitations: The research examined library services offered to DHH students during the academic years 2024-2025.

Human Delimitations: The study was limited to academic librarians working in Saudi universities that admit and serve DHH students.

Topical Delimitations: The study focused on examining academic librarians' perceptions toward serving DHH students, identifying the challenges that hinder effective activation of library and information services for this population, and determining the requirements necessary for developing such services to better meet their needs.

Research Questions

Based on the above, the present study seeks to investigate the following research questions:

1. What are university librarians' perceptions toward serving DHH students?
2. Are there statistically significant differences in university librarians' perceptions toward serving DHH students based on the study variables?
3. What challenges limit the effectiveness of university libraries and information services in serving DHH students, from the librarians' perspective?
4. What are the necessary requirements for developing university libraries and information services for DHH students, according to the librarians' perspective?

Methodology

Participants

To achieve the objectives of the present study, a two-stage sampling strategy was adopted. In the first stage, purposive sampling was employed to select university librarians with relevant characteristics, ensuring homogeneity and the collection of rich, targeted data. In the second stage, random sampling was applied to distribute the questionnaires among participants, which enhanced the reliability of the data and secured broader representation across the study sample (Al-Qahtani & Al-Dhihan, 2020).

The study sample consisted of 63 university librarians, with females slightly outnumbering males (52.4% vs. 47.6%), reflecting a relatively balanced gender representation (Table 1). The majority of participants held at least a bachelor's degree (77.8%) and had more than five years of professional experience (81%). Regarding specialized training in serving DHH students, most librarians had not attended any training (65.1%), indicating a gap in professional development. Academically, Library and Information Science was the predominant field (39.7%), highlighting a direct link between academic background and professional role within university libraries.

Table 1. Study sample characteristics (N = 63)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	30	47.6
	Female	33	52.4
Qualification Educational	Secondary	7	11.1
	Postgraduate Diploma	3	4.8
	Bachelor's	49	77.8
	Postgraduate	4	6.3

Variable	Category	Frequency (n)	Percentage (%)
Years of Experience	years 5>	12	19.0
	years 10–5	25	39.7
	years 10<	26	41.3
Training Courses (for DHH Students)	None	41	65.1
	One Course	17	27.0
	More than One Course	5	7.9
Academic Major	Library & Information Science	25	39.7
	Sociology	3	4.8
	Social Work	9	14.3
	Physics	2	3.2
	Biology	2	3.2
	Business Administration	4	6.3
	Media Studies	3	4.8
	History	2	3.2
	Islamic Studies	2	3.2

Variable	Category	Frequency (n)	Percentage (%)
	Sharia	3	4.8
	English	2	3.2
	Arabic	4	6.3
	Computer Science	2	3.2

Design Research

This study forms part of a larger research project that investigated the status of library and information services provided to DHH students in Saudi universities. The current phase employed a quantitative survey approach, as it is well suited for analyzing the perceptions of university librarians through the use of questionnaire. This design enabled the identification of challenges and service needs, offering precise insights into the educational and social dimensions of the phenomenon. The quantitative survey was further chosen for its effectiveness in producing measurable data that can be generalized and used to generate practical recommendations (Ahmed et al., 2024).

Study instruments

The study employed a questionnaire to evaluate university librarians' perspectives on serving DHH students. It consisted of three main dimensions—librarians' perceptions, challenges to service activation, and needs for service development—with a total of 28 items. A five-point Likert scale (ranging from strongly agree to strongly disagree) was used to capture participants' responses. To verify its psychometric properties, a pilot study was conducted with 21 university librarians outside the main sample, and their responses were used to assess validity and reliability. Validity was confirmed through expert review (average agreement of 89.3%), extreme group comparison, and self-validity coefficients (0.906–0.938). Reliability was also strong, with Cronbach's alpha values ranging from 0.822 to 0.880, indicating that the instrument possesses robust psychometric characteristics for field application.

Procedures

Following the approval granted by the Scientific Research Ethics Committee at King Abdulaziz University, the questionnaire was developed through Google Forms and underwent validation and reliability assessment to ensure methodological rigor. Subsequently, formal correspondence was sent to public and private universities in Saudi Arabia that admit DHH students, requesting institutional support in disseminating the survey. Each participating university distributed the questionnaire to its academic librarians via the official university email system, ensuring controlled and authenticated outreach. Data collection was carried out over several weeks during the second quarter of 2024, allowing sufficient time for participation across institutions and enhancing the representativeness and stability of the dataset.

Data analysis

The collected data were analyzed using appropriate descriptive and inferential statistical methods aligned with the study objectives. Statistical analyses were performed utilizing IBM SPSS Statistics (Version 27). The analysis process included the computation of means and standard deviations for each questionnaire dimension, in addition to verifying the assumptions required for subsequent inferential tests. The first dimension was measured using a five-point Likert scale to capture a broader range of attitudinal responses, while the second and third dimensions employed a four-point scale to encourage decisive responses and reduce neutrality in participants' answers, which is consistent with best practices for minimizing mid-point bias in Likert-type scales (Kankaraš & Capecchi, 2024). This differentiation allowed for a more nuanced analysis of librarians' perceptions, challenges, and developmental needs regarding services for DHH students in Saudi university libraries.

Ethical Protocols

This study was carried out in accordance with the ethical guidelines approved by the Scientific Research Ethics Committee at King Abdulaziz University (Approval No. 45 95082, issued on 31 March 2024). The survey instrument was designed to align with the professional roles and responsibilities of university librarians, and all participants received a clear electronic consent form detailing the study aims, procedures, and confidentiality safeguards. Participation was entirely voluntary, and individuals had the unrestricted right to discontinue participation at any stage. No identifying information was collected, and all responses were handled anonymously and stored securely. The researcher ensured that the collected data were used solely for scholarly purposes and that all procedures complied with institutional regulations and internationally recognized standards for ethical research involving human subjects.

Results

Perceptions of academic librarians toward serving DHH students

This study examined academic librarians' perceptions toward serving DHH students, along with the challenges and needs related to improving such services. To answer the first research question—What are academic librarians' attitudes toward serving DHH students?—means and standard deviations were calculated for their responses. The results presented in Table (2) indicate that academic librarians' attitudes toward serving DHH students were generally positive, with a high overall mean score of 4.079 (SD = 0.538). Among the individual items, the highest-rated statement emphasized that providing specialized materials for DHH students reflects the library's mission and goals (M = 4.587, SD = 0.527) (Table 3). This was followed by the recognition that the lack of accessible pathways and facilities hinders service provision (M = 4.476, SD = 0.563). In contrast, the lowest-rated item concerned the practice of continuous evaluation of services for DHH students (M = 3.238, SD = 1.146), suggesting that systematic assessment remains a weaker aspect. Overall, the findings highlight a strong professional awareness and positive orientation among academic librarians toward serving this student group.

Table 2. Means and standard deviations of academic librarians' perceptions toward serving DHH students

Dimension	Mean	Standard Deviation	Response Level
Overall mean of academic librarians' perceptions toward serving DHH students	4.079	0.538	High

Table 3. Frequencies, percentages, means, and standard deviations of academic librarians' perceptions toward serving DHH students (N = 63)

Item .No	Statement	Mean	SD	Rank	Response Level
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1	Providing training and workshops for academic librarians enhances their skills in serving DDH students.	4.428	0.874	5	Very High
2	Involving DDH students in improving library services ensures that their needs are met.	4.476	0.618	3	Very High
3	Awareness of the needs of DDH students is key to achieving equity in access to knowledge and resources, and to adapting services accordingly.	4.476	0.692	4	Very High
4	We are committed to helping DDH students access the information and knowledge they need for success.	4.079	0.938	7	High
5	We recognize the importance of improving our communication skills with DDH students to ensure equitable services.	4.317	0.736	6	Very High
6	Lack of accessible pathways and central facilities for DHH students hinders their ability to benefit from library services.	4.476	0.563	2	Very High
7	Providing specialized materials for DHH students reflects the library's mission and goals in serving all community groups.	4.587	0.527	1	Very High

8	We provide orientation tours and training programs for new DDH students to help them utilize library services.	3.667	1.244	8	High
9	We deliver services and information to DDH students in Arabic (spoken and written) without using sign language.	3.555	1.089	10	High
10	We continuously evaluate services for DDH students to improve policies and practices for this group.	3.238	1.146	11	Moderate
11	We make continuous efforts to attend training courses to develop our skills in serving DDH students.	3.571	1.088	9	High
Overall Mean	—	4.079	0.538	—	High

Perceptual differences by study variables

The second research question examined whether statistically significant differences exist in the perceptions of academic librarians toward serving DHH students based on demographic variables (gender, academic qualification, professional experience, and prior participation in training programs). To test the related null hypothesis, the data were first assessed for normality to ensure the suitability of statistical analysis.

Differences in responses by gender

The Kolmogorov–Smirnov test confirmed the normality of total attitude scores by gender (Table 4). Levene’s test indicated homogeneity of variances between male and female groups (Table 5). Accordingly, an independent-samples t-test was conducted to compare the mean responses of males and females, revealing no statistically significant differences.

Table 4. Kolmogorov–Smirnov Test results for librarians’ attitudes by gender

Variable Category	Total Score	Smirnov Test–Kolmogorov			
		Statistic	df	value-p	Significance
Male	Overall Attitude				
Female		149.	30	087.	Not significant
		106.	33	*200.	Not significant

Table 5: Levene’s Test for Homogeneity of variances by gender

Independent Variable	Total Score	Levene Statistic	value-p
Gender	Overall Dimension	2.288	136.
			Not significant

Differences in responses by educational qualification

The Kruskal–Wallis test results (Table 6) showed a chi-square value of 5.254 with 3 degrees of freedom and a p-value of .154, which is not statistically significant at the .05 level. This indicates that there were no significant differences in the mean rank scores of university librarians’ attitudes toward serving DDH students across the different educational qualification groups (secondary, postgraduate diploma, bachelor’s, postgraduate studies). Thus, librarians’ attitudes toward this student group appear to be relatively consistent, regardless of academic qualification.

Table 6. Mean Rank Differences by Educational Qualification (Kruskal–Wallis Test)

Educational Qualification	N	Mean Rank	Square-Chi	df	value-p	Significance
Secondary	7	26.50	5.254	3	154.	Not significant
Postgraduate Diploma	3	13.67				
Bachelor's	49	33.01				
Postgraduate Studies	4	43.00				

Differences by Years of Experience

The Kruskal–Wallis test results (Table 7) revealed no statistically significant differences in librarians' attitudes toward serving DDH students based on years of experience ($\chi^2=5.497$, $df=2$, $p=0.064$). This indicates that participants' responses were relatively consistent across the three experience categories (less than 5 years, 5–10 years, more than 10 years).

Table 7. Kruskal–Wallis Test Results by Years of Experience

Years of Experience	N	Mean Rank	(Square-Chi) $^2\chi$	df	(Sig. (p	Significance
Less than 5 years	12	23.25				
years 10–5	25	30.28	5.497	2	0.064	.Not Sig
More than 10 years	26	37.69				

Based on the Kruskal-Wallis test, no statistically significant differences were found between the mean ranks of university librarians' responses regarding their attitudes toward serving DDH students according to the training variable (none, one course, more than one course), with a chi-square value of 5.271, 2 degrees of freedom, and a significance level of 0.072. These findings indicate a similarity in responses among librarians regardless of the number of training courses attended, suggesting that the training may have been limited in depth or

practical application, or that librarians already held a positive baseline awareness toward this population.

Discussion

This study aimed to assess academic librarians' attitudes toward serving DHH students in Saudi university libraries. The findings indicated a generally high level of positive attitudes, reflecting strong professional commitment. Such outcomes can be meaningfully interpreted through the lens of UDL principles and the SEM, which highlight that inclusive practices necessitate adaptation at individual, institutional, and societal levels, ensuring librarians' skills and attitudes are aligned with the diverse needs of DHH students. These results reveal a clear service orientation among academic librarians toward supporting DHH students, highlighting an encouraging professional awareness within Saudi university libraries. This finding contrasts with Pionke (2019), who reported that many library staff felt unprepared or insufficiently trained to meet the needs of patrons with disabilities. However, it aligns with Bala (2025), who found similarly that librarians generally hold positive service orientations, emphasizing the importance of equitable access and specialized support for students with disabilities—a pattern that resonates with the heightened awareness observed in the present study.

Such differences may be attributed to supportive academic environments or prior professional experiences, echoing Bushman's (2018) emphasis on the role of experience in enhancing service quality. While the results are encouraging, they underscore the importance of ongoing institutional support to translate positive attitudes into consistent practices and effective policies.

The study results highlight a notable similarity between male and female academic librarians in their attitudes toward serving DHH students, reflecting a shared professional awareness and equal institutional commitment across genders. This convergence can be interpreted through the lens of UDL principles and the SEM, which suggest that consistent training opportunities and standardized professional environments at the institutional level contribute to equitable attitudes and inclusive practices across individual librarians. This outcome may be attributed to unified training opportunities and the standardized professional environments within Saudi university libraries, which foster consistent positive orientations. Additionally, increasing societal awareness of disability rights and the promotion of inclusive policies within higher education likely contribute to reducing gender-based differences. These results align with studies emphasizing the role of training and institutional policies in shaping positive professional attitudes (e.g., Bushman, 2018), while differing from other research that did not provide detailed insights into gender differences (e.g., Ali & Al-Ajmi, 2021). The findings underscore the importance of sustaining training programs and institutional policies to maintain consistent and inclusive attitudes toward serving DHH students.

The primary finding indicates no statistically significant differences in librarians' attitudes toward serving DDH students based on educational qualification, reflecting a convergence of professional perspectives across different academic backgrounds. According to UDL and SEM frameworks, educational qualifications alone may not directly influence inclusive service practices; rather, institutional supports, professional development, and the broader socio-ecological context shape librarians' skills and attitudes toward DHH students. This outcome can be attributed to the fact that educational qualification alone does not necessarily provide specialized training for serving DHH students, leading librarians' attitudes to be more influenced by their practical experience and personal professional stance. The similarity in attitudes across educational levels may also reflect a broader professional awareness within the university environment regarding equity and inclusivity in library services for all students. These findings partially align with Kulbin & Virkus (2015), who emphasized the role of personal characteristics and affective attitudes in developing library services, while highlighting the specificity of the present study in focusing on a distinct student group and employing a quantitative methodology.

The analysis revealed no statistically significant differences in librarians' attitudes toward serving DDH students based on years of experience. This finding contrasts with previous research (Bushman, 2018; Noh et al., 2011), which suggested that professional experience enhances the depth and effectiveness of services for DDH patrons. The divergence may be attributed to methodological differences (quantitative vs. qualitative approaches), sample characteristics, or institutional contexts. From a UDL and SEM perspective, this suggests that individual experience alone is insufficient to ensure inclusive practices; rather, it is the interaction between personal competencies, institutional policies, and the broader socio-ecological environment that shapes effective service attitudes. The absence of significant differences could also reflect the role of unified institutional policies and standardized training programs, which minimize the effect of individual experience. These results highlight the need for future studies to adopt mixed-methods designs to gain a deeper understanding of how professional experience shapes service attitudes.

The results suggest that the current training courses for university librarians may not be sufficient to significantly alter or enhance their attitudes toward serving DHH students. The observed similarity in responses could reflect an existing general awareness or positive predisposition among librarians, rendering the number of training sessions less influential in shaping practical attitudes. Applying UDL and SEM principles, it becomes evident that training programs need to be embedded within comprehensive institutional frameworks and supportive environments, combining skill development with systemic policies to translate awareness into effective, inclusive library practices. These findings highlight the need for more comprehensive and application-focused training programs to strengthen librarians' competencies and improve the quality of services provided to this population. Moreover, such

training should be accompanied by structural and cultural changes within libraries to ensure effective service delivery to this group (Payne, 2016).

Limitation

This survey represents one component of a larger mixed-methods project; therefore, the current findings reflect only the quantitative strand. The study relied on self-reported data from academic librarians, which may not fully capture actual service practices or day-to-day interactions with DHH students. Although participants were drawn from several Saudi universities, the survey sample remains limited and may not represent the full diversity of library environments nationwide. The data were collected during a specific period, which restricts the ability to observe changes that might occur across semesters or following institutional initiatives. Additionally, the survey did not incorporate direct assessments of library facilities or service quality, which may have provided deeper contextual insights. Future work within the broader mixed-methods project will integrate qualitative evidence and field observations to offer a more comprehensive understanding.

Implications for Practice

The findings of this study offer several practical implications for academic libraries aiming to enhance services for DDH students. First, although librarians generally demonstrate positive perceptions toward serving DHH students, sustained institutional support is necessary to translate this awareness into consistent practices. Libraries should implement structured and ongoing professional development programs focusing on visual communication strategies, use of assistive technologies, and disability-inclusive service design.

Second, standardized policies and procedures should be established to ensure equitable access to library resources, including accessible pathways, sign-language facilitation, and visually oriented learning materials. Encouraging librarians to actively involve DHH students in feedback mechanisms can enhance service alignment with student needs.

Third, training initiatives should be practical and application-oriented, emphasizing hands-on experience with adaptive tools and real-world scenarios. Such programs would complement the librarians' baseline positive awareness and improve their confidence in delivering effective support. Finally, integrating accessibility considerations into institutional strategic planning will reinforce a culture of inclusion and ensure that positive perceptions are consistently reflected in service delivery.

Conclusion

The findings of this study indicate a generally positive orientation among academic librarians in Saudi universities toward serving DHH students, reflecting strong professional awareness and commitment. However, positive attitudes alone are insufficient to ensure equitable access. Systematic institutional support, structured professional development, and the implementation of inclusive policies are essential to bridge the gap between intent and practice.

Although demographic factors such as gender, educational qualification, professional experience, and prior training did not significantly affect librarians' attitudes, the results emphasize the importance of a holistic approach that integrates skill development, institutional infrastructure, and policy frameworks. Applying UDL principles, guided by the SEM, can support the creation of library environments that are accessible, inclusive, and responsive to the diverse needs of DHH students (Skaggs & McMullin, 2024; Hunt et al., 2023; Havelka & Arzola, 2021).

By combining UDL-informed service design, sustained training, and organizational commitment, academic libraries can move beyond symbolic accessibility measures toward tangible improvements in information access. Such an integrated strategy enhances DHH students' academic experiences, fosters meaningful participation, and ensures that libraries function as truly inclusive knowledge hubs. Implementing these evidence-based practices aligns with global trends in inclusive library services and supports Saudi Vision 2030's objectives of equity, accessibility, and innovation in higher education.

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