
Digital Literacy Skills of University Librarians: A Predictor of the Digital Reference Services Provided

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This paper aims to measure the digital literacy skills (DLSs) of university librarians (ULs) as the predictor of the enhanced digital reference services (DRSs) they provide. It also attempts to identify the best predictor of DLSs to improve DRSs in libraries. The study population comprised the ULs of Punjab, Pakistan. A structured questionnaire was developed to collect quantitative data from the study participants.

The purposive sampling technique was used to collect data from 190 ULs. The findings highlighted that the level of UL's DLSs to provide DRSs was high. The DLSs of ULs created 59.8% variability in providing DRSs. Furthermore, the beta coefficient value of the factor 'information retrieval skill' was identified as the best predictor of DRSs compared to other skills. The results concluded that DLSs are a prerequisite for offering vibrant DRSs. This research may help ULs to improve the deficient areas of their DLSs and provide advanced-level DRSs. The findings may also help ULs and policymakers design continuous development training programs to enhance the DLSs of librarians.

Keywords: Digital literacy skills (DLSs); digital reference services (DRSs); university librarians (ULs); Punjab; multiple regression.

INTRODUCTION

The fast pace of the investigation, creation, and advancement of ICTs has raised the importance of the effective consumption of information. There is continuous two-way traffic, and data is accessible 24/7. It has eliminated physical distances, minimized communication expenditures, and facilitated the learning of new skills, especially in the current information and knowledge society (Prytherch, 2016). In this information age, the information flood demands the development of technological skills and fundamental digital literacies.

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Literacy is an aptitude for understanding and using information from different sources. Several authors have used the phrase digital literacy since the 1990s (Tenopir & Ennis, 2002). They have defined it as an ability to read and understand information documents in hypertext or multimedia formats (Bawden, 2001). Digital literacy skills (DLSs) are also 21st-century skills (Ocholla & Shongwe, 2013), which play a vital role in the librarians' ability to provide effective digital reference services (DRSs) to library users. DLSs are a continuous process that empowers librarians to achieve the goals of satisfying their users or helping them provide better DRSs per the changing demands of users in the present era. Reference services and sources have changed their mode due to the development of the Internet and ICTs. This new mode of providing services in the reference section is recognized as DRS (Chowdhury & Margariti, 2004).

Reference services, sometimes referred to as reference and information services or user services, encompass the personal assistance librarians offer to library patrons to fulfill their information needs (Bunge, 1999). Librarians offer reference services to play an intermediary role between the users' information needs and information sources. The reference section is a central section in libraries that provides personal support to library users in finding and accessing up-to-date information. However, due to emerging trends in libraries and the use of the World Wide Web, customary reference services have transitioned to DRSs (Tenopir & Ennis, 2002).

DRSs are defined as services where the librarian uses some electronic means (email, chat, WhatsApp, and Google forms) to take and answer the questions put forth by library users (Janes et al., 1999). Generally, there are four factors in DRSs: user, interface, librarian, and electronic and print resources. Many studies have been conducted to investigate the DLSs or DRSs of librarians and users separately. However, there is an acute need to discover the existing relationship between ULs' DLSs and the DRSs they provide, as so far, it has yet to be explored by researchers. Therefore, the present study has been organized to quantify the level of DLSs of ULs of Punjab, Pakistan, as a predictor to enhance their provided DRSs.

Internet-based reference services are very beneficial for remote library users who cannot come to the library to access their needed information. Universities play an essential role in disseminating higher education and research culture globally. Accordingly, universities are trying to provide DRSs to their users by using digital innovations, such as the Internet and the World Wide Web. Therefore, DLSs like library literacy, computer literacy, technology literacy, information retrieval literacy, and research support literacy have become necessary skills for university librarians (ULs) to provide DRSs (asynchronous reference services, synchronous reference services, research support services, and other digital reference services).

Understanding the relationship between DLSs and DRSs is crucial in the modern information landscape, where digital resources play a significant role in research and information retrieval (Zan et al., 2021). This study aims to illustrate how the digital competence of university librarians influences the services they provide, emphasizing the importance of librarians possessing adequate DLSs to meet the evolving needs of library users (Hamad et al., 2021).

LITERATURE REVIEW

Digital Literacy Skills (DLSs)

American Library Association defines digital literacy as the capability of a person to use ICTs to find, understand, assess, create, and communicate digital information by applying his cognitive and technical skills (ALA, 2013). Digital literacy refers to the ability of individuals to effectively use information and communication technologies (ICTs) to search for, understand, evaluate, create, integrate, and communicate information across various digital tools for living, learning, and working in a digital society (Soeparno & Ismaniati, 2022). An individual has to be active and participative information literate to deal with digital devices and process raw materials into usable information in this digital environment (Sharkey & Brandt, 2008). Conversely, Lanham (1995) argued the need for a new form of literacy to process the information available in the form of text, images, or sound. He called it 'multimedia literacy' and stressed that it differed from customary literacy.

Khan (2020) investigated the level of DLSs of Pakistani ULs and reported a poor level of skills that were incompatible with the librarianship job market. The study findings indicated that the library professionals were neither motivated to enhance their current level of DLSs nor able to acquire these skills due to the unavailability of training facilities and the presence of other barriers. Batool (2010) seconded the earlier observation and revealed that if a library wanted to provide advanced technological services to its users, then skilled, knowledgeable, and trained staff was required. Raju (2014) explored the variety of knowledge, skills, and competencies needed to work in libraries in the modern digital environment among library professionals in South Africa. Recently, Christy and Yusuf (2021) investigated the low level of DLSs among academic librarians working in Nigerian Universities and found that DLSs were necessary for offering 21st-century library services. In contrast, a study conducted by Ali (2022) found that most ULs in Sindh, Pakistan, possessed good DLSs despite the various physical, managerial, and technological barriers.

Baro, Obaro, and Aduba (2019) reported that African ULs possessed excellent skills in searching and using online resources like databases, websites, uploading documents, open-access software, digital libraries, various file formats, etc. However, their metadata and website development abilities were lacking. Similarly, a study by

Gani et al. (2016) also found that most Nigerian ULs were skilled in website maintenance, system application, and networking. However, they could not use Web 2.0 applications and developing systems. Thus, there was a dire need to train librarians in those areas to enable them to perform effectively and efficiently.

Okeji, Tralagba, and Obi (2020) found that a small sample of librarians rated their DLSs as excellent, while others rated them as moderate. Bansode and Viswe (2015) reported that most ULs had basic-level knowledge and competencies related to library operations. Iqbal and Khan (2017) also found that ULs of Punjab were well aware of the basic technological tools, Internet, and other applications. In contrast, no praiseworthy improvement was identified by Kenton and Blummer (2010) and Safahieh and Asemi (2010) in computer literacy levels among ULs despite having long experience and literacy training in using computers and other related technologies.

Younus and Sajjad (2020) found a basic and an intermediate level of theoretical knowledge of ICT skills among the heads of advanced libraries in Punjab. They claimed they did not possess satisfactory skills to meet the market needs. Similarly, Obuh (2019) revealed a low level of the ICT skills needed to perform the role of system managers among academic librarians in Nigeria. Ahmed and Rehman (2016) and Farooq et al. (2016) identified that Pakistani ULs were dissatisfied with their level of professional and personal competencies in managing the libraries due to insufficient technological infrastructure. They wanted to upskill themselves to meet the library users' ever-changing needs. Mirza and Mahmood (2013) endorsed the preceding statements and found that IT has a significant impact on increasing the experience and awareness regarding professional development activities and job satisfaction levels in Pakistani ULs compared to those who were not aware of IT.

The findings of Zan et al. (2021) also revealed a significant correlation between DLSs of librarians and factors like age, education, title, and work experience. Similarly, the study by Mansour (2017) also identified a significant relationship between the South Valley ULs' demographic characteristics (age and education) and their DLSs. Ahmed and Sheikh (2021) showed that the ICT skills of ULs significantly influenced enhanced library services. In the same way, Ali and Ahmed (2022) found that the information literacy skills of ULs in Pakistan could significantly predict the level of research support services provided.

Brown, Wolski, and Richardson (2015) illustrated a need for formal and informal training programs for old-fashioned academic librarians at Griffith University to play a role as data librarians in a research support environment. Similarly, Martzoukou and Elliott (2016) examined the developments in the curricula of the Master of Library and Information Science programs because both technological knowledge and DLSs are required to prepare librarians to work in the libraries of the digital age. Ullah, Ameen, and Bakhtar (2011) reported that Pakistani medical

librarians were unacquainted with the latest competencies of medical librarianship, except those who opted for this elective course. Almost all Pakistani ULs agreed to the need to remain proficient in ICTs used in libraries. Seminars and workshops were considered effective training programs for improving professional competencies (Bhatti & Nadeem, 2014).

Digital Reference Services (DRSs)

Kasowitz, Bennett, and Lankes (2000) defined DRSs as internet-based information amenities that use humans as intermediaries. Digital reference services have been found to support informal learning and integrate it with formal education (Silverstein & Webb, 2021). These services, also known as virtual reference or ask-a-librarian services, provide traditional human reference services without any constraints on time or space, utilizing information and communications technologies (Khan et al., 2017). Owusu-Ansah (2020) indicated that people comfortably use and rely on digital services in their daily routine lives. Therefore, they expect these types of online services (DRSs) from librarians as well. DRSs may occur in numerous forms. Asynchronous transactions, synchronous transactions, and collaborative DRSs are the three main types of DRSs. The COVID-19 pandemic has been a crucial catalyst for libraries to enhance their digital collections and DRSs, making them more effective and efficient (Kaba, 2021). A survey by Janes (2002) revealed that 83% of ULs were offering DRSs while others were stagnant in this regard. Furthermore, there was a 39.1% decrease in student reference questions due to the use of DRSs. On the other hand, Johnson (2004) reported that while awareness and utilization of DRSs were low in universities, the respondents predicted they would be used heavily after a decade.

Qutab, Bhatti, and Ullah (2014) found that the adoption level of ICTs was satisfactory and much improved for operations and services in public sector ULs in Pakistan. However, the situation was the opposite in the private sector. Gawli, Veer, and Khiste (2017) reported that the status of ICT applications was up to the mark in all library modules involved in providing library services except for library management support services, such as those maintaining library and user records. Singh, Krishna, and Jaiswal (2014), Sampath Kumar and Kumar (2010), and Arya and Talukdar (2010) found that in different Indian university libraries, the library staff was aware and satisfied with the utilization of Internet sources to provide DRSs. However, Husain and Nazim (2015) shared that Indian academic librarians mostly used basic ICTs, compared to advanced computer technologies, to manage their library resources and provide library services to their users. Similarly, Ilesanmi and Mabawonku (2020) found that ULs in Nigeria used very few social media applications (Facebook and WhatsApp) to deliver their services. They further explained that slow internet connection and outdated ICT tools were the main causes of low use of social media applications.

Malik and Mahmood (2013) found that even though the university libraries in Punjab had better DRSs infrastructure and electronic reference materials, work was still needed to design and implement DRSs in libraries effectively. On the other hand, Jan and Sheikh (2011) reported that the public sector university libraries in Islamabad were leading in modernization (DRSs) of libraries in all respects. However, these libraries required further efforts to satisfy patrons as adopting technology would significantly influence the usage of library sources and services. Conversely, Rehman and Mahmood (2010) and Ali and Haider (2016) disclosed that DRSs were at the developing stage in university libraries in Lahore and Karachi because the ULs lacked sufficient ICT knowledge and skills to be able to provide ICT-based services to their users. Moreover, they also observed that librarians adopted asynchronous (email/ask the librarian) reference services more than synchronous reference (live chat/ instant messaging) services.

Khan et al. (2017) reported that ICT skills, ease of use, and usefulness successfully influenced DRSs' implementation among the ULs of Pakistan. Similarly, Krubu and Osawaru (2011) observed a positive impact on UL's operations and services using Strategic Library Automation Management (SLAM) software. The study findings by Chua and Goh (2010) and Mahmood and Richardson (2013) illustrated a significant positive correlation between adopting DRSs and using Web 2.0 technologies in libraries. Therefore, librarians must have ICT skills to provide DRSs effectively. The literature review highlighted that various studies have been conducted to gauge the librarians' DLSs and DRSs separately. However, no comprehensive study has been conducted to analyze the DLSs of ULs as a predictor of DRSs. Therefore, the current study was conducted to fill the gap.

PROBLEM STATEMENT

Due to the excessive use of information technology and the attitude of information society towards IT, librarians have to be digitally literate and skilled to provide accurate and time-saving DRSs to users. Adekunle, Omoba, and Tella (2007) and Okwilagwe and Ogbomo (2012) confirmed that DLSs work as performance predictors in researchers' research activities, lecturers' use of digital resources to advance their output and lawyers' achievements in their profession. Studies in LIS have also highlighted that librarians who possess a high level of ICT skills and are used to an automated library environment are more capable of using virtual information resources more efficiently than their counterparts (Quadri, 2012). The above discussion indicates that DLSs are obligatory in dealing with technological tasks effectively. The literature review revealed that diverse studies (Ahmed & Sheikh, 2021; Becker, 2018; Christy & Yusuf, 2021; Ilesanmi & Mabawonku, 2020; Iqbal & Khan, 2017; Jan, 2018; Mansour, 2017; Rehman, Shafique, & Mahmood, 2011; Shahid, 2018; and Younus, 2014) have been conducted to explore the rank, satisfaction, evaluation,

perception, and impact of DLSs on DRs or their relationships among ULs. However, no research was conducted to gauge the DLSs of ULs as a predictor of DRs. Therefore, considering the literature review, the researchers revealed a need to design and execute a study to measure the DLSs of ULs as a predictor of their provided DRs. The study also intends to explore which aspect of DLSs of ULs was the best predictor to enhance their provided DRs. The study findings would benefit working and future librarians in managing their deficiencies in this regard.

OBJECTIVES AND HYPOTHESES

The key objective of this research was to examine the DLSs (library, computer, technology, information retrieval, and research support literacies) among the ULs as a predictor of enhanced DRs (asynchronous reference services, synchronous reference services, research support services and other digital reference services). Barth et al., 2023 presented a methodology for predicting later categories of activity based on earlier assessments. Various studies have predicted their constructs accordingly (Ahmed & Sheikh, 2021; Ali & Ahmed, 2022; Park et al., 2009; Soltani-Nejad et al., 2020). Therefore, keeping in view the said studies, two hypotheses were developed to accomplish the preceding goal:

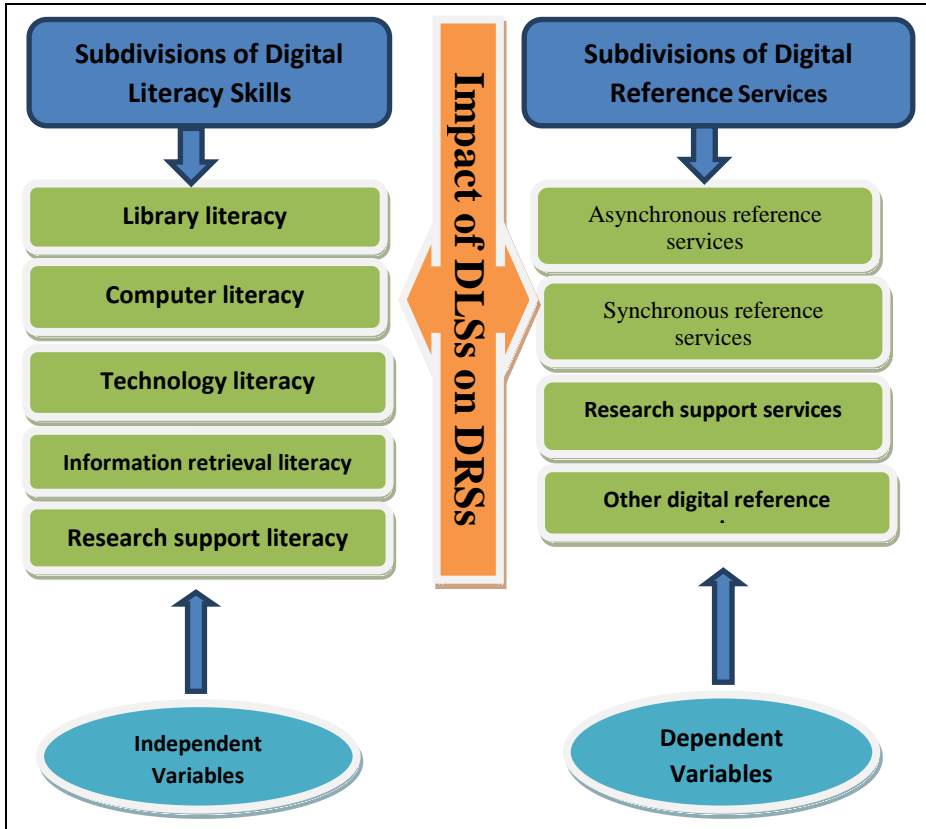
- H₁ How thoroughly do the five factors of DLSs of ULs predict their provided DRs?
- H₂ Which factor of DLSs of ULs is the best predictor of their provided DRs?

THEORETICAL FRAMEWORK

The theoretical framework of this research is based on the action theory. Digital literacy skills are the first variable in this research study. It consists of five subdivisions: library literacy, computer literacy, technology literacy, information retrieval literacy, and research support literacy (Ahmed & Rasheed, 2020; Ali & Ahmed, 2022; Bawden, 2001). The second variable in this research is DRs. It has numerous subdivisions; however, only four subdivisions were considered in this study: asynchronous reference services, synchronous reference services, research support services, and other digital reference services (Alenzuel & Kamilova, 2018; Ali & Haider, 2016; Ali et al., 2022).

Figure 1.1

Theoretical framework



METHODOLOGY

A quantitative survey helps gather a large amount of data quickly and presents a numeric or quantitative description of a population’s attitude (Creswell & Creswell, 2017). Therefore, in this study, the researchers applied a quantitative approach to study the relationship between DLSs of ULs working in Punjab, Pakistan, and their provided DRSSs. A survey method was applied to conduct this empirical study. A relevant questionnaire that could measure the above relationship was unavailable. Hence, the statements were adapted from prior relevant studies (Ali, 2022; Dollah & Singh, 2007; Khan, 2020; Younus, 2014; Zan et al., 2021), and a self-structured closed-ended questionnaire was developed to collect data from the ULs.

The questionnaire consisted of three parts: demographic information, DLSs, and DRSs of ULs. Likert scales up to five points, very low to very high, and strongly disagree to strongly agree, were used for the later parts. Five field experts checked the questionnaire and recommended various changes, which were incorporated. The final questionnaire was administered offline and online using Google Forms. Library professionals serving in government and private sector universities of Punjab (Pakistan) were the target population of this research study. Purposive sampling was applied to collect data from the targeted population. Overall, about 500 ULs were working in 96 universities. According to Krejcie and Morgan's (1970) Table, the sample size was comprised of 217 ULs. The questionnaire was sent to the whole sample (217 ULs). For data gathering, the researchers used various approaches such as personal visits to the libraries, traditional mail, emails, and social media tools to maximize the responses. 190 filled questionnaires were received, with a response rate of 87%. One questionnaire was incomplete and was rejected. The rest of the 189 questionnaires were considered suitable for data processing. SPSS 21.0 version was used for data analysis purposes.

RESULTS

The instrument's reliability was checked using the Cronbach's alpha (CA) test. The CA value for library literacy (n = 14) was $\alpha = .86$, computer literacy (n = 8) $\alpha = .86$, technology literacy (n = 5) $\alpha = .81$, information retrieval literacy (n = 9) $\alpha = .92$, research support literacy (n = 8) $\alpha = .87$, and DRSs (n = 4) $\alpha = .96$ (Table 1). The coefficients of reliability of DLSs were between .81 and .92, which was excellent.

Table1

Cronbach's alpha (CA) statements (n=189)

Variables	Factors	No. of items	Cronbach's alpha value
Digital Literacy Skills	Library Literacy	14	.86
	Computer Literacy	8	.86
	Technology Literacy	5	.81
	Information Retrieval Literacy	9	.92
	Research Support Literacy	8	.87
Digital Reference Services	DRSs	4	.96

Measure

Regression analysis was applied after checking all the assumptions from the independent variables (library literacy, computer literacy, technology literacy, information retrieval literacy, and research support literacy) to predict the dependent



variable (DRSs). Furthermore, a comparison was conducted among the IVs (DLSs) to examine the level of their contribution toward DRSs (Table 2).

Multicollinearity

The above 0.3 relationships were found between all the IVs and the DV (Table 2). According to Tabachnick et al. (2007), a relationship value above 0.90 may create singularity or multicollinearity in bivariate or multivariate. The relationships between all the IVs and DV were less than 0.71, so all subdivisions were taken for analysis. The independent variable's tolerance value was found to be between 0.42 and 0.58, which was above 10. Therefore, the multicollinearity assumption was not violated. This was also reinforced by the values of VIF (variance inflation factor) from 1.69 to 2.36, which were less than the cut-off value of 10 (Tabachnick et al., 2007) (Table 5).

Normality, outliers, linearity, homoscedasticity, and independence of residuals

All points were placed in a rationally straight line, suggesting that there was no significant deviation from the normality shown in the normal scatter plot. Most residual scores were distributed rectangularly, concentrating in the center of the standardized residuals of the scatter plot. Moreover, by inspecting the Mahalanobis distance, the outliers were also checked. In this analysis, five IVs were used. According to Tabachnick et al. (2007), the critical value for the five IVs was 20.52. Two cases had the above value compared to the critical value of Mahalanobis distance, which is given in the table of residual statistics. Pallant (2020) states, "if only two cases have a higher Mahalanobis distance value, it does not matter, and it may be ignored". Likewise, in the case-wise diagnostics table, only two cases had the anticipated residual value of below -3.0 or above 3.0 , which were -3.72 and -3.22 . In the case-wise diagnostics table, the recorded score (40,109) of the respondents did not expect well, which is in contradiction to the 'digital library services' predicted value (100, 161). Only 1% of circumstances would be anticipated to drop outside the range of -3.0 to 3.0 in normally distributed cases. Further, the concentrated value for Cook's distance was .265 in the residual statistics table, suggesting no significant problems.

The descriptive statistics showed a high level of 'library literacy' using the online public access catalog (OPAC). The results indicated that 'computer literacy' showed the respondents' very high literacy level in dealing with Microsoft applications like Word, Excel, PowerPoint, etc. ULs were also literate enough about various technological tools. Respondents showed a high literacy level when operating printers, scanners, barcode readers, and photocopy machines. Moreover, ULs were literate in retrieving information from search engines, HEC national digital library, and other online full-text databases to help the researchers and other users. The results have also demonstrated that ULs had high DLSs regarding anti-plagiarism software, using online survey tools, and maintaining institutional research repositories, and they

are able to provide research support to researchers. However, their capability to use quantitative and qualitative software was low.

Table 2

Relationship between subdivisions of DLSs and DRSs (n = 189)

Variables	1	2	3	4	5	6	P
1 DRSs	1						
2 Library Literacy	.50	1					0.000
3 Computer Literacy	.39	.46	1				0.000
4 Technology Literacy	.35	.50	.67	1			0.000
5 Information Retrieval Literacy	.70	.52	.55	.54	1		0.000
6 Research Support Literacy	.71	.57	.51	.48	.71	1	0.000

Note. Correlation is significant at the 0.01 level (two-tailed).

The results of this research have shown a statistically significant difference between DLSs (IVs) and DRSs (DV) (Table 2). After checking all the assumptions, a multiple regression analysis was applied to predict DRSs (DV) from subdivisions of DLSs (IVs). As shown in Table 3, the value of R of DRSs was 0.773, indicating a high level (77.3%) prediction. The R² (coefficient of determination) of .598 shows that IVs (DLSs) can explain 59.8% of the variability in the DV (DRSs). The analysis of variance confirmed that the IVs (DLSs) statistically significantly predicted the DV (DRSs): F (5, 173) = 51.415, p < 0.000, R = .773 (Table 4).

The researchers took the standardized coefficient values because they were interested in comparing the contribution of each factor of the IVs at an identical scale. As shown in (Table 5) ‘information retrieval literacy’ showed the largest beta coefficient value β = 0.42, indicating the best contribution to predict DRSs. The beta value of ‘research support literacy’ (β = 0.41) was slightly lower, which means that its contribution was also decent. The β value of ‘library literacy’ as β = 0.11 indicated a low contribution. Conversely, the contribution of ‘technology literacy’ (β = -.125) and ‘computer literacy’ (β = -.026) was much lower. The results show that the two variables, ‘information retrieval literacy’ (1.53) and ‘research support literacy’ (1.44) made a statistically significant unique contribution toward predicting DRSs. However, other variables did not significantly contribute to predicting DRSs.

Table 3

Evaluation of the model

R	R ²	Adjusted R ²	Standard error of the estimate
.773	.598	.586	16.2

Table 4
Statistical significance prediction

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	67474.04	5	13494.81	51.41	.000
Residual	45406.6	173	262.46		
Total	112880.7	178			

Table 5
Summary of Regression Results

Model	Un-standardized Coefficients		Standardized Coefficients	t	P	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero order	Partial	Part	Tolerance	VIF
¹ (Constant)	42.25	7.90		5.34	.000					
LL	.26	.14	.117	1.87	.063	.50	.14	.09	.589	1.69
CL	-.12	.31	-.026	-.37	.707	.39	-.03	-.01	.488	2.05
TL	-.81	.44	-.125	-1.8	.072	.35	-.13	-.08	.485	2.06
IRL	1.53	.26	.426	5.7	.000	.70	.40	.27	.424	2.36
RSL	1.44	.25	.414	5.6	.000	.71	.39	.27	.430	2.32

Note. LL (library literacy), CL (computer literacy), TL (technology literacy), IRL (information retrieval literacy), and RSL (research support literacy).

DISCUSSION

The regression analysis compared the DLSs (IVs) of ULs with their provided DRs (DV). The findings have shown that DLSs explain 59.8% of the variance in DRs, which proves the first hypothesis true. It also explains that the explanatory power of DLSs with DRs is at a slightly higher level, which indicates that librarians offering DRs must have a higher level of DLSs. The study findings are similar to the results of Ahmed and Sheikh (2021), Bansode and Viswe (2017), and Ayoku and Okafor (2015), who have confirmed that ICT skills assist in providing computerized circulation facilities and Internet-based DRs to library users. These outcomes are somewhat consistent with the findings of Ali and Ahmed (2022), who have reported that the

information literacy skills of ULs are a strong predictor of research support services. DLSs empower library professionals, which assists them in proposing improved library amenities to library users. In light of the obtained results, factors of DLSs significantly facilitate the enrichment of DRSs in numerous ways.

Researchers also compared the contribution of the various IV (DLSs) factors to predict the DV (DRSs). The largest beta value of 'information retrieval literacy' indicates that it is the best predictor of DRSs compared to other factors of DLSs, which also proves the second hypothesis. The beta value of 'research support literacy' is slightly lower than that of 'information retrieval literacy,' which shows that it is also a close contributor to predicting DRSs. This means the above two factors make a statistically significant and unique contribution to predicting DRSs. However, the other three factors (library literacy, computer literacy, and technology literacy) of DLSs did not significantly contribute to predicting DRSs. It appears to be an area of weakness for ULs, which may be because they are not skilled in using computers or modern technologies. So, they have to learn these skills to progress in the profession.

The data analysis of 'library literacy' shows that the ULs' level of use of the 'online public access catalog' (OPAC) is high. The reason may be that the concept of the OPAC became known to almost every professional librarian due to the provision of library automation operations. These results were confirmed by Kumar (2014), who also found a highly satisfied response from those with sufficient knowledge of OPAC. The high mean score regarding library orientation programs by the ULs shows that the concept of library awareness programs is becoming popular in academia. Findings reveal a moderate level of literacy in some digital library software and integrated management software (Virtua). This may be due to the high price and the lack of practice with this software, as most university libraries use free and open-source library automation software compared to the purchased ones. The results mentioned above are consistent with the findings of Ahmed and Sheikh (2021); they have also reported that the ability of LIS professionals was at a high level to use customized or online library-integrated software, except Virtua.

The findings of the second factor of DLSs, 'computer literacy,' show a very high literacy level of the respondents when dealing with Microsoft applications like Word, Excel, PowerPoint, etc. This may be due to the ULs' frequent usage of these applications to do documentation work in soft formats. The findings of this research concerning application software somewhat match the study findings of Ahmed and Sheikh (2021) and Ayoku and Okafor (2015) who also found satisfactory skills in librarians to use Word, Excel, and PowerPoint. However, a low literacy rate is found in using Adobe Photoshop. Therefore, ULs have to improve this skill. University librarians are literate enough about the technological tools used in libraries. The study results illustrate a high level of literacy in ULs related to operating printers, scanners, barcode

readers, and photocopy machines. The reason for this may be that ULs use these machines daily. Conversely, their level of literacy is moderate regarding the use of server machines. The cause may be that servers are managed mainly by IT staff. Findings suggest that ULs have to improve their literacy regarding server machines. The above findings are contradictory to the results of Khan (2020) who found that UL's technology literacy was at a lower level.

Authentic information retrieval is a very serious issue in this information age. Every reader faces hurdles while trying to search for information according to their needs. Data analysis reveals that ULs are more literate about information retrieval from search engines, the HEC national digital library, and online full-text databases to provide DRSs to users. The study results are consistent with the outcomes of Ahmed and Sheikh (2021), who revealed that ULs had excellent literacy skills in consuming information recovery methods, specifically obtaining information using search engines (Google and Alta Vista). Similarly, Bronstein and Tzivian (2013) observed a high level of self-efficacy in librarians related to information retrieval skills. The study findings of Warraich and Ameen (2010) also found that participants were strongly satisfied with the availability of the HEC national digital library.

Results of 'research support literacy' reveal that ULs have a high level of literacy in using anti-plagiarism software, online survey tools, and maintaining IRRs. Conversely, they have a moderate level of literacy in using the quantitative and qualitative data analysis software. The findings of the study are in line with the outcomes of Ali, Ahmed, and Latif (2022); and Hanif, Ahmed, and Sabzwari (2018). They highlighted that ULs agreed they had good skills in using online survey tools, plagiarism software, and maintaining IRRs. However, the findings regarding quantitative software were contradictory. They also revealed that ULs were less confident in using qualitative software. Therefore, digital reference librarians have to be literate in terms of research skills to help researchers in their research work. Khan and Ahmed (2016) also suggest that ULs should seek and provide information to promote the research culture and make a scientific and knowledge-based society.

CONCLUSION AND RECOMMENDATIONS

The study aimed to examine the DLSs as the predictor of DRSs. The present research results have exposed that the five factors of DLSs of ULs are good predictors of the DRSs they provided, supporting the first hypothesis. The DLSs create 59.8% variability in DRSs. The findings also proved the second hypothesis: 'information retrieval literacy' is the best predictor of DRSs. However, the study is based on the self-efficacy of ULs, so that may be a limitation to prevent these results from being applied to the whole population. The findings of this study recommend that fresh and in-service ULs have to improve their DLSs to deal with computers and other modern technological devices to offer better DRSs. Otherwise, the libraries may face a digital

gap between librarians and users in the near future. This study also recommends that the administration develop Continuous Performance Development programs to develop the DLSs of ULs. The current study would help augment the literature on workplace DLSs, as an insufficient amount of literature is available on this topic in Pakistan.

The practical implications of this research extend to university libraries, library associations, librarians, and library professionals, emphasizing the necessity of enhancing DLSs to cope with modern technological advancements effectively. The study has highlighted the need for further research to explore the relationship between DLSs and other factors like research support services, user satisfaction, acquisition, and information management, suggesting a broader scope for future investigations in this area. Additionally, the study has pointed out the scarcity of literature on workplace DLSs in Pakistan, indicating a potential direction for future research to enrich the existing knowledge base.

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