Information Retrieval Behavior of Research Students: A Case of Higher Education Commission (HEC) Digital Library of Pakistan

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Abstract

Purpose: This study aimed to explore the perceptions of Pakistani research students regarding the Higher Education Commission (HEC) digital library's usage, problems, issues, and effectiveness of its federated search tool (Summon).
Method: A quantitative approach using the survey method was used. Data were collected from research students enrolled in HEC affiliated public and private universities of Pakistan.
Findings: The study results revealed that the research students used the HEC DL and other online databases frequently. However, the Summon search tool was seldom used. The major challenges faced by the respondents included a lack of knowledge about access, lack of assistance from the library staff and on-screen help, inability to formulate queries, and a lack of awareness about applying operators while searching in Summon. The participants of the study considered Summon to be an effective discovery tool for the HEC DL in terms of retrieving the relevant sources, providing speedy information, offering accuracy in searching, and its other features.
Implications: The findings of the study would help enhance the usage of the DL as well as improve the information retrieving skills of the research students by encouraging the development of information literacy programs.
Keywords: Information retrieval system, information search process, HEC digital library

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Introduction

Industrialized societies have been slowly becoming information societies due to the ongoing information revolution and the emergence of the knowledge economy. The developing countries view knowledge as a vital social and economic resource that can allow them to excel in the current knowledge economy (Lwoga & Sangeda, 2019). Pakistan and other developing countries are also growing more technologically savvy and improving their information systems and infrastructure to compete among the various emerging knowledge societies (Ashiq & Warraich, 2012; Saleem et al., 2021). The concept of digital libraries (DL) emerged because of the technological advancements and innovations that occurred in information management in the 1990s. Digital library resources now play a critical role in the knowledge landscape of higher education (Bhatti, Chohan & Asghar, 2014).

Higher Education Commission (HEC) Pakistan's Digital Library

Pakistan's Higher Education Commission (HEC), formerly known as the University Grant Commission (UGC), was founded in 2002 by Presidential Ordinance in Pakistan (Warraich & Ameen, 2010). HEC has eventually evolved to be the primary regulator of higher education in Pakistan and strives to enable institutions of higher learning to serve as engines of Pakistan's socio-economic growth. Among its various initiatives is the National Digital Library (NDL) established by HEC in 2004. The HEC National Digital Library (DL) is a program designed to make accessible, high-quality peer-reviewed journals, databases, articles, and e-books across a broad range of disciplines to researchers at public and private universities in Pakistan as well as non-profit and research organizations (Bhatti, Chohan & Asghar, 2014). HEC DL includes around 75,000 pieces of electronic content that have been made available online to meet the information needs of Pakistani researchers. It has enabled its users to search or browse for information based on their specific information requirements. Users can search or explore the digital library by selecting a single database or by using a federated search option. Currently, the HEC (NDL) is accessible to 503 public and private sector entities.

HEC Summon Discovery Tool

Summon is a federated search engine and offers one window to access all resources from all HEC subscribed digital databases. It retrieves results from all databases against the keywords given by the researcher. Further refinement of the search results is possible using various filters offered such as full-text, journal articles, books, conference proceedings, date, discipline, subject terms, and language.

LIS specialists in Pakistan have undertaken several studies on the use and usefulness of HEC digital library resources in both teaching and research (Ameen & Rafiq, 2009; Arif & Kanwal, 2009; Warraich & Kanwal, 2010). These studies have been conducted on faculty, LIS professionals, and graduate students. Previous research has indicated that Pakistani university students use HEC digital library services to obtain their desired scholarly information and research materials. However, there has been limited research that has simultaneously investigated the importance, usage, and problems related to the HEC digital library and its Summon discovery tool. The current study seeks to fill this gap by assessing the role of these resources and their effectiveness in fostering research innovation as well as the usage of this national resource and any problems encountered by the users. The findings of this study would help graduate students involved in research to use HEC (NDL) in a way that is beneficial for them. The NDL aims to provide quality online library services. In light of this goal, this study undertook to review the perception of research students at Pakistani universities reading its services.

Research Questions

1. What are the approaches employed by the PG students to access the HEC DL and online databases?
2. What are the search strategies and tools adopted by the PG students for finding their queries?
3. What are the problems being faced by the PG students regarding the HEC DL interface and search engines?
4. Is the subscribed search engine Summon effective for resource discovery?
5. Is there any difference of opinions among Pakistani research students regarding the HEC DL problems, challenges for using the Summon discovery tool, and effectiveness of Summon in terms of gender, educational level, type of university and disciplines?

Explaining the Objectives of the Study

Objective 1: Approaches to Access HEC DL and Online Databases

Understanding how postgraduate (PG) students use the Higher Education Commission Digital Library (HEC DL) and other online resources is essential since PG students are vital to the academic community. This goal is to present the various strategies that PG students use to navigate the digital environment. Through an analysis of the different approaches people take, whether it through direct access to databases, institutional portals, or other channels, the research attempts to shed light on the complexities of their information-seeking practices.

Objective 2: Search Strategies and Tools of PG Students

This objective examines the complex network of search techniques and resources that PG students employ. It explores the strategies PG students use to formulate questions and conduct information searches. The goal is to identify the details of their information retrieval strategies and tools, from the usage of external search engines to database-specific search, adding to a more thorough understanding of their scholarly practices.

Objective 3: Problems Faced with HEC DL Interface and Search Engines

The objective is to identify and assess the obstacles that PG students have when navigating the digital realm. The study tries to identify areas where improvements can be made by concentrating on the issues PG students have with the HEC DL interface and other search engines. Enhancing the usability and user experience of these digital platforms can be made possible with the help of this exploration.

Objective 4: Evaluation of Summon Search Engine

To achieve this goal, the efficacy of the Summon subscribed search engine is crucial. The purpose of the study is to evaluate how much Summon helps PG students find resources. Through an assessment of its usability, search result relevancy, and overall effect on information retrieval, the goal offers important insights into how useful Summon is for PG students' academic endeavours.

Objective 5: Differences in Opinions Across Demographics

This objective identifies the differences in opinions among Pakistani research students. The study is to investigate potential differences depending on demographic factors such as gender, educational level, university type, and academic disciplines. By examining these differences, the objective adds subtle insights to the study, resulting in a more comprehensive picture of PG students' subjective experiences and viewpoints in the digital information ecosystem.

Literature Review

Information Retrieval

Literature provides various definitions of Information Retrieval, it has been comprehensively defined as ‘information retrieval encompasses the return of results from a database of stored information and is measured by precision (relevancy) and recall (completeness) of returned results’ (Gorman, 2006). Information

retrieval is the process of finding the relevant information resources from a collection of information resources. The retrieval process is initiated whenever a user enters a query into the system. It is dependent on the user's understanding of the topic, prior knowledge, and skill. According to Dilhani (2020), users' information search and retrieval skills require strengthening. According to Akinboro and Olayinka (2023) that students' information retrieval is the process by which they search, obtain, and use relevant information to help them with their academic objectives. In an educational setting, students frequently participate in information retrieval whether performing research, completing projects, or pursuing self-directed learning. This includes creating successful search queries, using different search tactics, and traversing digital platforms, databases, and libraries to find relevant materials. Similarly, Seifouri and Namvar (2022) stated that information retrieval habits are influenced by elements such as the nature of their academic tasks, the specificity of their information requirements, and the resources at their disposal. With the growing use of digital resources, students frequently rely on online databases, academic libraries, and search engines to access a wide range of intellectual literature. Besides, teachers and educational institutions that want to improve students' digital literacy must have a thorough understanding of how students retrieve information. It entails resolving difficulties that students can have, like sifting through intricate databases, assessing the validity of internet sources, and refining search techniques (Akinboro & Olayinka, 2023; Seifouri & Namvar, 2022).

It is necessary to provide students with better training in the use of electronic resources for academic advancement. Developing user education programs and training for cultivating information retrieval abilities, research methodologies and skills in students should be integrated into the university curriculum. All these skills would prove to be extremely beneficial to the students for their studies and research activities.

Information retrieval background and search behavior

Hjørland (2021) informed that the study of information retrieval has a long history that explores how people look for and use information. Information science is its foundation, and it looks at how techniques and tools have changed over time to extract pertinent information from large databases. To comprehend the background of information retrieval, one must examine the past evolution of databases, digital libraries, and search engines, emphasizing turning points that have influenced the state of affairs now.

Although there was discussion of end-user searching in the 1970s, many saw the information retrieval market to be exclusively made up of professional librarians (Bourne & Hahn, 2003). In the 1980s, the researchers shifted to a user-centered approach from a system centered approach. More studies were organized to explore the behavior and interaction of users with information and to determine the individuality and variety of users and their behaviours (Dervin & Nilan, 1986). Chowdhury (1999) in his review of information retrieval (IR) research identified ten major areas of study: 1) analysis of retrieval, 2) search output, 3) search engines, 4) organization of information, 5) bibliographic control or metadata of the Internet, 6) intelligent agents in IR, 7) information reliability, 8) user search behavior, 9) interface design, and 10) comparisons between traditional databases and the Internet. The literature in each of these areas is extensive; therefore, this study will only focus on the final three. Similarly, Kuhlthau offered a "six-stage information search process (ISP) model" that incorporates cognition, emotion, and behavior. The process ends with stage six, search closure, where the student completes his/her search, either with a sense of accomplishment or disappointment (Kuhlthau, 2004). Information retrieval has become a scientific discipline that describes the analysis, design and implementation of computerized systems that address the representation, organization, and access to a large quantity of heterogeneous information encoded in digital format (Cerulo & Canfora, 2004). It is critical for users to become familiar with the "search tools" and "search tactics" before beginning to search for information. This would allow them to avoid "spending many pointless hours flailing around, and eventually drowning in a sea of meaningless knowledge" if they follow these instructions (Tyner, 2001). In this context, search behavior is important because it illustrates the methodical processes people use to look for information. It entails creating queries, selecting search phrases, and applying a variety of search techniques. Search activity can be observed and analyzed to learn about user preferences, difficulties encountered when retrieving information, and the efficacy of various search tools (Dobreski et al., 2022; Hjørland, 2021).

Challenges and Problems Associated with Information Retrieval

The most frequently encountered concerns included inadequate staff training, lack of online searching skills, lack of access to historical materials, slow internet connectivity, power failure/fluctuation, and usability issues (Saleem et al., 2021; Warraich & Ameen, 2010). Khan and Ahmad (2013) stated that limited or no access to these resources outside of the university premises, slow internet speeds, and a lack of knowledge regarding

the effective use of advanced search techniques to reach the desired and highly relevant sources. Ossai (2011) informed that majority of students struggled to locate and identify appropriate library information sources for case law, legislation, and journal articles. Similarly, Ratanya (2017) reported that lacked operational electronic information resources and offered offline access were key issues. This indicated that the students had limited access and lacked optimal access to the scholarly information resources. Gathoni (2021) recommends ongoing information literacy training that incorporated fundamental computer skills, search tactics, and information sources. The reviewed literature informed that the library users and particularly the research students were still in the process of developing their information retrieval skills, which are arguably essential for their information literacy activities required for scholarly information management. Students' ability to find material electronically is a determinant factor of academic success. This literature further identified that students now begin their research process on the Internet using search tactics more suited to a casual browser rather than the diligent inquirer.

Research Method

A quantitative approach based on the survey method was used in this study. Data were collected via a structured questionnaire from Pakistani research students enrolled in HEC affiliated public and private universities in Lahore and Islamabad. The questionnaire was created considering the body of existing literature as well as the specific local context of the research, with a focus on Pakistan's Higher Education Commission (HEC) digital library. To guarantee the content validity, expert feedback from academic and professional professionals in the LIS field were also obtained. The recommendations were then integrated into the questionnaire. The questionnaire is attached as Annexure-I. The data was collected from conveniently selected 384 participants during their library visits to the respective universities. The convenience sampling was used due to non-availability of a complete list of students visiting in those libraries. Out of the 384 distributed questionnaires, 237 were received back from heterogeneous respondents. Data analysis was performed using SPSS.

Results

Characteristics of Respondents

Table 1 summarizes the basic characteristics of the participants. A total of 237 (61.72%) research students responded to the questionnaires. Out of the total (237) responses, 149 (62.9%) respondents were male and 88(37.1%) were female. Of these

participants, 175 (73.84%) were studying in M.Phil./MS programs and 62 (26.16%) were enrolled in PhD programs. As regards the type of university, 116 (48.95%) were from the public sector and 121 (51.05%) were from the private sector. The population comprised of currently enrolled research students in various disciplines at the selected universities including 80 (33.8%) from social sciences, 57 (24.1%) from sciences, 34 (14.3%) from engineering and technology, 32 (13.5%) from arts and humanities, 11 (4.6%) from health and life sciences, and 23 (9.7%) from other disciplines.

Table 1: Characteristics of respondents (n=237)

Gender	**Frequency**	**Percentage**
Male	149	62.9
Female	88	37.1
Educational Level		
M.Phil./MS	175	73.84
Ph.D.	62	26.16
Sector of Institution		
Public	116	48.95
Private	121	51.05
Disciplines		
Social Sciences	80	33.8
Sciences	57	24.1
Engineering & Technology	34	14.3
Arts & Humanities	32	13.5
Health and Life Sciences	11	4.6
Others	23	9.7

Frequency of visiting HEC Digital Library

In response to "how often do you visit the HEC DL and online databases?" Most of the participants were found using the

HEC DL and online databases on a daily basis followed by weekly visits. However, some students were found to have never used the

Table 2: Frequency of visiting HEC Digital Library

Scale	Frequency	Percentage (%)	Mean
Daily	83	35.0	2.30
Weekly	65	27.4	
Monthly	42	17.7	
Quarterly	28	11.8	
Never	19	8.0	

Frequency of using Summon.

The findings revealed that most of the respondents sometimes (36.7%) or seldom (30%) used the *Summon* (search engine) for the HEC DL. There were a limited number of research students who always (12.2%) used this search engine or frequently (8%) used it as presented in Table 3.

Table 3: Frequency of using Summon.

Scale	Frequency	Percentage (%)	Mean
Sometimes	87	36.7	2.72
Seldom	71	30.0	
Never	31	13.1	
Frequently	29	12.2	
Always	19	8.0	

Approaches Employed to Access HEC DL

Table 4 showed that most of the participants commonly used the general "internet search engines" (mean=3.65) to access HEC DL and online databases followed by "database supplier and publishers' websites (mean=3.22)"; "used library websites (mean=3.22)"; and "direct access using URL of HEC DL (mean=3.04)". Whereas most of the participants were found uncertain about using the "Summon

(search engine provided by HEC Digital Library)" (mean=2.70) tool for approaching the resources. Furthermore, the respondents used to create queries of "subject/topic (mean=3.59)" followed by "title (mean=3.44)" based queries to search the HEC digital library and online databases.

Table 4: Approaches employed to access HEC DL

Approaches to access HEC DL and Online Databases	**Mean**	**SD***
Using Internet search engines (e.g. Google, Yahoo, MSN, etc.)	3.65	1.030
Database supplier and publishers' websites (e.g. Ebscohost, Sciencedirect, Springer, ProQuest etc.)	3.22	1.150
Using library websites	3.22	1.089
Direct access using URL of HEC DL http://www.digitallibrary.edu.pk/	3.04	.993
Tools to access HEC Digital Library: SUMMON	2.70	1.201
Search Field P/G students used to find information		
Subject/topic	3.59	.997
Title	3.44	1.107
Keyword	3.42	.996
Browsing	3.35	1.024
Author	3.30	1.017

Scale: 1=Never, 2=Seldom, 3=Sometime, 4=Frequently, 5=Always and SD= standard deviation*

Search Strategies Adopted for Finding Information

Table 5 summarize that the participants used to adopt frequent search strategies including "Limitation search" (mean=3.89) followed by "Basic/ simple search" (mean=3.48); "Proximity search" (mean=3.07); and "Boolean Operators" (mean=3.04). However, the respondents were unfamiliar with "Field searching" (mean=2.53).

Table 5: Search strategies adopted for finding information.

Online searching techniques used to find information	**Mean**	**SD***
Limitation search	3.89	1.194
Basic/ simple search	3.48	1.146
Proximity search	3.07	1.127
Using Boolean Operators (AND, OR, NOT)	3.04	1.053
Field searching	2.53	.884

Scale: 1=Never, 2=Seldom, 3=Sometime, 4=frequent, 5=Always and SD= standard deviation*

Problems Faced While Using the HEC DL

Table 6 highlighted the major problems they faced during online searches. Most of the respondents faced major problems including the "Lack of knowledge to access Summon" (mean=1.79); "Lack of assistance from library staff" (mean=2.56); "Lack of on-screen help" (mean=2.76) and "Difficult to make searching terms or keywords for my information needs" (mean=2.79).

Table 6: Problems faced while using HEC DL

Sr. No.	**Problems**	**Mean**	**SD***
1	Lack of knowledge to access SUMMON	1.79	0.859
2	Lack of assistance from library staff	2.56	0.935
3	Lack of on-screen help	2.76	0.879
4	Difficult to make searching terms or keywords for my information needs	2.79	0.921
5	Provides irrelevant search results	2.82	0.869
6	Slow response time and network	2.85	0.966
7	Difficulty in accessing the full text sources	2.88	0.923
8	Limited number of desktop computers in library	2.9	0.843
9	Irrelevant widgets and images	2.9	0.922

10	Unstable electricity	2.92	0.897
11	Server is down	3.19	1.186
12	Difficult and confusing to use	3.51	0.987

Scale: 1=Very Big problem, 2=Big problem, 3=Little problem, 4=Not at all and SD= standard deviation*

Challenges Faced by Researchers in Using the Summon

Table 7 indicated that they were: "unable to formulate a query in Summon" (mean=3.56); "unfamiliar to use operators while searching in Summon" (mean=3.48) or sometimes the "library staff did not help in using Summon" (mean=3.51)

Table 7: Challenges for using SUMMON.

Sr. No.	Challenges	Mean	SD*
1	I am unable to formulate query in it.	3.56	1.027
2	Library staff does not help in using SUMMON.	3.51	1.068
3	I am not familiar to use operators while searching online information in SUMMON.	3.48	1.040
4	I am unable to change the words in query while searching.	3.37	1.075
5	I usually found irrelevant Hits against my query.	3.35	1.062
6	I am aware of information retrieval systems.	3.31	1.161
7	This search engine's response is slow.	3.28	1.025
8	I face problems in navigating SUMMON.	3.20	1.190

Scale: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree and SD= standard deviation*

Effectiveness of Summon for HEC DL

Table 8 summarizes that the participants considered Summon as an effective discovery tool for the HEC digital library in terms of "retrieving relevant search results (mean=3.54); providing completeness of searching, (mean=3.54); provision of speedy

information (mean=3.53); providing citation and export features (mean=3.52) and offering accuracy of searching (mean=3.52)".

Table 8: Effectiveness of Summon for resource discovery.

Sr. No.	Items	Mean	SD
1	I retrieve the relevant search result	3.54	.951
2	It provides Completeness of Searching	3.54	1.037
3	It provides speedy information	3.53	.974
4	It provides citation and its export features	3.52	1.019
5	It provides Accuracy of Searching	3.52	1.056
6	It provides all required search filters	3.49	.994
7	It has user friendly interface	3.49	.972
8	It provides good content coverage	3.47	.958
9	The searching techniques (e.g. Simple or advanced search) are easy to apply.	3.45	.979
10	It provides recommendations/related materials feature	2.71	.843

Scale: 1= Strongly disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly agree and SD= standard deviation*

Ranking the Service of Summon as a Discovery Tool

Most of the respondents (n=121) ranked this service as "good" on the scale. However, a few of the respondents ranked it as being very bad, due to their unfamiliarity with this service (Figure 1).

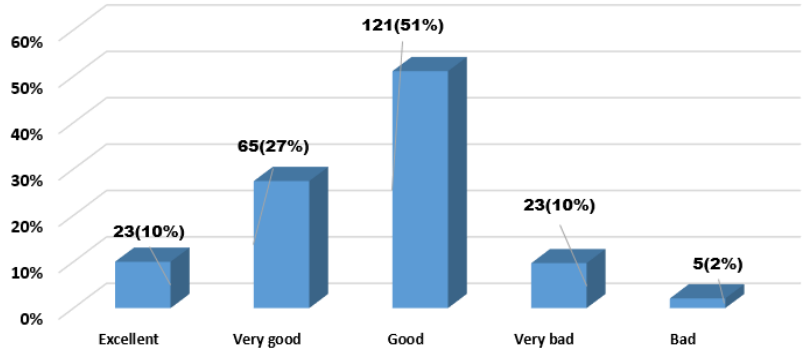

Figure 1: Ranking of services on Summon discovery tool.

A t-test was applied to check for respondent's differences of opinions based on their gender (male, female), educational level (MPhil/MS, PhD), and type of university (public, private) regarding three variables i.e., HEC DL problems, challenges for using the Summon discovery tool, and the effectiveness of Summon for information retrieval by Pakistani research students. The t-test result showed no difference in opinion based on gender, educational level and type of university (Table 9).

Table 9: Results of t-test

Variable	**Test**	**Problems**		**Challenges**		**Effectiveness**	
		Test result	***p***	**Test result**	***p***	**Test result**	***p***
Gender	*t*-test	t=1.61 male:2.93 female:2.78	.10	t=-.95 male:3.40 female:3.30	.33	t=.85 male:3.50 female:3.41	.39
Educational level	*t*-test	t=-.02 MPhil:2.88 PhD:2.89	.97	t=.63 MPhil:3.39 PhD:3.32	.52	t=-.15 MPhil:3.47 PhD:3.49	.88
Type of university	*t*-test	t=1.04 public:2.93 private:2.84	.30	t=-.24 public:3.37 private:3.40	.80	t=1.04 public:2.93 private:2.94	.30

Furthermore, one-way ANOVA was performed on the basis of disciplines (Social sciences, sciences, engineering and technology, arts and humanity, and health and life sciences) to see the respondent's difference of opinion on three variables as mentioned in Table 10. The result showed no significant difference of opinion on these three variables (Table 10).

Table 10: Result of one-way ANOVA

Variable	**Test**	**Problems**		**Challenges**		**Effectiveness**	
		Test result	***p***	**Test result**	***p***	**Test result**	***p***
Disciplines	One-way ANOVA	F=.44	.81	F=1.75	.12	F=1.40	.22

Discussion

This study found that the research students at Pakistani universities were using the HEC DL and online databases for accessing quality resources. The research students used different strategies to find the required and relevant information sources through limitation search, basic/ simple search, proximity search, and Boolean operators. However, some students did not use the HEC DL and online databases due to a lack of knowledge regarding how to access the library resources and the Summon discovery tool, lack of assistance from the library staff, lack of on-screen help and difficulty in making search terms or keywords relevant to their information needs. The findings of this study corroborate previous research conducted in Pakistan by Ansari and Zuberi (2010), who discovered that some departments did not use e-resources due to a variety of factors including a lack of awareness about e-resources, lack of adequate computer facilities, and a preference for the printed material. Rafiq and Ameen (2012) described how textbook-based education, a lack of digital access to indigenous research, and a lack of orientation hindered Pakistani students from using digital media. Similarly, Mubeen, Soroya, and Mahmood (2021) recognized that the major reasons behind the non-usage of the DL were the preference for printed material, slow downloading speeds, non-availability of archival publications, absence of remote access, and a lack of awareness about the HEC DL.

A library's discovery tool is an important tool for information discovery and is considered to be very helpful in accessing and obtaining full-text versions of required materials (Bhatti, Chohan, & Asghar, 2014). As regards the HEC DL Summon discovery tool, the results revealed that the participants were aware of this tool for searching and browsing the subscribed information resources. Furthermore, the majority of the respondents ranked this service as "good". The participants considered the Summon search to be an effective discovery tool in terms of retrieving relevant search results, providing completeness in searching, providing speedy information, providing citation and export features, and offering accuracy in searching. However, some respondents were unable to use it because they did not know how to use the service well. There were a limited number of research students who used this search engine frequently and always. Participants indicated that some of the major challenges while using this search tool were the inability to formulate queries in the Summon search, lack of help from the library staff, and unfamiliarity with using the Boolean operators. These findings are similar to those of earlier studies. The respondents also indicated other challenges to be a lack of knowledge about email alerts and simple syndication (RSS) services, limited access, lack of training,

inadequate computers or computer labs, and a lack of enough librarians to help them in the use of the HEC digital library resources. Arif and Kanwal (2009) identified a lack of an IL program, IT training, and IT-trained LIS workers as the primary impediments to maximizing the use of the HEC's digital library resources. The findings of this study have corroborated those of Warraich and Kanwal (2010), who concluded that insufficient training on the HEC digital library resources and a lack of patron skills in using keyword options and sorting (relevancy/date) of information were the primary barriers to patron use of these resources and services. Without a doubt, these issues can be resolved with adequate training and understanding. For this purpose, LIS professionals have advocated for the expansion of structured orientation sessions.

The inferential statistics results (t-test and one way ANOVA) showed no difference in opinion based on gender, educational level, type of university, and disciplines in terms of problems with the HEC DL, challenges in using the Summon discovery tool, and the effectiveness of the Summon tool for information retrieval by the Pakistani research students. These findings are different from earlier studies conducted by Ahmad et al., (2021) and Mubeen, Soroya, and Mahmood (2021), which have reported a statistically significant difference in the use of the HEC NDL by the research students based on their gender and program of study. The female research students had a higher mean score on the HEC than the male research students (Ahmad et al., 2021; Mubeen, Soroya, & Mahmood, 2021) and the PhD students had a higher mean score than the M.Phil students (Mubeen, Soroya, & Mahmood, 2021) in these studies. This difference might be because the participants in the Mubeen, Soroya, and Mahmood (2021) study were from one university (University of Sargodha), and the participants in the Ahmed et al., (2021) study were from two universities from one district (Peshawar). On the other hand, the current study was conducted on a population of research students studying in two large cities known to be knowledge hubs in Pakistan; Lahore, which is the capital of Punjab, and Islamabad, which is the capital of the country.

Undoubtedly, the HEC DL is an important platform for Pakistani research students. The library has bridged the knowledge gap that was between Pakistan and the developing world. It is suggested that librarians should focus on the enhancement of users' information literacy skills, particularly on how to search in the HEC DL using the Summon tool and how to filter the results to achieve the desired results. Librarians must recognize that users are always aware of their information needs but unaware of where to fulfil them. Consequently, the requirement for assistance with knowledge

discovery is constant, which saves users time and energy and possibly improves the usability and utility of digital libraries (Khan & Qutab, 2016). Similarly, training and orientation programs, seminars, and workshops have the potential to assist users in overcoming the inefficient usage of digital libraries (Khan & Qutab, 2016). In a nutshell, the HEC-DL has had a positive impact on the higher education system of Pakistan. However, there is a need to further promote the usability of Summon among the students by the libraries and university management to fully utilize this digital library. This is essential if the country's universities and research institutions are to boost their research productivity.

Implications of the study

The responders have stressed the need of organizing training workshops, seminars, and lectures for librarians and researchers regarding the HEC DL. The study results have highlighted that while many items are available in the DL, they are either inappropriately used, or users are unaware of how to use them at all. Libraries and professional organizations must play a role in promoting the usage of these important resources in Pakistan. Albeit the research students in the universities of Pakistan perceive the HEC digital library to be an effective and useful tool. However, librarians need to focus on the enhancement of their users' computer skills and train them on the use of DL and Summon.

Limitations of the study

The study's geographical limitations are noteworthy because data was collected solely from Islamabad and Lahore, two major Pakistani cities. Although these metropolitan centers offer insightful information, the study's generalizability may be limited by the possibility that its conclusions won't apply to all locations or types of urban environments. Moreover, the study's representativeness is challenged by the convenience sample used. Due to participant accessibility and availability, this sampling technique may introduce biases into the sample. An additional constraint concerns the respondents' disciplinary distribution, which is notably skewed toward the social sciences and sciences. The limitations that have been revealed also offer prospects for future research projects to fill up these knowledge gaps and advance a more thorough comprehension of information retrieval behaviors in various circumstances.

Conclusion

The study results have shown that Pakistani research students have been visiting the HEC digital library and online databases

frequently. However, the Summon search tool was seldom used by the respondents as a search engine or discovery tool. The participants commonly used the general internet search engines to access the HEC digital library and online databases. Furthermore, the students tended to create queries of subject and title in the HEC digital library and online databases for searching for their needed information. The participants were also adopting the methods of using search limitations and basic/ simple search features of the databases and the digital library. This study has highlighted some problems and challenges faced by users including a lack of knowledge regarding access to the HEC DL, a lack of assistance from the library staff and on-screen help, an inability to formulate queries and unawareness of applying operators while searching in the Summon. Contrary to the problems and challenges, the participants absolutely considered the Summon as an effective discovery tool for the HEC digital library in terms of retrieving relevant and complete search results, providing speedy information, citation and export features and offering accuracy in searching. The research students ranked it as a good service.

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