Decoding the Information Discovery Patterns of Post-Graduate Students in Pakistan

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Abstract

In digitization, Information Retrieval (IR) seems to be an unavoidable element. Information on the World Wide Web is massively increasing and availing the required one, is getting difficult. People are approaching the internet with different techniques for retrieving their required digital information. The study focuses on the searching attitude and behavior of post-graduate students of one of the leading universities of Pakistan, The University of Karachi. This study focuses on their preference for required information, their methods of selection, their preferences, and the strategy used for content selection. The survey method was used to gather the data from respondents and then analyzed quantitatively. It was found from the results that postgraduate students prefer to get information from libraries and consult primarily books and journals for information. It brings clarity to the fact that many students still prefer to read print than online, reflecting the serendipity of the physicality of the book. In printed searching, they prefer citation searching, while in online, they go for browsing, title, and keyword searching. The most used search engine is Google and Google Scholar. The study will be significant in getting an insight into the information retrieval preferences of postgraduates during their research. It will be helpful for the institutions to design more digital literacy programs for scholars. It will also compare the search patterns of students in Pakistan with other international educational systems, bringing equal opportunities for scholars in developing states.

KEYWORDS: Information searching, postgraduate research scholars, digital libraries, information searching patterns, attitude of information searching

Introduction

Since the universe came into existence, human needs are the driving force behind every man's creation. Thus the need to fulfil the requirements yields a person to strive for it. The needs of the students vary at different educational levels in the academic environment. This need for information takes us toward the advancement of knowledge and learning optimization. The advent of the internet and the era of information explosion has revolutionized the world with great opportunities but also challenged people with information needs. The study is conducted on the postgraduate students of the University of Karachi, established in 1951, which is one of the leading universities incorporating 27 research centers. Each department present at the University offers postgraduate programs for students to enhance their knowledge and skills. To identify the attitudes and methods postgraduate students opt for searching in today's world has been analyzed. The universe of information that may be searched online is starting to mirror the huge number of sources available in manual print environments as more diverse databases are brought online. Databanks have evolved from their initial focus on bibliographic databases—the online equivalent of abstracting and indexing (A & I) services—to now include the full text of journals and other documents, as well as directories, encyclopedias, and other traditional library reference materials.

However, when new resources come online, the searcher must take into account a more complicated search environment, both in terms of the sources to use and the search techniques to use with these. Modern information-searching models can better inform our thinking when facing effective interfaces since they more closely resemble the actual behavior of information searchers than the standard information retrieval model.

End users may start with just one aspect of a larger issue or just one pertinent reference while conducting real-world searches in manual sources before moving through several sources. Every new piece of information they come across gives them fresh perspectives, new avenues to explore, and ultimately a fresh understanding of the question. They don't just change the search phrases used at each stage to get a better result for a single query. Instead, the question itself (together with the search phrases used) is always changing, either completely or in part. Here, we refer to this kind of search as an evolving search.

The user may also find relevant data and references at each level and with each variant of the query conception. In other words, the query is met by a succession of selections of individual references and pieces of information at each stage of the constantly evolving search, rather than a single final retrieved set. Berry picking is the term used here to describe this type of incremental retrieval that represents a complete user's approach toward finding the desired results. The patterns and behaviors searchers usually follow address the following styles such as; Footnote chasing, citation searching, journal run, area scanning, subject searches in bibliographies and (Indexing Abstracting databases) IA services, and author searching. It is part of the nature of searching that people adapt the strategy to the particular need at the moment; as the need shifts in part or whole, the strategy often shifts as well—at least for effective searchers.

Undoubtedly, the integration of Artificial Intelligence in the world of libraries has transformed the searching behavior of postgraduate students. The application and utilization of AI-powered tools help researchers refine their research based on multiple elements such as past research, user preferences, and patterns of behavior. This technological advancement incorporates Google's RankBrain and many AI-driven academic databases, aiding to provide efficient and relevant retrieval of information.

While focusing the case of postgraduate students at University of Karachi, where students are exposed to similar type of information sources and limited approach to diversified techniques and tools.

Models Of Information Seeking Behavior

Many studies have been conducted on Information-seeking behavior and user approaches towards information searching. A few models that are recognized and utilized by many studies over the period are Wilson's Information Behavior model, Dervin's Sense-Making Approach and Ellis's Model of Information-seeking behavior.

Dervin's Sense-Making Approach

Dervin's Sense-Making Approach, developed by Brenda Dervin in the 1970s. Focusing on the user's approach that tends to fulfill the knowledge gap was the key element of Dervin's Model. It explains the way users search, interpret and use the information. In comparison, to previous studies, Dervin focused on the personal experience, the context, and the cognitive process that influence human emotion and the social influences of individuals during information seeking. It has three major components Situation, gap and bridge.

Wilson's Information Behavior Model

T.D developed Wilson's model in 1981(revised in 1996 and 1999), which explains how people find, process and utilize information. It is a globally recognized model and gives a structured approach to understanding the enablers, motivating factors, and disturbing factors while information seeking in different contexts. Even while information searching users make multiple approaches as per their knowledge to pursue the desired outcomes. While the study is highly influential but lacks the provision of specific search strategies in different contexts.

Ellis's Model of Information Seeking Behavior

Ellis's Model of Information-Seeking Behavior, developed by David Ellis (1989), is an Information-seeking behavioral framework based on real-world experiences of individuals. The study defines the behavior of individuals while searching and retrieving information in academic settings. Ellis's model relies on the patterns usually followed by students and does not focus their thought processes. The model has been used and appreciated in studies of library sciences, digital information retrieval and academic researchers. Ellis's model highlights search behaviors like starting, chaining (i.e. following references), browsing techniques, differentiating (assessing source relevance), monitoring, and extracting. The Model was later expanded by adding Verifying and ending components in it.

Literature Review

Users in need of information try to reach out to the best possible and convenient methods for satisfying their potential needs. Besides the Internet, users also approach databases, gateways, and the World Wide Web in need of information. The technological era has made it convenient for users to secure their time and efforts by providing the required information from any source. The arrival of e-resources has completely transformed the way people search for their required information. Contemporarily, today's generation highly relies upon e-resources, still the experienced ones believe and feel comfortable reading printed content or it can be said that with a book in hand (Monyela, 2013), hence it can be said that age and feeling of serendipity for books is still present in students today. To study the behaviors and attitudes of students towards electronic scholarly communication many studies have been conducted in different regions of the world. Students largely rely upon the e- information resources and the Internet to search for the required content (Monyela, 2013; Mussa & António, 2020). Besides completely depending on the internet, post-graduates also consult databases and gateways (Nazim, 2008). The students at the university level utilize their academic library-provided search tools and Google & Google Scholar are the most for information searching. (Asher et al., 2013; Monyela, 2013).

The searching methods discussed by many studies also reveal interesting aspects of postgraduate students' searching behaviors, Studies indicate that there is a great difference in searching patterns of graduates and Post-graduates (Callinan, 2005), mature students often pursue printed information resources of young ones (Monyela, 2013) and they focus on the credibility, currency, and relevance of the achieved document (Dalal et al., 2015). When searching, it was observed that students also go for "keyword searching methods" while searching over the Internet(Monyela, 2013; Mussa & António, 2020). Post-graduates also focus on "subject" while searching but their searching methods are highly dependent on the discipline, they are enrolled in (Niu & Hemminger, 2011). Along with searching over the Internet, students reflect a behavior of searching only the first page of their search results and are not interested in committing ahead (Asher et al., 2013; Dahlen & Hanson, 2023) which represents their priority of convenience in searching and considering the most relevant must present there (Cross & Gullikson, 2020). Hence, the credibility comes at stake where students prioritize convenience over reliability. Studies from North America and Europe has shown that postgraduates students are likely to assess the impact factors (Dahlen & Hanson, 2023) of the journals where as in Asian states postgraduates rely on recommendations, free available resources and university provided resources.

Students who feel disappointed by searching with the subject, transform their search terms in different manners relating to the relevant information of the required one (Dalal et al., 2015), while some students agree to the fact that they only go for those e-resources that are recommended by their professors and they have to put no effort in searching (Agosto, 2002). Studies show that post-graduates when find their required papers over the Internet, they further proceed by reading abstracts of the studies(Cross & Gullikson, 2020).

Although searching the internet is convenient and helpful today, it also bears some inconvenience on its part. Some issues still faced by the users were lack of training,

information overload, and issues related to connectivity. (Avhad, 2023; Mussa & Antonio, 2020; Nazim, 2008). Students face difficulties while searching require training in searching techniques and methods, and ask for guidance for searching e-resources (Mohammed, 2020). While some students reported difficulties in using databases (Mussa & António, 2020). It was observed that students who belong to those disciplines where courses related to modern technologies are incorporated, face fewer problems than others. Post-graduates find it difficult to address the matters with their supervisors and require assistance from supervisors in searching for e-resources(Zhang et al., 2023).

Other studies conducted in Pakistan in different regions indicate that postgraduate students from Peshawar majorly use electronic information resources to fulfill their information needs focusing on the internet and online available databases. (Khan & Khan, 2020b) Postgraduate students at KPK prefer to read journals' articles, textbooks, and even research projects. They select the material on the recommendations of their research supervisor and also try to look for innovative ideas when commencing any new project. (Jan et al., 2022) the postgraduate students at Lahore prefer HEC-provided digital library services when searching for their research purposes (Habib et al., 2018b). The issues faced by postgraduate students while searching are poor internet connections, lack of ICT facilities, and unavailability of rooms(Khan & Khan, 2020b), while some students also reported for shortage of printed resources and an absence of trainings and awareness programs for e-resources(Jan et al., 2022).

In addition, postgraduate students in developed states receive library training programs focused on enhancing their digital literacy skills. In contrast, Pakistani students lack advanced searching techniques and face many challenges. This is a generalized aspect for Asian states where financial and infrastructural constraints become a barrier in students' development.

The constraints do not end here, but information overload seems another big issue in the digital searching environment. Where the students highly rely upon keyword and title searching without proper guidance of filtering strategies. Those searches provide numerous results and yields insignificant analyses and frustration among postgraduate students.(Zhang et al, 2023). Countries such as Finland and Germany, provides training in academic programs and during research (Antonio, 2020), this aspect seems neglected in Pakistan.

Research Methodology

It discusses the method implemented in this study to achieve the desired aims, focusing on the research design, methods, and procedure followed at each research process step. Quantitative approaches were applied as they rely on measuring and summarizing the responses relying on numbers and statistical methods with objectivity.

The process of data collection follows the survey method. The participants selected for studying their searching behavior are the post-graduate students, as for their research and assignments they spend most time searching for the required information. The postgraduate students are difficult to approach as they are busy conducting their research, hence snowball sampling method was applied to reach one another. Also, the faculty of each department was contacted to get an appointment from the students to fill out the questionnaire. The targeted

population was 150 respondents, from which the received responses were 121. The achieved responses were then analyzed statistically by obtaining the mean value and frequency of the responses, desired to achieve the objectives of the study.

Research Questions

1. What information-searching behavior do postgraduate students carry?
2. What information-searching strategy do postgraduate students apply while searching for their required content?

Objectives

The study encompasses the following objectives;

1. To Inquire about the behavior towards information searching in the printed collection by postgraduate students
2. To identify the behavior towards information searching in the online collection by postgraduate students
3. To identify the strategy used for content selection.

Demographic Information

The data represents the general information of the respondents in Table 1 and Table 2 respectively. Table 1 signifies the representation of scholars from the following university departments. The higher representation was seen from ASCE and Mass Communication.

Table 1

Name of Department

Area Study Centre for Europe	13	10.74
Applied Economic Research Centre (AERC)	6	4.96
Library and Information Science	5	4.13
Mass communication	12	9.92
Sociology	6	4.96
Islamic History	6	4.96
General History	4	3.31
Education	5	4.13
Urdu	5	4.13
Social work	6	4.96
Persian	3	2.48
English	6	4.96
Arabic	8	6.61
Islamic learning	7	5.79
International Relation	5	4.13
Sindhi	6	4.96
Political Science	5	4.13
Total	121	100

Table 2 indicates the qualification of the postgraduates consulted as respondents to gather the required data. The maximum number of respondents (n=26) were enrolled in their Ph.D. studies, while there were n=19 respondents enrolled in M.Phil. leading to Ph.D. program. The students enrolled in M.Phil. were n=18 while n=8 were enrolled in the M.S. degree program.

Table 2
Level of Education

M.S.	10	8.26
M. Phil.	27	22.31
M. Phil. Leading to Ph.D.	41	33.88
Ph. D.	33	27.27
	121	100

Analysis of the Responses

The respondents were inquired about their method of selection of topic for their in-depth study as shown in Table 3. The higher responses received show that post-graduates (n=26) consult existing research to opt new topic of study. Also, students (n=21) consult their supervisors for the selection of their topic. However, few students (n=18) mention their interests as the way to select their topic of study. Some (n=12) select the topic from the list that their consulted teachers provide them, while (n=8) mention the new trending issues and practical concerns that seem to be their preference for selecting a topic of study.

Table 3
Selection of topic

The teacher provides a list of topic	22	18.18
New issues	12	9.92
Experiencing practical issues	8	6.61
Own Interest	20	16.53
Supervisor consultation	37	30.58
	121	100

The postgraduates were inquired about their preference for information media (Table 4), as print and electronic media both are highly used by people today. The responses revealed that the majority (n=44) of the respondents prefer both print and electronic formats of information. Upon discussion, it was revealed that they tend to seek as much related information and do not bind themselves with format. The respondents who opted for print format (n=14) were the most senior students among all and always preferred to read and marginalize their content in the process of learning and gaining knowledge. The respondents (n=33) opted for electronic media and, upon discussion responded that they think reading directly through electronic devices saves their time and money.

Table 4
Preference of Information Media

Print	14	11.57
Electronic	41	33.88
Both	52	42.98
	121	100

Table 5 represents the preferences of the respondents over the information sources they may consult. The respondents were asked to select all the options that apply to them, hence the *n* is not the representation of the number of respondents.

Table 5
Preference of information sources

	N	%
Book	66	54.55
Journal	63	52.07
Thesis	55	45.45
Research report	52	42.98
Any source that fulfills your need	23	19.01
Any other	8	6.61
	333	

*As the respondents selects more than 1 option.

As shown in Table 6, students were asked about their selection of channel to satisfy their information needs, where they were asked to select all the scenarios that apply to them. Thus, the n of the results is not a complete representation of the population. The responses signify that all (n=71) postgraduates consult the library to get information, while n=55 seek assistance from the internet within the library. Some students (n=41) use their library for this purpose and a few students also consult the record center (n=260, the information center (n=23), and other channels to satisfy their information needs.

Table 6
Selection of information channel

	N	%
Library	71	58.68
Internet	55	45.45
Record center	26	21.49
Information centre	23	19.01
Personal Library	41	33.88
Any other	22	18.18
	238	

*As the respondents selects more than 1 option.

Searching Behavior In The Library

The searching behavior in the library with the printed collection was identified by analyzing the type of library used by the respondents, the method of searching, and the use of the searching technique. It was identified from Table 7 that many postgraduates (n=62) use the departmental library when seeking information. Also, postgraduates (n=59) use the university library and n=56 use other libraries outside the university premises.

Table 7
Type of library in use

	N	%
University Library	59	48.76
Departmental/Institute Library	62	51.24
Any other library	56	46.28
	177	

*As the respondents selects more than 1 option.

Table 8 represents the postgraduates' approach to searching in the library. It was analyzed that n= 63 postgraduates prefer to ask librarians when they have information needs. Also, N=49 read the shelf to search for their required material, while, n= 46 consulted the subject catalog to fulfill their information needs. Postgraduates (n=31) prefer subject bibliographies for searching the required information, while only n=2 opted for other methods of searching.

Table 8
Method of searching in the library

	N	%
Shelf reading	49	40.50
Subject catalogue	46	38.02
Subject bibliography	55	48.62
Ask library staff	63	52.07
Any other	10	9.65
	223	

*As the respondents selects more than 1 option.

The respondents were inquired about the searching techniques they may use in the library as shown in Table 9. It was observed that many postgraduates (n=64) use citation searching techniques to reach their desired information. Searching the Content list of journals is also done by n=43 respondents, while n=28 uses footnote chasing techniques for searching.

Table 9
Use of the following search techniques

	N	%
Citation searching consulting the bibliography of an article	71	62.89
Content list of journals	43	35.54
Footnote chasing	28	23.14
	142	

*As the respondents selects more than 1 option.

Searching Behavior Over Internet

The postgraduates were inquired about their searching behavior for electronic resources over the Internet. As represented in Table 10, the majority of the postgraduates (n=70) optimized the browsing technique, while (n=60) selected power browsing (i.e. browsing with the fastest search engines). Also, n=59 opted for skimming and squirreling techniques for searching over the Internet.

Table 10

Strategy for content selection on the Internet

	N	%
Browsing	70	57.85
Power browsing	60	49.59
Skimming	59	48.76
Squirreling	59	48.76
	248	

*As the respondents selects more than 1 option.

Respondents were also inquired about the method of query formation as shown in Table 11, while searching over the Internet. It was identified that *n* = 121 i.e. all respondents search their content by title, and others *n* = 101 prefer keywords for query formation related to their searching needs. Almost *n* = 55 respondents agree that they use the Question searching technique when searching over the Internet, while *n* = 14 respondents use the Phrase S>T Quotation mark and Boolean operators (*n= 27)*. Some respondents *n* = 15 opt wild card, and few (*n*= 12) selected the Truncation technique for the formation of their queries. While proximity operator NEAR for the formation of the query was selected by (*n*=7).

Table 11

Method of query formation

	N	%
Question searching technique	55	45.45
Keyword	101	83.47
Title Searching	121	105.79
Phrase S>T Quotation mark	14	11.57
Use the Boolean operator AND OR NOT	27	22.31
Truncation e.g. inform*	12	9.92
Wild card	15	12.40
Proximity operator NEAR	7	5.79
	352	

*As the respondents selects more than 1 option.

When inquiring about the searching behavior of respondents, they were asked about their use of the Internet and web resources (as shown in Table 12), it was observed that all postgraduates students utilize e-journals the most (*n*= 121) and focus on searching the web (*n*=119). Also many respondents selected databases (*n* =89) and services offered by scientific

databases (*n* =88). Also, some postgraduates (*n*=38) prefer searching the web pages of libraries.

Table 12

Use of internet services and web resources

	N	%
Searching the web	119	98.35
Searching library web page	38	31.40
Searching Databases	89	73.55
Searching e-journals	121	100.00
Services offered by scientific databases	88	72.73
Any other	12	9.92
	467	

*As the respondents selects more than 1 option.

Selection Of Search Engine

The students searching behaviors can be analyzed with their intent to use the search engine. Thus many students use single search engines, web directories, and even meta-web directories to satisfy their information needs through the internet. The criteria of the search may vary due to different reasons but the selection of specific methods represents their behavior of searching the internet. Table 13A shows that all (*n*=121)respondents use Google and Google scholar, as Google is considered to be the most user-friendly search engine by the respondents, while a few responses (*n*=13) were received for using altered and AltaVista as a search engine. For searching in a broader context, usually, the information is searched over a web directory.

Table 13A
Single Search Engine

www.google.com	121	100.00
www.google scholar.com	121	100.00
www.altheweb.com	13	10.74
www.iycos.com	0	0.00
www.hotbot.com	0	0.00
www.altavista.com	13	10.74
Any other	0	0.00
	268	

*As the respondents selects more than 1 option.

The postgraduate students were inquired about the web directory they prefer where *n*= 114 respondents opted for Yahoo and few responses was received over dmoz and yahooigans as shown in Table 13B.

Table 13B
Web Directory

www.yahoo.com	114	94.21
www.dmoz.com	7	5.79
www.about.com	0	0.00
www.yahooligans.com	4	3.31
Any other	0	0.00
	125	

*As the respondents selects more than 1 option.

Table 13C represents the use of the meta-web directory by the respondents. It was observed that most respondents were unaware of the meta-web crawler, but only a few respondents (*n*=11) have used viviso.com, mamma.com (*n=6),* webcrowler.com (*n*=8), and metacrawler.com (*n*=6) for searching.

Table 13C
Meta Web Directory

www.mamma.com	10	8.26
www.vivisimo.com	11	9.09
www.metacrawler.com	6	4.96
www.webcrowler.com	8	6.61
www.digpile.com	0	0.00
Any other	0	0.00
	35	

*As the respondents select more than 1 option.

Discussion and Conclusion

Discussion

The increasing literature has made searching a challenge for students. The growing options in print and electronic media have diversified the approach of the students in need. The study has focused on the information-searching behaviors of postgraduate students, to identify the most approached methods and techniques that satisfy the postgraduate students today. It was analyzed by the responses that the postgraduate students are from different departments of the University of Karachi and mostly enrolled in research-oriented programs. The highest response rate was from the faculty of social science, where the participants were engaged in seeking a doctorate through a Ph.D. program and an M.Phil. leading to a Ph.D. program.

The respondents' searching behavior was analyzed as how they approached their selection of research topic and selection of reading material. Most of the respondents select their topic of research by conducting a literature review and consulting their supervisors. Few students prefer their supervisor’s recommendation while some opt for the trending issues to study. As

discussed by Dalal, et al(2015) students prefer a supervisor's recommendation when selecting research topic.

Students, while searching, prefer information in both mediums as electronic and printed mediums, while students enrolled in PhD ages prefer more printed information than that of young ones. Monyela (2013) discussed the preference of students where it was observed that students of older ages or enrolled in PhD programs prefer to read on printed information. Among all information sources, many students prefer books as the basic source of information, following journals, thesis, and reports as well. Some students have no priority of it and they seek information from any source they receive (Mussa, 2008). The postgraduate students prefer their departmental libraries to study at and seek assistance from their library staff. As discussed by Nazim (2008) students consider using seminar libraries a s easily accessible and time saving while doing research.

The approach students use in printed material while searching for their required material is content searching, meanwhile, for online searching, they opt for the Browsing technique to get the desired information. Many students also search by title, followed by keyword searching. Studies as; Monyela (2013), Mussa & Antonio (2020) also discussed the use of title and keyword searching as the most commonly used practice in online searching. Among the use of search engine, the most preferred search engine was Google & Google Scholar among postgraduate students. Asher, et al (2013) and Monyela (2013) highlighted the use of google and google scholar at majority of research students prefer to use these tools for searching online. The web directly utilized by students was Yahoo.com, although students were completely unaware of Meta web directories neither any of the respondents used it. It can be said that students are satisfied with google and google scholar, they does not need to go far to reach the desired information.

The postgraduates of University of Karachi faces many issues and are deprived of many technological advancements in field of research. Where the developed states are many the most of AI-driven personalized searching engines, Pakistan lack resources for it. The students majorly rely on freely accessible resources like Google Scholar and local repositories. The absence of training programs is also an issue to access and utilize available resources.

The study not solely but reflects Dervin's approach here as in order to fulfill the knowledge gaps students often relying on peers or supervisors when faced with search difficulties.

The study's findings resonate with Wilson's framework, particularly in the context of Pakistani students' challenges in accessing paywalled research and their limited training in advanced search techniques. The study's results align well with Ellis's model, particularly in students' reliance on citation searching and browsing techniques.

Conclusion

To conclude, this research can be of significance in understanding the information-searching behavior of students who are pursuing postgraduate studies focusing on research, especially the students who are enrolled in the University of Karachi. With the changes in the academic setting in terms of both print and electronic availability of resources, students are using different strategies to cope with their research requirements. The study points out that the

literature review and supervision of the supervisors become the main sources of selection of the research topics for postgraduate students, especially for those who are at the M.Phil. and Ph.D. levels. Even though they have a preference for both electronic and printed materials, it is evident that older students are more inclined to the printed materials than younger students. Books, journals, theses and reports come out to be the widely used sources of information, considering the fact that several students do not seem to be rigid in terms of format and adopt whatever form is available approach. The departmental libraries and the library personnel are still important avenues of assistance to students as they pursue their studies. As regards the searching, students tend to do content searching for printed materials and browsing the internet for information, with Google and Google Scholar being the most preferred ones. Increasingly, however, there is such a tendency to explore meta-web directories available online.

The study reflects lack of attention of HEIs towards training scholars for information searching in today's technological era and suggest HEIs for enhanced library services, improvisation in resource accessibility and to foster more effective research practices. By recognizing the diverse approaches students employ, educational institutions can better support students in navigating the vast array of information available to them.

Recommendations

When compared globally, Pakistani postgraduate students encounter particular difficulties, such as restricted access to sophisticated databases and a dearth of organized instruction in search techniques.
The following suggestions are put forth in order to address these problems:

1. Improved Digital Literacy Training: To help students become better researchers, universities should include courses on Boolean reasoning, credibility assessment, and sophisticated search strategies.
2. Library and Institutional Support: Research accessibility gaps can be closed by expanding access to global digital repositories through institutional partnerships.
3. Awareness of AI Biases: Students should learn how to diversify their search tactics and the dangers of AI-driven filter bubbles in training programs.
4. Integration of Theoretical Models: To give students a systematic grasp of search behaviors, research training should include information-seeking models like; Wilson, Dervin, Ellis.

By putting these strategies into place, Pakistani universities can equip postgraduate students with more advanced and efficient research skills, bringing their information-seeking habits into line with international best practices.

Digital literacy programs should emphasize critical assessment skills, such as source verification and metadata analysis, in light of the growing prevalence of false information.

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