Linking Information Literacy with Research Productivity: A Survey of Mathematicians in Pakistan

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abstract: The present study aims to determine the impact of perceived information literacy (IL) skills on the research productivity of mathematics faculty members in Pakistan. The study explores their opinion of their ability to identify information needs and information sources. It also examines their perceived capability of constructing effective and efficient strategies for locating, accessing, evaluating, and applying the needed information legally and ethically. A structured questionnaire was developed based on the SCONUL Seven Pillars of Information Literacy. Questionnaires were sent to 300 academicians from 36 public sector universities in the Punjab province of Pakistan through personal visits, e-mail, and postal service. After repeated follow-up calls, 185 filled questionnaires were received. The major findings of the study showed that the mathematics faculty members believed they had reasonable IL skills. The majority of them had published research articles in learned journals. The study revealed a positive impact of perceived IL skills on the research productivity of mathematics faculty members. IL instruction sessions designed for faculty may improve the research output of mathematics scholars in their respective universities.

Introduction

Moving beyond the traditional approach of investigating students' information literacy (IL) skills, this study explores the perceived IL skills of mathematics faculty members in connection with their research productivity. Limited IL research has been conducted in the domain of mathematics.[1] The library literature traces the advances of the twenty-first century and argues that modern society calls for more than subject-specific knowledge.[2] Prior research has determined that library-related experiences can broaden the vision of mathematicians.[3] Studies further showed

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that interaction with a variety of information sources could improve their insights into research processes and give them a deeper understanding of the discipline.[4] Preliminary work such as that of Gloria Leckie and Anne Fullerton identified that many faculty in mathematics lack awareness of IL instruction.[5] Significantly, studies highlighted that successful mathematics applications require reasoning, logic, and critical thinking, which are in congruence with IL competencies.

Ellen Hazelkorn proposed research as the key factor for advancing the knowledge economy.[6] Countries across the globe have increased their budget and prioritized resources to support research activities and projects. Wise investment in research demands efficiency of researchers, innovative ideas, and creation of new knowledge.[7] Literature also highlights the factors impacting the growth of the knowledge economy and the advancement of research; among those, IL skills are considered significant. Certainly, such skills empower the individual as an independent information seeker and evaluator.[8] Sheila Webber, Stuart Boon, and Bill Johnston holistically called IL an "adoption of appropriate information behaviour."[9] A number of studies established a strong relationship between the research productivity of academic staff and their IL skills.[10]

Universities and other institutions of higher education aim to create innovative knowledge to support and steer the knowledge economy. Universities expect their faculty members to be critical thinkers who respond to economic crises and societal issues through research.[11] Moreover, research boosts the reputation of the parent institutions and improves their global ranking. The changing academic landscape places pressure on academicians to become involved in innovative projects and to produce research to enhance university ranking, funding, and image. With the appearance of more and more scholarly communication in diversified formats, IL skills have become a fundamental and integral need in the higher education sector. Academicians must build their confidence in finding, organizing, evaluating, and using multiple formats of information sources.[12] Studies have shown that information-literate researchers develop sharp critical thinking skills and perform well on research projects.[13]

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Within the last decade, a research culture has begun to emerge in Pakistan, with increased government funding in the form of a digital library, research grants, and national and international scholarships for researchers. As a result, the number of PhD degrees and research publications has surged.[14] According to statistics provided by *UrduPoint*, an Urdu-language news website, around 14,000 scholars completed PhDs during the last 19 years in Pakistan.[15] However, few studies have explored the impact of IL skills on the research productivity of university faculty members, particularly mathematicians. The present study is designed to fill this gap. Here, research productivity can be defined as production by the faculty members of such scholarly publications as books, chapters, articles, and conference papers.

Review of Literature

Studies of information-seeking behavior by mathematicians, chemists, physicists, astronomers, and other scientists found that to get information, they mostly preferred online materials and relied on primary sources, including journals, preprints, and conference proceedings.[16] A comparative survey reported that students used keyword searching, while mathematicians searched more specifically by author or title. The survey also noted less use of social networking sites and reference sources by the scientists compared to the students.[17] A 2020 mixed methods study by Ian Gordon, Brian Cameron, Debbie Chaves, and Rebecca Hutchinson highlighted the evolving information needs and challenges of mathematicians, including researchers and faculty. The authors pointed out that mathematicians assessed themselves as poor in IL skills. A majority of them could not get current information in a timely fashion and felt information overload while seeking relevant material. Moreover, they preferred to search Google Scholar and academic databases.[18] Mathematicians differ from other scholars in their information behavior as they value originality, evidence, and critical thinking and may be slower to identify truths and facts. Therefore, it is important to study their IL skills.

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Generally, an examination of literature in library and information management revealed the significance of IL skills for all sectors or population groups. The IL concept has evolved from basic library instruction to lifelong learning skills. The educational sector has responded to these changes by developing IL models or frameworks and specific curriculum to cater to the needs of students.[19] Within higher education institutions, IL becomes the shared responsibility of librarians, staff, and faculty members. Faculty must integrate these skills into the curriculum not only for their students but also for themselves and their research productivity.[20] Literature focusing on the educational sector widely explored the application and assessment of the IL skill set.[21] Studies have observed increased academic performance and research skills of students with the incorporation of an IL skill set into the curriculum.[22]

Researchers, communities, and professional organizations have developed IL models that provide a road map for the delivery of information.[23] Some important models mentioned in the literature are the Society of College, National and University Libraries (SCONUL) Seven Pillars of Information Literacy; the Big Six skills, a six-step process to solve information-based problems;[24] Carol Kuhlthau's information search process, a guide to stages in the quest for facts;[25] Marjorie Pappas and Ann Tepe's Pathways to Knowledge, a model for teaching and learning in schools;[26] and the Empowering 8, an information literacy approach developed in Sri Lanka.[27]

SCONUL developed the Seven Pillars of Information Literacy in 1999. The model was revised in 2011 as a generic "core" model for higher education with a series of lenses for different learning groups of various communities and ages. Librarians and teachers around the globe have adopted the model as a guideline to deliver IL skills to their

learners.[28] The core model was reviewed again in 2015 and represents the set of needed skills, competencies, attributes, and understandings.[29] It declares that "information literate people will demonstrate an awareness of how they gather, use, manage, and create information and data in an ethical manner and will have the information skills to do so effectively."[30] The present study is designed around the Seven Pillars of Information Literacy to assess the IL skills of faculty members in the public sector universities of the Punjab, Pakistan. Several other studies in the literature also used this model to investigate the IL skills of different communities. For example, P. Gowri and P. Padma undertook an exploration of the IL skills of engineering students in India.[31] A study by Olatokunbo Christopher Okiki and Iyabo Mabawonku also used the core model to assess the impact of IL skills on the research productivity of the teaching staff at Nigerian federal universities.[32]

Several assessment methods have been employed to measure the impact of IL skills on students' academic performance.[33] Experimental research is popular in this regard.[34] For example, Purnima Banik and Bezon Kumar have assessed the influence of IL abilities on the accomplishments of undergraduate students in Bangladesh. Their findings suggest that IL skills improve the students' performance.[35] Few researchers, however, draw attention to the significance and impact of IL skills on academicians' or faculty members' performance or research productivity. Teachers are major stakeholders of IL instruction programs and are required to develop into efficient information seekers or researchers. Obiora Cyril Nwosu, Amaka Raymonda Obiamalu, and Obiora Kingsley Udem investigated the relationship between the IL skills of academic staff and their research output at Nnamdi Azikiwe University, Awka, Nigeria. Their findings revealed a significant and positive relationship between IL skills and research productivity.[36] Dorothy Williams and Louisa Coles concluded that IL is a strong factor that may limit the development of an information and research culture among teachers.[37]

A growing body of literature focuses on the significance of IL skills and the assessment of different population groups.[38] Much work has been done in the education sector, mostly from the perspective of students or librarians. Some self-reported surveys measured IL skills among students.[39] Few studies investigated the IL abilities of academic staff (teachers or faculty) and the impact on their performance, particularly on their research productivity. The present study was designed to fill the gap by assessing the faculty members' opinion of their IL skills using the SCONUL Seven Pillars of Information Literacy model. The model lists seven competencies: identifying, scoping, planning, gathering, evaluating, managing, and presenting information. The researchers aimed to explore the relationship between perceived IL skills and research productivity among faculty members in Pakistan.

Research Questions

The following research questions address the aim of the present study:

1. How do mathematics faculty members in the public-sector universities of the Punjab rate their IL skills?
2. How do mathematics faculty members differ in estimating their IL skills based on their gender, educational qualifications, faculty rank, and experience?
3. What is the impact of perceived IL skills on the research productivity of mathematics faculty members in the public sector universities of the Punjab?

Methods and Procedures

The present study employed a survey research method, commonly used to investigate the preferences, practices, concerns, and attitudes of large groups and individuals.[40] Several national and international studies applied this technique to assess IL skills. A draft of a structured questionnaire based on the SCONUL Seven Pillars of Information Literacy was developed. Help was taken from the studies by Gowri and Padma; Nwosu, Obiamalu, and Udem; and Okiki and Mabawonku.[41] The instrument was divided into three sections: (1) demographic information, (2) IL skills, and (3) research productivity. The first section covered the demographic variables of the academics, such as gender, faculty status, academic qualifications, and experience.

The second section of the survey instrument was mainly based on the Seven Pillars of Information Literacy including (1) identification of the need for information; (2) assessment of current knowledge and identification of gaps; (3) construction of strategies for locating information and data; (4) location and accessibility of the information and data needed; (5) reviewing, comparison, and evaluation of information and data; (6) professional and ethical organization of information; and (7) application, presentation, synthesis, and dissemination of the findings. The seven abilities are often referred to as *identify*, *scope*, *plan*, *gather*, *evaluate*, *manage*, and *present*. The seven constructs were measured using 41 items, each scored on a five-point Likert-type scale from 1 = strongly disagree to 5 = strongly agree.

The final section of the survey instrument asked about the research output of the academics, measured by the number of articles, books, book chapters, conference papers, and other writings published during the last three years. The questionnaire was sent to four experts to check the items' relevancy and accuracy, and necessary changes, revisions, and modifications were made to the draft. Reliability was ensured through a pretesting process, carried out among 20 volunteer faculty members in mathematics from two private universities in Lahore, Pakistan, the University of Management and Technology and COMSATS University. To ensure the internal consistency and reliability of the scale, Cronbach's alpha was applied. A determined value of Cronbach's alpha (.926) was found, which is above the reasonable value.

The population of the study included all faculty members from mathematics departments of public sector universities in the Punjab recognized by the Higher Education Commission (HEC), the government body that oversees higher education institutions in Pakistan. Twenty public sector universities out of a total of 36 offered academic programs in mathematics. A list of 300 faculty members was prepared from the websites of these universities, and the questionnaire was sent to all faculty members through personal visits, e-mail, and postal service. After repeated follow-up calls, 185 completed questionnaires (61.6 percent) were received. Data were coded and analyzed through SPSS by using descriptive statistics, such as means, standard deviations, and inferential statistics, to make interpretations. Relationship testing between the study variables was done by three statistical techniques: the independent samples *t*-test and one-way ANOVA (analysis of variance) to compare the means of the groups; and simple linear regression to examine the nature and strength of relationships between the variables.

More than half the respondents were male (101, 54.6 percent), leaving a reasonable participation of females (84, 45 percent). A large majority of the respondents were lecturers and assistant professors (133, 74.6 percent), while one-quarter were senior faculty members, either associate or full professors (47, 25.4 percent). The demographic details indicate

diversity among participants in terms of gender and educational qualifications. More than half of the academics had a PhD (104, 56.2 percent), followed by the respondents having an MPhil degree (71, 38.4 percent). Only 10 respondents had a master's degree.

Table 1.

Demographics of the respondents (N = 185)

	Frequency	Percentage
Gender		
Male	101	54.6
Female	84	45.4
Faculty rank		
Professor	17	9.2
Associate professor	30	16.2
Assistant professor	62	33.5
Lecturer	71	41.1
Educational qualification		
PhD	104	56.2
MS/MPhil (18 years of education)	71	38.4
Master's (16 years of education)	10	5.4
Teaching experience		
Up to 5 years	65	35.1
6–10 years	45	24.3
11–15 years	32	17.3
16 years and above	43	23.2

Sixty-five faculty members (35 percent) had 1 to 5 years of teaching experience, followed by 43 (24 percent) with 6 to 10 years. Twenty-three percent reported 16 or more years of experience. See Table 1.

Findings

IL Skills

The second part of the questionnaire measured the self-perceived IL skills of the academics. They were asked to report their level of IL skills on a five-point Likert-type scale. The mean and standard deviation of their responses for the overall scale and for all its subdimensions were calculated. The results demonstrated that these academics felt confident and saw themselves as competent in IL skills, with a mean value for the overall

scale close to four (3.92). The mean score and standard deviation of each subdimension revealed that the academics assessed themselves as capable of identifying information needs and gaps in their current knowledge. They considered themselves able to plan search strategies and to gather, locate, evaluate, and manage needed information. They were confident in synthesizing, presenting, and disseminating their findings through verbal and written communication. The values presented in Table 2 fall close together, indicating little significant difference between the subdimensions. See Table 2.

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Table 2.

Mathematicians' perceptions of their information literacy skills (N = 185)

Skill*	Mean	SD†
Identify: identification of need for information	3.86	0.615
Scope: assessment of current knowledge and identification of gap	3.94	0.532
Plan: construction of strategies for locating information and data	3.92	0.597
Gather: locate and access the needed information and data	3.86	0.554
Evaluate: review, compare, and evaluate information and data	3.99	0.586
Manage: organize information professionally and ethically	3.96	0.655
Present: application, presentation, synthesis, and dissemination of information	3.95	0.523
Overall IL skills scale	3.92	0.484

Scale: 1 = Strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly agree.

*According to the Society of College, National and University Libraries (SCONUL), the seven primary IL competencies are identify, scope, plan, gather, evaluate, manage, and present ("The SCONUL Seven Pillars of Information Literacy: Core Model for Higher Education," 2011, https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf).

†SD = standard deviation; a low standard deviation indicates that the values tend to cluster close to the mean.

Relationship Testing

The relationships of the total mean scores of the overall IL skills scale and its subdimensions with demographic variables (for example, gender, faculty status, academic qualification, and experience) were examined by applying inferential statistics, such as correlation coefficients, to calculate how one variable changed when another did, *t*-tests, and ANOVA.

IL Skills and Gender

An independent samples *t*-test was applied to investigate the difference in academics' perception of their IL skills by gender. The results in Table 3 show a statistically significant difference between the opinion of males and females on three subsections of IL skills: (1) scope, (2) evaluate, and (3) manage. The *p*-values for those three were less than or equal to the alpha value, the threshold for statistical significance. The mean differences were statistically significant neither for the other four IL dimensions nor for the overall IL scale, as the *p*-values were greater than the alpha value. See Table 3.

Table 3.

Difference in perception of IL skills by gender (N = 185)

Skill*	Mean		t†	p-value§
	Male	Female		
Identify: identification of need for information	3.90	3.81	1.03	.31
Scope: assessment of current knowledge and identification of gap	4.01	3.86	2.01	.05†
Plan: construction of strategies for locating information and data	3.97	3.87	1.15	.25
Gather: locate and access the needed information and data	3.88	3.84	0.50	.62
Evaluate: review, compare, and evaluate information and data	4.07	3.90	2.05	.04†
Manage: organize information professionally and ethically	4.05	3.86	2.00	.05†
Present: application, presentation, synthesis, and dissemination of information	4.01	3.88	1.68	.95
Overall IL skills scale	3.97	3.85	1.623	1.06

*According to the Society of College, National and University Libraries (SCONUL), the seven primary IL competencies are identify, scope, plan, gather, evaluate, manage, and present ("The SCONUL Seven Pillars of Information Literacy: Core Model for Higher Education," 2011, https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf).

†The greater the magnitude of t, the greater the evidence of a significant difference between the two means.

§$p \leq .05$; the p-value represents the probability that the difference between the values can be attributed to chance alone.

IL Skills and Faculty Rank

A one-way ANOVA test was applied to investigate how differences in faculty rank related to the perception of IL skills. The results are shown in Table 4. The comparison among academics based on their faculty rank showed a statistically significant difference of opinion on the overall IL skills scale and four dimensions: (1) gather ($p = .03$); (2) evaluate ($p = .01$), (3) manage ($p = .00$), and (4) present ($p = .00$). However, no difference of mean scores was found regarding the three other components of IL skills, those related to the identification of the need for information; assessment of current knowledge; and strategies for locating information and data. The result of the one-way ANOVA is significant in the case of the overall scale (mean = 3.92) as well as for four individual SCONUL pillars: gather, evaluate, manage, and present. See Table 4.

Table 4.

Difference in perception of IL skills by faculty rank (N = 185)

Skill*	Mean					
	Professors	Associate professors	Assistant professors	Lecturers	F†	p-value§
Identify: identification of need for information	3.99	4.04	3.84	3.76	1.40	0.24
Scope: assessment of current knowledge and identification of gap	4.06	4.09	3.93	3.85	1.86	0.12
Plan: construction of strategies for locating information and data	4.04	4.08	3.92	3.81	2.21	0.07
Gather: locate and access the needed information and data	3.96	4.12	3.81	3.77	2.70	0.03†
Evaluate: review, compare, and evaluate information and data	4.07	4.30	3.89	3.92	3.56	0.01§
Manage: organize information professionally and ethically	4.29	4.26	3.92	3.78	4.92	0.00§
Present: application, presentation, synthesis, and dissemination of information	4.01	4.27	3.86	3.86	4.30	0.00§
Overall IL skills scale	4.04	4.16	3.87	3.84	3.83	0.01§

*According to the Society of College, National and University Libraries (SCONUL), the seven primary IL competencies are identify, scope, plan, gather, evaluate, manage, and present ("The SCONUL Seven Pillars of Information Literacy: Core Model for Higher Education," 2011, https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf).

†F indicates how much variability there is between the groups relative to how much there is within the groups; the larger the value of F, the greater the likelihood that the differences between the means are due to real effects. §$p < .05$; § $p \leq .01$; the p-value represents the probability that the difference between the values can be attributed to chance alone.

The results of post hoc multiple comparisons, applied to several different pairs of variables, are presented in Table 5. Regarding confidence in their gathering of information, there was a significant difference among associate professors, assistant professors, and lecturers. Associate professors (mean = 4.12) saw themselves with more IL skills than did assistant professors (mean = 3.81) or lecturers (mean = 3.87). No significant difference was found among the other groups. Similarly, there was a significant difference among associate professors, assistant professors, and lecturers for confidence in their skills for evaluating and presenting information. Associate professors saw themselves better able to evaluate and present information than did assistant professors and lecturers. Both professors and associate professors regarded themselves as more skilled to manage information professionally and ethically than did assistant professors and lecturers. See Table 5.

Table 5.

Results of post hoc multiple comparisons of faculty ranks for the IL skills gather, evaluate, manage, and present

Faculty rank	Rank to which compared	Significance			
		Gather	Evaluate	Manage	Present
Professor	Associate professor	.332	.193	.852	.088
	Assistant professor	.338	.245	.029*	.308
	Lecturer	.205	.307	.003*	.287
Associate professor	Professor	.332	.193	.852	.088
	Assistant professor	.013*	.002*	.015*	.000*
	Lecturer	.004*	.002*	.001*	.000*
Assistant professor	Professor	.338	.245	.029*	.308
	Associate professor	.013*	.002*	.015*	.000*
	Lecturer	.645	.806	.212	.962
Lecturer	Professor	.205	.307	.003*	.287
	Associate professor	.004*	.002*	.001*	.000*
	Assistant professor	.645	.806	.212	.962

*Indicates a result less than or equal to the threshold for statistical significance.

IL Skills and Qualification

One-way ANOVA was applied again to compare the perceived IL skills based on the educational qualifications of the academics, such as PhD, MPhil, and master's degrees. The results revealed no statistically significant difference in the overall IL scales and six of the seven pillars of IL skills: identify, scope, plan, gather, evaluate, and present. See Table 6.

Table 6.

Difference in perception of IL skills among faculty members by educational qualification (N = 185)

Skill*	PhD Mean	MPhil Mean	Master's Mean	F†	p-value§
Identify: identification of need for information	3.94	3.73	4.00	1.80	.15
Scope: assessment of current knowledge and identification of gap	4.02	3.85	3.89	2.06	.11
Plan: construction of strategies for locating information and data	3.98	3.86	3.93	1.70	.17
Gather: locate and access the needed information and data	3.90	3.82	3.93	0.78	.51
Evaluate: review, compare, and evaluate information and data	4.07	3.88	4.00	1.56	.20
Manage: organize information professionally and ethically	4.09	3.82	3.72	3.07	.03§
Present: application, presentation, synthesis, and dissemination of information	3.99	3.88	4.04	0.79	.50
Overall IL skills scale	3.98	3.83	3.94	1.72	.163

*According to the Society of College, National and University Libraries (SCONUL), the seven primary IL competencies are identify, scope, plan, gather, evaluate, manage, and present ("The SCONUL Seven Pillars of Information Literacy: Core Model for Higher Education," 2011, https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf).

†F indicates how much variability there is between the groups relative to how much there is within the groups; the larger the value of F, the greater the likelihood that the differences between the means are due to real effects.

§$p < .05$; the p-value represents the probability that the difference between the values can be attributed to chance alone.

A post hoc multiple comparisons was applied to gage the difference among all groups. The difference of mean values denotes that PhD faculty members considered themselves more skilled in managing and organizing information professionally and ethically than did their MPhil counterparts.

IL Skills and Experience

The Pearson product-moment correlation coefficient was applied to test the strength of the relationship between perceived

. . . PhD faculty members considered themselves more skilled in managing and organizing information professionally and ethically than did their MPhil counterparts.

IL skills and the professional experience of the faculty members. The results indicated a weak yet positive relationship between experience and IL skills for the overall scale and three subdimensions, as *p*-values were less than the alpha value (.05). However, four pillars—plan, gather, evaluate, and present—revealed no relationship with experience, as the *p*-values were greater than the alpha value. Overall, the confidence in IL skills ($p = .039$) of faculty members rose as their years of professional experience increased. See Table 7.

Table 7.

Relationship between perceived IL skills of faculty members and years of teaching experience (N = 185)

Skill*	Pearson correlation†	p-value§
Identify: identification of need for information	.168†	.022§
Scope: assessment of current knowledge and identification of gap	.160†	.030§
Plan: construction of strategies for locating information and data	.076	.307
Gather: locate and access the needed information and data	.125	.090
Evaluate: review, compare, and evaluate information and data	.126	.088
Manage: organize information professionally and ethically	.181†	.014§
Present: application, presentation, synthesis, and dissemination of information	.090	.226
IL skills	.152†	.039§

*According to the Society of College, National and University Libraries (SCONUL), the seven primary IL competencies are identify, scope, plan, gather, evaluate, manage, and present ("The SCONUL Seven Pillars of Information Literacy: Core Model for Higher Education," 2011, https://www.sconul.ac.uk/sites/default/files/documents/coremodel.pdf).

†The Pearson correlation indicates how closely the movements of the two variables are associated.

§$p \leq .05$; the p-value represents the probability that the difference between the values can be attributed to chance alone.

Research Productivity of Academicians

In the last section of the questionnaire, the academics were asked to report their research output for the years 2016 to 2019. Their production, including articles in research journals, conference papers, book chapters, occasional or technical papers, and textbooks,

is presented in Table 8. The results showed that 113 respondents (61 percent) had published articles in research journals, while 43 respondents (23.2 percent) had presented conference papers. A few had written book chapters and occasional or technical papers or had produced textbooks. A great majority of the respondents had never published any textbooks (97.3 percent), occasional or technical papers (92.4 percent), book chapters (90.8 percent), or conference papers (77 percent). See Table 8.

Table 8.

Research publications of respondents from 2016 to 2019

	Articles in research journals	Conference papers	Occasional or technical papers	Book chapters	Textbooks
Zero	72 (39%)	142 (77%)	171 (92.4%)	168 (90.8%)	180 (97.3%)
1–5	50 (27%)	38 (21%)	8 (4.3%)	14 (8%)	2 (1.1%)
6–10	24 (13%)	4 (2.2%)	1 (0.5%)	1 (0.5%)	–
11–15	11 (5.9%)	1 (0.5%)	2 (1.1%)	1 (0.5%)	2 (1.1%)
16–20	10 (5.4%)	–	–	–	–
Above 20	18 (9.7 %)	–	3 (1.6%)	–	1 (0.5%)

Articles in research journals were the only category of research productivity reported by the majority of the faculty. The mathematics faculty produced more articles for scholarly journals than any other form of research output.

Impact of Perceived IL Skills on Research Productivity

The linear regression test was used to see the impact of the participants' perceived IL skills on their output of articles for research journals. The statistics presented in Table 9 showed a beta value of .23 and a *p*-value of .001, which indicate that the academics' opinion of their IL skill set is a positive predictor of their research output. The value of R^2 was .255, which suggests that 25.5 percent of the variation in research productivity is due to IL skills. Faculty members who saw themselves with more IL skills published more research. See Table 9.

Faculty members who saw themselves with more IL skills published more research.

Table 9.

Impact of perceived information literacy skills on research productivity

	Unstandardized coefficients		Standardized coefficients		
	Beta	Standard error	Beta	t	p-value§
Information literacy skills	.97	.29	.23	3.25	.001§

Note: R2 = .255

These statistics examine how much of the difference in faculty's research productivity can be explained by a difference in perceived information literacy skills. The beta value (.23) and *p*-value (.001) suggest that the perceived IL skill set of the academics is a positive predictor of their research output. R^2, the coefficient of determination, was .255, which indicates that 25.5 percent variation in research productivity is due to IL skills. Faculty members who saw themselves with more IL skills published more research articles.

Discussion

The analysis presented here reveals that the academics considered themselves as information literate. They felt confident and competent in the IL skills listed on the overall IL scale and its subdimensions. These findings need to be interpreted carefully considering the cognitive bias of illusionary superiority, in which people overestimate their ability because they lack the self-awareness to accurately assess their own skills. This cognitive bias was explored, explained, and discussed by David Dunning and Justin Kruger and named the Dunning-Kruger effect. Khalid Mahmood found evidence of the Dunning-Kruger effect by systematically reviewing empirical studies in the area of IL and determining that low performers overestimate their IL skills in most cases.[42] On the other hand, the academicians' sense of IL competency might be attributed to the nature of their job, that is, teaching and research. To fulfill their responsibilities, faculty members must consult multiple information sources. During this "purposive seeking for information,"[43] they may learn the techniques and abilities to identify, locate, filter, organize, store, and use information from various sources. As a result, their experience with research and teaching may boost their competence and confidence. Moreover, university libraries actively provide IL instruction to faculty and students.[44]

Muhammad Asif Naveed claimed that IL programs offered at the university level in Pakistan are behind those of the developed world. Naveed concluded that a lack of formal IL training had serious implications for the research productivity of scientists in terms of quality and quantity. Nevertheless, the authors of the present study believe that, even at an early stage, such programs have a positive impact on the IL skills of academics.[45] The researchers strongly recommend that a survey be conducted to identify how IL instruction is provided in these universities and their impact on the IL competencies of faculty members.

The items-based analysis of IL skills in the present study indicated that academicians lacked advanced searching ability, such as using controlled vocabularies and taxonomies. They also lacked competence in using retrieval tools and resources to locate and access needed resources and in using bibliographical software, such as EndNote or Mendeley, to manage retrieved information. These academicians were confident about their basic-level IL skills, but they were less competent in certain advanced-level skills. These findings also have major significance for the research output of the academicians.

. . . the present study indicated that academicians lacked advanced searching ability, such as using controlled vocabularies and taxonomies.

Academics' faculty status and experience appeared as the main predictors of confidence in IL skills. The academics' belief in their IL ability increases as their experience grows. More years of research and teaching enhance learning, foster competencies, and boost confidence. These findings resound with those of Noa Aharony and Hadas Gur and those of Aharony and Tali Gazit, who identified that experience as well as age positively affects IL skills levels.[46]

The findings showed no statistically significant difference among groups based on the respondents' gender and qualifications. These findings align with those of Khalid Mahmood and Elijah Ojowu Ode, who reported that gender had no apparent influence on IL skills.[47] However, a significant difference between the opinion of males and females appeared on three subdimensions of IL skills—scope, evaluate, and manage. Men considered themselves more competent than women on these subdimensions. Some studies reported that men appeared more discerning than women in rating their level of IL competencies,[48] while other studies found women ahead of men in their perceived IL skills.[49] Educational qualifications seemed to have no relationship with IL skills, contradicting some previous studies, which reported that higher qualifications positively affected the level of IL skills.[50]

As far as research output of academics is concerned, articles in research journals was the only category that appeared in high numbers. The finding was expected since universities provide financial incentives mainly for research articles. Furthermore, articles published in research journals count significantly for promotion. Research productivity was lower in other types of publications, such as conference papers, book chapters, occasional or technical papers, and textbooks. The reasons for low output may be financial and time constraints. The study establishes that the perceived IL skill set of the academics is a positive predictor of their research output, meaning that the faculty members who saw themselves with more IL skills also published more research articles.

Conclusion, Implications, and Limitations

The study offers certain implications for university administration, especially for libraries to develop need-based IL programs for faculty members. Particularly, library staff should offer advanced levels of IL instruction because academics consider themselves competent enough in basic IL skills. Since an IL skill set has a positive impact on the

research output of the academicians, policy makers within academia should arrange to provide IL instruction programs to their faculty members.

Research is a key factor for advancing the knowledge economy. It lays the foundation for cultural growth, economic development, and societal improvement. IL programs ultimately will produce information-literate personnel capable of actively contributing to the socioeconomic standing of the country. The Higher Education Commission of Pakistan (HEC) should collaborate with universities to develop national-level IL programs for faculty members and researchers with the help of librarians or information professionals. A credit course for undergraduate students could be designed and integrated in the existing curriculum of universities to prepare an information-literate workforce for the future. Broadly, librarians or information professionals can help in improving the research output of the faculty they serve by providing IL instruction in their respective libraries.

The findings from this study need to be strengthened with more studies, which should be conducted at the national level with academicians of both public and private sector universities. Furthermore, qualitative exploration of faculty issues and barriers to acquiring information literacy may help stakeholders to steer policy making into the right pathways.

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Appendix

Questionnaire

1. Name of your institute:……..……..……..…….

2. Faculty / Department…….

3. Gender: (a) Male (b) Female

4. Designation: (a) Professor (b) Associate professor (c) Assistant professor (d) Lecturer

5. Nature of your job: (a) Full-time (b) Part-time (c) Contract

6. Qualification: (a) PhD (b) MPhil (c) Master's

7. How long have you been teaching / working in the university?
   (a) Up to 5 years (b) 6–10 years (c) 11–15 years (d) 16 and above

Identify: Identification of need for information					
	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
As an academic, I am able to:					
Identify a lack of knowledge in a subject area.					
Identify a search topic / question and define it using simple terminology.					
Recognize a need for information and data to achieve a specific end, and I am able to define limits to the information need.					
Use background information to underpin the search.					
Take personal responsibility for an information search.					
Manage time effectively to complete a search.					
Scope: Assessment of current knowledge and identification of gaps					

As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Identify any information gaps.					
Identify which types of information resources will best meet the need.					
Articulate current knowledge on a topic.					
Identify the available search tools, such as general and subject-specific resources at different levels.					
Identify different formats in which information may be provided.					
Plan: Construction of strategies for locating information and data					
As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
State search question clearly and in appropriate language.					
Define a search strategy by using appropriate keywords and concepts, defining and setting limits.					
Identify controlled vocabularies and taxonomies to aid in searching if appropriate.					
Identify appropriate search techniques to use as necessary.					
Identify specialist search tools appropriate to each individual information need.					
Gather: Location and accessing of information and data needed					

As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Use a range of retrieval tools and resources effectively.					
Construct complex searches appropriate to different digital and print resources.					
Access full-text information, both print and digital, read and download online material and data.					
Use appropriate techniques to collect new data.					
Keep up to date with new information.					
Engage with their community to share information.					
Identify when the information need has not been met.					
Use online and printed help and can find personal, expert help.					
As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Assess the quality, accuracy, relevance, bias, reputation, and credibility of the information resources found.					
Assess the credibility of the data gathered.					
Read critically, identifying key points and arguments.					
Critically appraise and evaluate my own findings and those of others.					
Manage: Organizing information professionally and ethically					

As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Use bibliographical software (EndNote, Mendeley, etc.) if appropriate to manage information.					
Cite printed and electronic sources using suitable referencing styles.					
Demonstrate awareness of issues relating to the rights of others including ethics, data protection, copyright, plagiarism, and any other intellectual property issues.					
Meet standards of conduct for academic integrity.					
Present: Application, presentation, synthesis, and dissemination of information					
As an academic, I am able to:	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
Use the information found to address the original question.					
Summarize documents and reports verbally and in writing.					
Incorporate new information into the context of existing knowledge.					
Analyze and present data appropriately.					
Synthesi[ze] and appraise new and complex information from different sources.					
Communicate effectively using appropriate writing styles in a variety of formats.					
Communicate effectively verbally.					

Appropriate publications and dissemination outlets in which to publish.					
Develop a personal profile in the community using appropriate personal networks and digital technologies.					

Kindly provide the number of your research publications during last three years, i.e. 2016–2019.

Type of publication	Number of publications
Textbooks	
Chapters in books	
Coauthored textbooks	
Occasional papers	
Articles in learned journals	
Conference papers	

Thank you very much for taking time to complete this questionnaire.

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