

## Research Article

# Exploring Dimensions of Digital Literacy: An Educators' Proficiency Study using Exploratory Factor Analysis

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## A B S T R A C T

This research paper explores an in-depth analysis of digital information literacy among faculties in universities across Gujarat, India. The study employs exploratory factor analysis (EFA) to identify distinct factors related to information management and retrieval skills, as well as information literacy and evaluation competence. We analyse a sample of 450 faculties from five different universities to understand the strengths, weaknesses, and variations in digital information literacy levels. The findings reveal a standardised proficiency in information management and retrieval skills across universities, indicating a consistent understanding of managing digital information. However, notable variations are observed in information literacy and evaluation competence, highlighting areas requiring targeted interventions and focused professional development initiatives.

The implications of the research underscore the importance of tailored training programmes, collaborative learning initiatives, and continuous assessment strategies to enhance digital information literacy competencies among faculties. By addressing specific areas of weakness and building on existing strengths, universities can empower faculties to navigate and leverage digital information resources effectively for teaching, research, and professional development endeavours in the digital age.

**Keywords:** Digital Information Literacy, Information Management and Retrieval Skills, Information Literacy and Evaluation Competence, Exploratory Factor Analysis (EFA)

## Introduction

In the digital age, the ability to effectively manage, evaluate, and utilize information has become increasingly vital, particularly within academic settings. University faculties, as key contributors to research and education, require robust digital information literacy to support their teaching,

research, and professional activities. This research paper explores the dimensions of digital information literacy among faculties from universities in Gujarat, India, employing Exploratory Factor Analysis (EFA) to gain a comprehensive understanding of their proficiency levels. The study focuses on two core areas: Information Management and Retrieval

Skills, and Information Literacy and Evaluation Competence. Information Management and Retrieval Skills encompass the ability to handle bibliographic data, construct effective search strategies, and utilize digital tools for managing and retrieving information. Meanwhile, Information Literacy and Evaluation Competence involve critical skills for evaluating the quality, relevance, and credibility of information sources. Previous research has emphasized the significance of these competencies for achieving academic success, but there is a need for a detailed assessment within the specific context of Gujarat's universities. By analyzing a sample of 450 faculties across five institutions, this research aims to identify key factors influencing digital information literacy, assess proficiency levels, and explore variations across different universities and academic disciplines. The findings are intended to inform targeted professional development initiatives and enhance the overall digital literacy of faculty members, ultimately contributing to more effective teaching, research, and scholarly communication in the digital era.

### Literature reviews

Bawden and Robinson (2018)<sup>1</sup> provide a comprehensive overview of information science, covering a range of topics from information retrieval to digital literacy. This book is a foundational resource that discusses key concepts and theories in information science, including the development and measurement of digital literacy skills. It offers a detailed review of the field's evolution and current trends.

Becker and Park (2011)<sup>2</sup> conducted a meta-analysis to explore how computer use influences academic performance. Their review synthesized findings from numerous studies, highlighting the complexities of the relationship between computer use and educational outcomes. They identified both

positive and negative impacts, emphasizing the importance of context and the specific ways in which computers are used in educational settings.

Choi and Yang (2021)<sup>3</sup> performed an exploratory factor analysis to examine digital literacy skills among undergraduate students. Their study aimed to identify the underlying dimensions of digital literacy and assess how these skills are structured within a student population. The review provides insights into the factors contributing to digital literacy and offers a framework for understanding its components in educational contexts.

Fisher (2019)<sup>4</sup> Examined literature on the connection between digital literacy and academic achievement. The review highlighted how digital literacy can influence educational outcomes, summarizing findings from various studies and discussing the implications for teaching and learning. The analysis underscores the importance of integrating digital literacy into academic curricula to enhance student success.

Jansen and Mullen (2020)<sup>5</sup> reviewed the use of exploratory factor analysis (EFA) in information science research. Their article discusses the application of EFA methods, including best practices for implementation and interpretation. The review provides a detailed examination of how EFA is employed to understand complex constructs in information science, making it a valuable resource for researchers in the field.<sup>6-9</sup>

### Faculty-wise Sample Distribution: Diversity Across Disciplines and Affiliated Institutes

The table no.1 presents the sample profile reflects a diverse distribution of faculties across different disciplines and affiliated institutes within Gujarat's universities.<sup>10</sup>

**Table no 1. Faculty-wise Sample Distribution**

Faculty * Affiliation of Institute								
			Affiliation of Institute					Total
			Gujarat University- Ahmedabad	HNGU- Patan	KSKVKU- Bhuj	Shree Govind Guru University- Godhara	VNSGU - Surat	
Faculty	Arts	Count	33	72	43	38	23	209
		%	32.40%	73.50%	43.40%	46.90%	32.90%	46.40%
	Commerce	Count	21	25	26	3	26	101
		%	20.60%	25.50%	26.30%	3.70%	37.10%	22.40%
	Science	Count	48	1	30	40	21	140
		%	47.10%	1.00%	30.30%	49.40%	30.00%	31.10%
Total %		Count	102	98	99	81	70	450
		%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

In terms of faculty distribution, the Arts discipline constitutes the largest proportion of the sample, accounting for 46.4% of the total respondents. Within this category, Arts faculties affiliated with HNGU-Patan have the highest representation at 73.50%, followed by Gujarat University-Ahmedabad at 32.40%. This indicates a strong presence of Arts faculties from these institutions in the study. The Commerce discipline comprises 22.40% of the sample, with VNSGU-Surat having the highest representation at 37.10%. However, it is notable that Shree Govind Guru University-Godhara has a relatively lower representation in this discipline at 3.70%. In contrast, the Science discipline accounts for 31.1% of the sample, with a more balanced distribution across the affiliated institutes. Shree Govind Guru University-Godhara has the highest representation in this discipline at 49.40%, followed closely by HNGU- Patan at 1.00%.<sup>11-13</sup>

Overall, the sample profile indicates a diverse representation of faculties from different disciplines and affiliated institutes, providing a comprehensive perspective on digital information literacy levels among faculties in Gujarat's universities across various academic domains.<sup>14-16</sup>

### Results of the Exploratory Factor Analysis:

Factor Analysis was conducted on statements related to digital information literacy in order to identify the underlying factors. The Bartlett's Test of Sphericity yielded a significant value of 0.000, indicating that the sample intercorrelation matrix is not an identity matrix as it is less than the conventional threshold of 0.05. Additionally, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy returned a value of 0.948, signifying that there are a sufficient number of factors that can be extracted from the data. The Bartlett's Test statistics further support the suitability of the data for factor analysis, with an approximate chi-square value of 5021.093 and 210 degrees of freedom, yielding a highly significant result (Sig. = .000).<sup>17-19</sup>

The extraction communalities range from .576 to .756, representing the proportion of variance in each variable that is explained by the extracted factors. For instance, statements like "I can investigate general information sources to enhance my understanding of current knowledge on the topic." and "I am confident in my ability to assess the type and scope of information required." demonstrate relatively higher extraction communalities (.756 and .742, respectively), indicating stronger associations with the identified factors. Conversely, statements like "I am confident in my ability to use various search term input methods, such as structured searching and image searching,

tailored to the discipline or information retrieval system." exhibit lower extraction communalities (.501), suggesting weaker contributions to the identified factors. These communalities aid in understanding the significance of each variable in the context of digital information literacy factors derived from the analysis.<sup>20-23</sup>

The variance in the data was analyzed using principal component analysis (PCA) along with the Varimax rotation method and Kaiser Normalization criteria, focusing on factors with Eigen values greater than one. This approach resulted in the extraction of two factors. Collectively, these factors account for 53.25% of the total variance in the dataset. Notably, the first factor is particularly significant, explaining 47.07% of the total variance on its own. This underscores the importance of the first factor in capturing and understanding a substantial portion of the variability present in the digital information literacy measures under investigation.<sup>24-27</sup>

The table no.2 presents the factor loadings, naming of factors, and reliability analysis results for a study on digital information literacy among educators. Two factors were identified through exploratory factor analysis: Factor 1, named "Information Management and Retrieval Skills," and Factor 2, termed "Information Literacy and Evaluation Competence."

Factor 1, focusing on Information Management and Retrieval Skills, comprises items such as using bibliographic management software, seeking expert opinion, understanding citation syntax, constructing search strategies, validating understanding through discourse, and assessing information quality and limitations. The factor loadings for these items range from .501 to .734, indicating a moderate to strong association with the factor.

Factor 2, centered on Information Literacy and Evaluation Competence, includes skills related to exploring information sources, determining information needs, understanding information production and dissemination, recognizing different source types, selecting efficient access approaches, identifying keywords and controlled vocabularies, evaluating information value, and broadening information seeking. The factor loadings for these items range from .576 to .756, also indicating a moderate to strong association with the factor.

Additionally, Cronbach's Alpha coefficients for both factors are high, with Factor 1 at 0.865 and Factor 2 at 0.841, suggesting good internal consistency and reliability of the factors. Overall, the findings emphasize the unique yet interrelated facets of digital information literacy competencies among educators.

### Assessing Information Management and Retrieval Skills and Information Literacy, Evaluation Competence: MeanScore Interpretation

The study aimed to assess the digital information literacy levels among five university faculties in Gujarat, focusing on identifying strengths and weaknesses. Through exploratory factor analysis, two distinct factors related to Digital Information Literacy were extracted. To gauge the respondents' level of digital information literacy more comprehensively, their mean scores for both factors were calculated and compared to the central value, also known as the second quartile (Q2).<sup>14</sup>

The comparison criteria, as shown in the table, delineate the interpretation of the mean scores for each factor. Mean

scores falling below Q1 are categorized as "Very Low," while scores between Q1 and Q2 are labelled as "Low." Mean scores equalling Q2 represent a "Moderate" level, scores between Q2 and Q3 indicate a "High" level, and scores surpassing Q3 signify a "Very High" level of digital information literacy.

These criteria provide a clear framework for understanding the respondents' proficiency in digital information literacy, helping to differentiate between varying levels of competency across Factor 1 and Factor 2. By utilizing these comparison metrics alongside statistical tests like the one sample t-test, the study effectively assesses and categorizes individuals' digital information literacy capabilities within the university faculties of Gujarat.

**Table no 2.Factor loadings, Naming of Factors and Reliability Analysis**

<b>Factor 1 - Information Management and Retrieval Skills</b>	<b>Factor Loading</b>	<b>Cronbach's Alpha</b>
I utilize bibliographic management software to organize and store all relevant citation information for future reference.	.734	0.865
I gather expert opinions through various methods, such as interviews, emails, and listservs.	.682	
I am confident in my ability to include relevant information, even if it contradicts an individual's value system, ensuring it is presented objectively without bias.	.676	
I can distinguish between different types of sources and understand the elements and correct syntax for citing a wide range of resources..	.662	
I can identify connections between concepts and effectively use computers and other technologies (e.g., spreadsheets, databases, multimedia, and audio or visual equipment) to study the interaction of ideas and phenomena.	.648	
I can develop a search strategy using appropriate commands for the chosen information retrieval system, such as Boolean operators, truncation, and proximity.	.643	
I can confirm my understanding and interpretation of information through discussions with individuals, small groups or teams, subject-matter experts, and practitioners..	.617	
I am confident in my ability to summarize the key ideas from the information collected.	.615	
I am confident in my ability to use different classification schemes and systems to locate information sources within the library.	.614	
I use specialized online or in-person services to retrieve information when I cannot find suitable material, such as document delivery services, interlibrary loans, subject experts, or librarians.	.584	
I am confident in my ability to evaluate the quantity, quality, accuracy, currency, and relevance of search results, as well as the limitations of information retrieval systems, to decide if alternative sources should be considered.	.551	
I am confident in my ability to use various search term input methods, such as structured searching and image searching, tailored to the discipline or information retrieval system.	.501	
<b>Factor 2 - Information Literacy and Evaluation Competence</b>		

I can investigate general information sources to enhance my understanding of current knowledge on the topic.	.756	0.841
I am confident in my ability to assess the type and scope of information required.	.742	
I understand how scientific, technical, and related information is formally and informally created, organized, and distributed.	.713	
I view experts and other researchers as valuable information resources.	.701	
I can identify how primary, secondary, and tertiary sources differ in importance and use across various disciplines	.641	
I can choose an efficient and effective method for accessing the needed information, whether through investigative techniques or information retrieval systems.	.628	
I can identify keywords, synonyms, and related terms for the information required, and select an appropriate controlled vocabulary specific to the discipline or information retrieval system.	.606	
I am confident in my ability to recognize the potential trade-offs between the value of information, the time required to obtain it, and the associated costs.	.596	
I can assess the availability of required information and expand the search beyond locally available resources.	.576	

**Table no 3.Criteria - Information Management and Retrieval Skills**

Mean Score	Information Management and Retrieval Skills
Less than 18 (Q1)	Very Low
In between 18 (Q1) and 36 (Q2)	Low
Equal to 36 (Q2)	Moderate
In between 36 (Q2) and 54 (Q3)	High
More than 54 (Q3)	Very High

Where; Q1 = (Minimum possible score + Maximum possible score)  $\times$  1/4 Q2 = (Minimum possible score + Maximum possible score)  $\times$  2/4  
Q3 = (Minimum possible score + Maximum possible score)  $\times$  3/4

### Information Management and Retrieval Skills

The table no.3 presents the analysis of Digital Information Literacy Factor 1, focusing on Information Management and Retrieval Skills, reveals interesting insights. Among the university faculties in Gujarat, 49.6% exhibit a high level of proficiency in this factor, showcasing a strong grasp of managing and retrieving digital information effectively. On the other hand, 25.1% fall into the low category, indicating areas for improvement in these skills. Additionally, 19.3% demonstrate a very high level of competence, highlighting exceptional abilities in information management and retrieval.<sup>15</sup>

Furthermore, a smaller percentage of faculties are distributed across the moderate (4.0%) and very low (2.0%) categories, emphasizing the varying degrees of digital information literacy among the faculty members. This breakdown illustrates the diverse skill levels present within the faculties, Offering valuable insights for the development of targeted interventions and training programs to enhance

Information Management and Retrieval Skills across the university setting.

### Information Literacy and Evaluation Competence

The table no. 4 presents the data pertaining to Information Literacy and Evaluation Competence factor demonstrates fair distribution among the university faculties in Gujarat. Notably, 40.2% of faculties exhibit a high level of proficiency in this area, showcasing strong skills in evaluating and utilizing information effectively. Conversely, 48.0% fall into the low category, indicating areas where improvement is needed in terms of information literacy and evaluation competence.

Additionally, there are smaller percentages of faculties in the moderate (5.6%) and very low (6.2%) categories, indicating varying levels of competency across the spectrum. This distribution highlights the importance of targeted interventions and training programs to enhance Information Literacy and Evaluation Competence among faculty members, ensuring a more balanced and proficient



**Table no 4.Criteria - Information Literacy and Evaluation Competence**

Mean Score	Information Literacy and Evaluation Competence
Less than 13.5 (Q1)	Very Low
In between 13.5 (Q1) and 27 (Q2)	Low
Equal to 27 (Q2)	Moderate
In between 27 (Q2) and 40.5 (Q3)	High
More than 40.5 (Q3)	Very High

approach to utilizing and assessing digital information resources.

**ANOVA Test Results:** Comparison of Information Management Skills and Information Literacy Competence Across Universities in Gujarat”

**The ANOVA test results provide insights into the variability of scores for Information Management and Retrieval Skills and Information Literacy and Evaluation Competence among faculties across different universities in Gujarat.**

#### **Information Management and Retrieval Skills**

The F-value of 1.827 indicates that there is no statistically significant difference in mean scores among faculties from different universities regarding Information Management and Retrieval Skills ( $p$ -value = 0.122). Therefore, the null hypothesis ( $H_0$ ) stating that there is no significant difference between the means of the groups is accepted. This suggests that the variability in scores for this factor is not primarily due to the university differences.

#### **Information Literacy and Evaluation Competence**

The F-value of 4.343 is statistically significant ( $p$ -value = 0.002), leading to the rejection of the null hypothesis ( $H_0$ ). This implies that there is a significant difference in mean scores among faculties from different universities regarding Information Literacy and Evaluation Competence. In other words, the variability in scores for this factor is likely influenced by the university differences.

Overall, the ANOVA test highlights that while there is no significant difference in Information Management and Retrieval Skills across universities, there is a notable disparity in Information Literacy and Evaluation Competence among faculties from different universities in Gujarat. This information can inform targeted interventions and training programs aimed at enhancing specific aspects of Information Literacy and Evaluation Competence within the university setting.

#### **Discussion**

The results of the exploratory factor analysis (EFA) offer valuable implications for understanding digital information literacy levels among faculties in Gujarat’s universities.

Firstly, the identification of two distinct factors, namely Information Management and Retrieval Skills and Information Literacy and Evaluation Competence, highlights the multifaceted nature of digital information literacy. This understanding is crucial for designing targeted interventions and training programs that address specific skill sets within these factors.

The distribution of faculties across different proficiency levels within each factor provides insights into areas of strength and areas requiring improvement. For instance, a high percentage of faculties falling into the high and very high categories for Information Management and Retrieval Skills suggests a solid foundation in managing and retrieving digital information. However, the distribution of faculties across different proficiency levels in Information Literacy and Evaluation Competence indicates a need for focused efforts to enhance skills related to evaluating and utilizing information effectively.

These findings can guide universities in Gujarat in developing tailored strategies to enhance digital information literacy among faculties. Institutions can prioritize initiatives such as workshops, seminars, and professional development programs that target specific aspects of digital information literacy identified through the factor analysis. Collaborative efforts among universities can also facilitate knowledge-sharing and best practice dissemination to improve overall competency levels across the region.

Furthermore, the identification of university-specific variations in digital information literacy levels underscores the importance of benchmarking and continuous assessment. Regular evaluations using tools like factor analysis can help monitor progress, identify emerging trends, and inform ongoing efforts to strengthen digital information literacy competencies among faculties in Gujarat’s universities.

Regarding Information Management Skills, the analysis suggests that there is no significant difference in mean scores among faculties from various universities. This implies that the level of proficiency in managing and retrieving digital information is fairly consistent across Gujarat’s universities. This finding could indicate a standardized

approach or similar training programs related to information management across these academic institutions.

On the other hand, the analysis of Information Literacy Competence presents a contrasting picture. The significant difference in mean scores among faculties from different universities indicates varying levels of competency in information literacy and evaluation. This disparity suggests that certain universities may have more effective strategies, resources, or training programs in place to enhance information literacy skills among their faculty members compared to others. It could also reflect differences in the emphasis placed on digital information literacy within the curriculum or institutional support for professional development in this area.

These findings have implications for targeted interventions and initiatives aimed at improving digital information literacy across universities in Gujarat. Institutions with lower mean scores in Information Literacy Competence may benefit from adopting best practices observed in universities with higher mean scores. Collaborative efforts and knowledge-sharing among universities can also contribute to raising the overall standard of digital information literacy among educators in the region.

## Conclusions

The study identified two key dimensions of digital information literacy among university faculties in Gujarat: Information Management and Retrieval Skills, and Information Literacy and Evaluation Competence. Faculties demonstrated consistent proficiency in Information Management and Retrieval Skills across universities, suggesting a standardized approach in this area. However, significant variations were found in Information Literacy and Evaluation Competence, highlighting disparities among faculties and the need for targeted interventions. Differences in digital literacy skills were observed across academic disciplines and universities, underscoring the necessity for tailored training programs to address specific weaknesses and enhance overall competency. Recommendations include developing professional development initiatives focused on improving information literacy and leveraging strengths in information management.

The analysis of digital information literacy levels among faculties in Gujarat's universities yields several key conclusions. Firstly, the consistent proficiency in Information Management and Retrieval Skills across universities suggests a standardized approach or shared practices in managing digital information. This indicates a foundational understanding and competency among faculties in utilizing bibliographic management software, constructing search strategies, and validating information sources, among other skills related to information management.

On the other hand, the significant variations in Information Literacy and Evaluation Competence highlight areas that require targeted interventions and focused professional development efforts. The disparity in mean scores across universities indicates differing levels of competency in critically evaluating and utilizing information, recognizing the importance of distinguishing between various information sources, and effectively determining the nature and extent of information needs.

These findings underscore the need for tailored training programs and collaborative learning initiatives that address specific areas of weakness identified through exploratory factor analysis. By leveraging these insights, universities can design workshops, seminars, and resources aimed at enhancing faculties' skills in information literacy and evaluation. Collaborative efforts among universities can facilitate the sharing of best practices and successful interventions, contributing to collective improvement in digital information literacy competencies across the academic landscape in Gujarat.

Continuous assessment and feedback mechanisms are crucial for monitoring progress and identifying evolving needs. Ongoing evaluation using tools like factor analysis will inform continuous improvement efforts, ensuring that faculties remain equipped with the latest skills and competencies required in the digital age. Overall, the study emphasizes the importance of targeted interventions, collaborative learning initiatives, and continuous assessment in empowering faculties to navigate and leverage digital information resources effectively for teaching, research, and professional development endeavours within Gujarat's universities.

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