








Digital Divide among Faculty Members of Golestan University of Medical Sciences

Abdolhalim Rajabi¹ , Zohre Paranam² , Khadije Layegh² , Shima Kazemi Malekmahmoudi² ,
Naheed Ramezanghorbani³ , Ali Akbar Aghaeinejad⁴ , Masoud Mohammadi^{5*} 

¹ Department of Biostatistics and Epidemiology, Faculty of Health, Golestan University of Medical Sciences, Gorgan, Iran.

² Department of Research and Technology, Golestan University of Medical Sciences, Gorgan, Iran.

³ Department of Development and Coordination Scientific Information and Publications, Deputy of Research & Technology, Ministry of Health & Medical Education, Tehran, Iran.

⁴ Department of Operating Room, School of Allied Medical Sciences, Golestan University of Medical Sciences, Gorgan, Iran.

⁵ Golestan Research Center of Gastroenterology and Hepatology, Golestan University of Medical Sciences, Gorgan, Iran.

Abstract

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Introduction: The digital divide in higher education affects both access to technology and its effective use. This study examined the digital divide among faculty members at Golestan University of Medical Sciences and explored the relationships among ICT literacy, practical skills, and teaching/research requirements.

Methods: A cross-sectional study was conducted in 2024 among 95 faculty members selected from a total of 333 via convenience sampling. Data were collected using a validated questionnaire comprising five sections: demographic information; access to and use of information and communication technology (ICT); ICT literacy; practical abilities and skills in using ICTs; and educational and research requirements. Descriptive statistics, the Shapiro-Wilk test for normality, Mann-Whitney and Kruskal-Wallis tests for group comparisons, and Spearman's correlation for relationships between ICT dimensions were applied using SPSS.

Results: Indicators of ICT access showed no substantial access-based digital divide: 94.7% of participants reported high-speed internet access at home, 89.5% used ICTs several times per day, and 65.3% reported more than three hours of daily ICT use. However, mean scores for ICT literacy (22.58 ± 5.36 out of 32), practical ICT skills (109.39 ± 27.34 out of 160), and educational and research requirements (28.55 ± 8.33 out of 36) indicated moderate competency levels. Faculty members from clinically oriented schools, particularly Medicine and Dentistry, consistently obtained lower mean scores across these dimensions. Strong and statistically significant correlations were observed between ICT literacy and practical skills ($r = 0.605$, $p < 0.001$) and between practical skills and educational and research requirements ($r = 0.653$, $p < 0.001$).

Conclusion: At Golestan University of Medical Sciences, while ICT access is largely achieved, skill-based challenges remain, particularly in clinically oriented faculties. The interconnection among ICT literacy, practical skills, and teaching/research requirements indicates that the observed digital divide is primarily skills- and outcome-based rather than access-related, and that improvements in one dimension can support gains in others.

* Corresponding author:

Masoud Mohammadi

Email: Mohammadi.

msd84@gmail.com



Introduction

Information and communication technology (ICT) developments are occurring at an astonishing pace. The expansion of broadband, wireless Internet, and mobile phones has had a significant impact on all aspects of science, medicine, and healthcare

worldwide and has brought about various social benefits (1, 2). In this regard, digital technologies hold significant innovation potential and development prospects, and their spread has increased people's involvement in the social, political, and economic



dimensions of life (3). In addition, the rapid growth of ICT has had a significant impact on the online and offline education system (4); as the expansion of online databases allows professionals around the world to have instant access to hundreds of electronic journals at the touch of a button (2). Therefore, in the shift from written to digital environments, digital literacy is vital for work progress and individual and organizational development (3). In line with these changes, many jobs today also require expertise and skills in ICT (5), and individuals need digital literacy to learn and improve their daily performance.

ICT skills are also of great importance to education systems worldwide (6), with access to computers and the Internet in the office or university laboratory essential for teachers and professors to use these technologies to support their core professional responsibilities (3). Although new technologies are enhancing information exchange, communication, and collaboration across disciplines, they also risk widening a persistent digital divide by privileging professionals with advanced digital, analytical, and evaluative skills while marginalizing those with limited access, training, or digital literacy (4). The digital divide constitutes a major challenge for both policymakers and academic researchers. The concept has evolved significantly: it was initially defined narrowly in terms of access to ICT, particularly the Internet. Since the late 1990s, the definition broadened to encompass differences in usage. In its contemporary understanding, the digital divide refers to the broader gap in digital literacy and the ability to leverage technology (5).

The digital divide is a social inequality between individuals regarding 1- access to ICT, 2- frequency of technology use, and 3- ability to use ICT for different purposes (7). Therefore, to further develop, countries seek to create a society in which all citizens can access and share information by reducing the factors that create the digital divide (5, 8). The level of computer use and knowledge of how to use it are two important dimensions of the digital divide (7). In addition, demographic variables such as gender, age, education, marital status, geographical region, ethnicity, and economic status are other factors that affect the digital divide (1, 7). The use of information

technology in health, education, and research in medical and educational centers is very important because it speeds up operations and improves the quality of medical services (9). Although there have been rapid advances in technology, the digital divide has always existed, and this should be a concern for various educational groups, including professors and students (3). However, equipping with ICTs can reduce economic inequalities and the digital divide (9). There are studies investigating the digital divide among different groups, such as students (10) and the elderly (11). However, there are not enough studies on the level of access and use of digital technologies by university professors.

In addition, the focus of existing works is more limited to measuring physical access to digital devices. In contrast, this issue is subtler and involves various aspects that need to be examined from all angles. Such research helps to take the necessary measures to eliminate or minimize this problem among professors (3, 9). The use of ICT in education poses new and emerging challenges for teachers. They must not only learn how to use ICT, but also how to design new teaching models by integrating ICT into the curriculum (12). Given that university faculty members are an important segment of society that takes steps to advance and expand science, and, in this regard, requires access to information technologies as well as the skills and knowledge to use them. The existence of a digital divide among this segment of society will have a great impact on the scientific output of the country, and examining this issue in order to identify obstacles to the beneficial use of information technology, taking measures to eliminate them, and consequently reducing the impact of the digital divide on various sectors, can be very useful and valuable. Accordingly, the present study aimed to examine the status of the digital divide among faculty members of Golestan University of Medical Sciences in 2024 by assessing their access to and use of ICTs, levels of ICT literacy, and technology-related skills. In addition, the study explored the relationships between demographic and professional characteristics and different dimensions of the digital divide, as well as the associations among ICT literacy, technological skills, and the

educational and research requirements of faculty members.

Methods

This cross-sectional study was conducted in 2024 with a target population of 333 faculty members at Golestan University of Medical Sciences. From this population, a sample of 95 members was selected through convenience sampling. The sample size in this study was calculated using a 95% confidence level and an overall digital divide frequency of 51%, with an acceptable error of 0.1. A sample size of 92 people was calculated, assuming a 10% non-response rate, resulting in a final sample size of 102.

The data collection tool was a questionnaire originally designed by Qazi Mirsaeid et al. (13) to assess the status of the digital divide among academic staff members. The instrument evaluates multiple dimensions of the digital divide, including access to and use of ICTs, ICT literacy, technological skills, and educational and research requirements. The questionnaire's validity and reliability were confirmed, with a Cronbach's alpha of 0.978 (13). The researcher visited various faculties and departments, delivered the questionnaires to the faculty members, and after a specified period (about a week), collected the completed questionnaires. Data collection was conducted from March to May 2024. Furthermore, to increase the response rate, an electronic version of the questionnaire was sent via the university systems or the faculty members' work email, and they were asked to return it online or in print within the specified period. Before distributing the questionnaires, the researcher explained the purpose of the study and assured respondents of the confidentiality of their information. The questionnaire was organized into five sections: demographic information, dimensions of access and use of ICTs, dimensions of ICT literacy, dimensions of ability and skills in using ICTs, and dimensions of educational and research requirements of faculty

members (a set of activities that faculty members must perform in interaction with the workplace). In the demographic information section, the questions included the faculty department name, age, gender, marital status, teaching experience, and academic rank. The number of questions in the mentioned dimensions was 3, 8, 40, and 9, respectively, and items for dimensions 2, 3, and 4 were scored on a 5-point Likert scale ranging from 0 to 4. Accordingly, the possible score ranges for the dimensions ICT literacy, ability to use ICTs, and educational and research requirements are 0–32, 0–160, and 0–36, respectively. In the study of demographic variables, the status of ICT use is presented as frequencies and percentages, or as means and standard deviations. The Shapiro–Wilk test was applied to assess data normality. The distributions of the variables ICT literacy, ability, and skills to use ICTs, as well as faculty members' educational and research requirements, were found to be non-normal. Consequently, the Mann–Whitney U test was employed to compare the means of accessibility factors and the four dimensions across demographic variables with two categories, while the Kruskal–Wallis test was used for demographic variables with more than two categories. Moreover, Spearman's correlation test was used to examine the relationship between the questionnaire's dimensions. In the data analysis, the significance level was also set at less than 0.05.

Results

The response rate in this study was 93%. Findings shows that the mean age of participants was 44.93 ± 8.29 and their work experience was 11.7 ± 8.97 .

Demographic information of the participants shows that out of 95 faculty members, 59.34% of the samples were male, 84.04% married, and 61.05% assistant professors. Furthermore, 36.84% were faculty members in the basic sciences. Most of them (26.32%) were from the health faculty. (Table 1)

Table 1. Demographic information of the faculty members studied*

	Indicator	Frequency	Percentage
Faculty	Paramedical school	19	20.00
	Nursing	16	16.84
	Health	25	26.32
	Medicine	13	13.68
	Dentistry	6	6.32
	Advanced Technologies	12	12.63
	Research and Technology	4	4.21
Faculty Members	Clinical	35	36.84
	Basic Sciences	60	63.15
Gender	Female	37	40.65
	Male	54	59.34
Marital status	Single	15	15.95
	Married	79	84.04
Academic Rank	Instructor	15	15.79
	Assistant professor	58	61.05
	Associate professor	19	20.00
	Professor	3	3.16

* The discrepancy between the data in the variables and the total sample size is due to missing data.

Table 2 shows the frequency and percentage distribution of the items related to the access dimension. The findings show that most faculty

members have access to high-speed Internet at home and generally use ICTs several times a day and for more than 3 hours.

Table 2. Frequency and percentage distribution of access and use of ICT

	Indicator	Frequency	Percentage
High-speed Internet access at home	Yes	90	94.7
	No	5	5.3
Frequency of use of information technologies	Once or less	10	10.5
	Several times a day	85	89.5
Duration of use of ICTs	2 hours and less	14	14.7
	2 to 3 hours	19	20.0
	More than 3 hours	62	65.3

Table 3 shows that the average scores for the dimensions of ICT literacy, practical ICT skills, and faculty member requirements were 22.58 ± 5.36 (out of 32) and 109.39 ± 27.34 (out of 160), respectively. Educational and research requirements were 28.55 ± 8.33 (out of 36). In the ICT literacy dimension, faculty members of the Vice-Chancellor for Research and Technology had the highest average score (26.5), while faculty members of the Faculty of Dentistry and Medicine had the lowest average scores (19.50 and 20.23, respectively). In the ICT dimension, faculty members of the Faculty of Advanced Technologies had the highest average score (122.7), while faculty members of the Faculty of Medicine had the lowest (87.17). After the Faculty of Medicine, the Faculty of Dentistry had the lowest average score at 100.8. In the faculty member requirements dimension, the findings showed that faculty members of the Faculty of Paramedical Sciences had the highest average score of 31.63. In contrast, faculty members of the Faculty of Medicine and the Faculty of Dentistry had the lowest average scores of 23.08 and 26.5, respectively.

Table 3 also shows that there is no significant difference in the mean scores of ICT literacy across most demographic variables, including faculty, gender, marital status, academic rank, time, and frequency of ICT use (P -values ≥ 0.05).

The correlation between ICT literacy and information and communication abilities and skills was strong, direct, and statistically significant ($r=0.6$, $P<0.001$), and the correlation between ICT literacy and educational and research requirements was moderate, direct, and statistically significant ($r=0.41$, $P<0.001$). In addition, the correlation between technological skills and educational and research requirements was also strong, direct, and statistically significant ($r=0.65$, $P<0.001$) (Table 4).

Discussion

This study examined the current state of the digital divide and the relationships among its dimensions among faculty members at Golestan University of Medical Sciences, using a sample of 95 participants. The data showed high levels of basic access and usage: 94.7% of faculty had high-speed internet at

home, and 89.5% used ICTs several times a day. However, mean score analyses revealed variations in competency levels. Faculty from the Medicine and Dentistry schools—predominantly clinical in focus—consistently obtained the lowest mean scores across ICT literacy, skills, and educational/research requirements. These inter-faculty differences were not statistically significant ($P \geq 0.05$). Nevertheless, the descriptive trends, together with the sample composition (36.8% clinical vs. 63.2% basic sciences faculty), suggest a potential disparity in digital competencies consistent with the digital outcome divide (14), emphasizing that the critical gap lies not in access to technology but in the tangible benefits derived from its use. The study's most notable finding is the strong, statistically significant correlation between ICT literacy, technological skills, and educational/research requirements, indicating that these core dimensions of the digital divide are fundamentally interconnected.

The results of this study suggest that faculty members from the Medicine and Dentistry schools have lower ICT competencies than those from other faculties. This is reflected in their mean scores across ICT literacy, technological skills, and educational/research requirements (2.8–3.1 on a 5 point scale), despite generally high access and frequent use of ICTs. These patterns appear to be broadly comparable to findings from other contexts. For example, a study in Scotland reported that while many dentists had moderate IT skills, about one-third reported nil or low proficiency, and only one-quarter had accessed formal learning programs via computer (6). Similarly, Eslamipour et al. (15) found that general dentists in Isfahan had moderate knowledge and skills regarding computer and Internet use (mean knowledge score 23.4 ± 8.9 ; mean skill/performance score 4.7 ± 2.6), with 63.3% having a computer and 61.6% having internet access in their offices. Although our study did not directly assess self-confidence or perceived barriers, the relatively lower scores among clinical faculty may reflect challenges with ICT proficiency, similar to those identified by Gicheru and Mwangi (16) at the Kenya Medical Training College, where faculty had minimal ICT skills and lacked confidence in using

Table 3. The difference between the ICT dimensions regarding demographic variables of faculty members

Demographic variables		ICT literacy		Ability and skills to use ICTs		Faculty members' educational and research requirements	
		Mean±SD	P-value	Mean±SD	P-value	Mean±SD	P-value
Faculty	Paramedical	24.33±5.24	0.15	114.06±36.21	0.52	31.63±14.34	0.13
	Nursing	22.37±6.87		109.63±31.00		30.35±5.91	
	Health	22.20±4.40		112.2±19.70		27.96±5.92	
	Medicine	20.23±4.28		87.16±23.19		23.07±5.05	
	Dentistry	19.50±4.80		100.80±6.61		26.50±6.53	
	Advanced Technologies	23.83±5.60		122.70±19.69		29.72±3.10	
	Research and Technology	26.50±5.32		120.25±27.66		29.00±3.36	
Academic rank	Instructor	23.07±6.05	0.97	100.63±36.59	0.70	26.92±7.31	0.68
	Assistant Professor	22.48±5.39		111.40±25.70		28.87±9.53	
	Associate Professor	22.42±4.94		109.62±27.21		28.05±4.92	
	Professor	23.33±7.02		106.50±17.67		33.00±3.00	
Gender	Male	21.51±4.77	1.26	108.45±27.27	0.89	27.75±5.67	0.86
	Female	23.28±5.69		109.29±28.21		27.96±5.74	
Marital status	Single	22.66±6.01	0.91	113.53±25.83	0.54	28.92±5.06	0.84
	Married	22.50±5.27		108.43±27.95		28.44±8.86	
Internet access at home	Yes	22.69±5.41	0.39	108.90±27.97	0.54	27.81±5.73	0.00
	No	20.60±4.33		116.60±15.67		41.40±25.55	
Frequency of use of information technologies	Once or less	5.73±6.16	0.21	92.50±32.89	0.06	32.89±6.80	0.32
	Several times a day	25.55±5.25		111.32±26.22		26.22±8.48	
Duration of use of ICTs	Two hours and less	20.21±4.54	0.20	95.45±23.08	0.17	25.71±6.47	0.27
	2 to 3 hours	22.88±5.89		109.12±31.26		27.68±6.48	
	More than 3 hours	23.03±5.32		112.49±26.44		29.50±9.13	
Total (Mean±SD, [Min Max])		22.58±5.36 [11-34]		109.39±27.34, [16-160]		28.55±8.33, [14-87]	

Table 4. Correlations between ICT literacy, ICT skills, and faculty requirements

	Spearman's rho	ICT literacy	Ability and skills to use ICT	Educational and research requirements of faculty members
ICT literacy	Correlation Coefficient	-	.605**	.416**
	Sig. (2-tailed)	-	.000	.000
Ability and skills to use ICT	Correlation Coefficient	-	-	.653**
	Sig. (2-tailed)	-	-	.000
Educational and research requirements of faculty members	Correlation Coefficient	.416**	.653**	-
	Sig. (2-tailed)	.000	.000	-

technology. Taken together, these comparisons suggest that the critical digital gap in clinical faculties may lie more in the effective application of ICT skills than in access to technology.

A notable descriptive pattern in our results is that faculty members from the Medicine and Dentistry faculties consistently obtained the lowest mean scores across the dimensions of ICT literacy, skills, and requirements. However, these differences were not statistically significant. It is important to interpret this pattern cautiously. While this study did not directly assess or compare clinical versus basic sciences faculty as distinct groups, the Medicine and Dentistry faculties primarily consist of clinical educators. Therefore, the observed pattern might suggest that challenges related to digital competency are more pronounced in academic units with a strong clinical service and training mandate. This potential interpretation aligns with literature highlighting how contextual and situational factors—such as the demanding workload in clinical environments or a culture that may prioritize immediate patient care over technological skill development—can hinder technology integration. For instance, Soomro et al. (3) demonstrated that faculty members' access to and use of technology varies significantly based on their personal situations and institutional contexts. Future studies should explicitly measure and compare the digital divide between clinical and non-clinical faculty members to test this hypothesis directly.

Furthermore, the strong, statistically significant

correlations among the core dimensions of the digital divide provide crucial empirical insights. Our data show that ICT literacy is strongly correlated with practical ICT skills ($r = 0.605$, $p < 0.001$), and that practical skills, in turn, exhibit an even stronger correlation with educational and research needs ($r = 0.653$, $p < 0.001$). This interconnectedness indicates that enhancement in one dimension (e.g., skills) is likely to catalyze improvement in another (e.g., the ability to meet professional demands). This pattern of relationships offers empirical support for integrated theoretical models of digital inequality, such as the one proposed by Yu et al. (5). Their model posits those inequalities in knowledge and cognitive access—closely mirrored by our 'ICT literacy' and 'skills' dimensions—are fundamental drivers that create disparities in the effective use and outcomes of technology, which aligns with our 'educational and research requirements' dimension. Thus, our findings reinforce the view that the digital divide is a compound phenomenon where resource deficits in one area perpetuate inequalities in another.

On the other hand, this study found no significant differences in ICT access, use, or competencies across demographic groups, including gender, academic rank, and marital status. This lack of disparity is a positive finding, suggesting that faculty members across different demographic backgrounds have relatively equal access to technology and opportunities to develop digital skills. Such convergence could indicate a reduction in the digital divide within the

institution, which is desirable from both educational and professional perspectives. Although previous studies, such as those by Ghazimirsaeid et al. (13) and Bahadorani & Yamani (18), reported that personal characteristics, such as age and academic rank, can influence technology use and ICT competencies, our study did not replicate these patterns. Several factors may explain this discrepancy. First, the sample in our study was relatively small and drawn from a single university, potentially limiting the range of demographics. Second, improvements in infrastructure and widespread availability of ICTs may have reduced differences across groups over time. Overall, the absence of significant demographic disparities in our data may reflect a positive trend toward more equitable access to technology among faculty members.

This study has several limitations that should be considered when interpreting the findings. First, the sample was drawn from a single university and included 95 faculty members, which may limit the generalizability of the results to other institutions or contexts. Second, although data were collected across different faculties, individual-level comparisons between clinical and basic science faculty were not possible, as the questionnaires were not linked to participants' specific roles beyond their faculty affiliation. Third, the study relied primarily on self-reported measures of ICT literacy, skills, and educational/research requirements, which may be subject to response bias. Finally, the cross-sectional design captures a snapshot in time and does not allow for assessment of changes in digital competencies over time or the impact of interventions. Future research could address these limitations by including larger, multi-institutional samples, objective skill assessments, and longitudinal designs.

Conclusion

This study highlights that, in settings where technology access is broadly available, the central challenge for faculty lies in effectively transforming digital resources into meaningful educational and research outcomes. Clinically oriented faculties, such as Medicine and Dentistry, may encounter particular difficulties in applying ICTs, underscoring the need

for targeted skill development in these areas. The observed interconnections between digital literacy, practical skills, and the capacity to meet professional requirements suggest that targeted improvements in one area can strengthen overall digital competence. These findings underscore those fostering practical digital skills—not merely providing access—can enhance teaching effectiveness, research productivity, and institutional performance. By addressing the skills-based digital divide, higher education institutions can more effectively integrate technology into academic practice, ultimately supporting better learning and research outcomes.

Declaration

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Conflict of Interest

The authors declare that they have no competing interests.

Ethical Statement

The study protocol was reviewed and approved by the ethics committee of Golestan University of Medical Sciences (Ethics code: IR.GOUMS.REC.1402.492). At the same time as the questionnaire was distributed, the purpose and method of the research were explained to potential participants. The questionnaires were administered with the researcher's commitment to maintaining the anonymity and confidentiality of the information and the participants' right to withdraw from the research at any time. The study was conducted in accordance with applicable regulations and guidelines.

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Authors' Contribution

M.M. designed the project. Z.P. and Kh.L. collected the data. A.R. and A.A.A. carried out the statistical

analysis, Sh. M and N.R. prepared the first draft of the manuscript.

All authors read the final draft of the manuscript, critically revised it, and agreed to be accountable for all aspects of the work and for ensuring that questions related to the accuracy or integrity of any

part of the work would be appropriately investigated and resolved.

Use of Artificial Intelligence

The free version of ChatGPT artificial intelligence was used for English editing.

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