

## Analyzing Prospective Teachers' Information Handling skills for ICT-Enhanced Learning

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### Abstract

*Information handling skills literate individuals know how to locate, evaluate, organize and effectively use needed information. These skills are more important than ever in digital classrooms, where teachers must manage their own resources digitally, separate information from misinformation and carefully use technology to improve teaching (Hussain & Mahmood. 2022). Especially, they have to acquire these skills because soon they will become part of a technological educational system as prospective teachers in Pakistan. The current study is designed in this context and it evaluates the levels of Information handling skills of Pakistani prospective teachers to establish if they are prepared for ICT integrated teaching or not. The current study was quantitative and survey methods were used to data collected, using questionnaire. All the prospective teachers studying in various teacher education institutions were taken as population of the study. While 240 prospective teachers from six public sector universities were selected through multistage sampling technique. The present study was aimed to analyze Prospective Teachers' Information Handling skills for ICT-Enhanced Learning. Findings reveal significant gender disparities, with males outperforming females in data handling and database skills. Residence-based differences indicate that rural students demonstrate slightly better data handling skills, while urban students excel in internet and e-mail management. Self-support students consistently outperform regular students across most skill categories, suggesting a stronger drive to develop ICT competencies. Additionally, institutional differences highlight significant variations in ICT training quality, with students from Punjab University and NUML displaying the strongest skills. The study recommends gender-inclusive ICT training, improved digital infrastructure in rural areas, flexible learning for self-support students, and age-appropriate training modules. Strengthening ICT curricula, investing in resources, standardizing assessments, and promoting technology-enhanced learning are suggested to address skill gaps and enhance digital competencies.*

**Keywords:** Information Handling Skills, Digital Technology, ICT, Database Skills, Technology-Enhanced Learning, Email Management, Internet surfing

**Introduction**

ICTs encourage not only innovative pedagogical practices but also necessitate a change in the manner information is controlled, dealt with and dispensed to learners within classrooms. Information handling skills, which include locating, organizing, evaluating using and sharing skills necessary for ICT use in education (Anderson & Dexter, 2020). These are all important in a digital age classroom where the use of digital resources must be administered efficiently, information literacy helps to evaluate not only reliable and unreliable sources but also whether certain tasks that were traditionally analog can now take place within online platforms with associated criteria (Hussain & Mahmood, 2022). Nonetheless, the level to which pre-service teachers get through their teacher education programs with these abilities is not yet clearly described in ICT environments for top quality teaching and learning (Selwyn, 2021).

Prospective teachers who entering the world of work as teachers need a solid grounding in information handling skills and are expected to be competent digital citizens ready for their tech-enabled classroom. According to Greenhow et al. (2020), using these tools is foundational to finding, evaluating, and capitalizing on different digital assets as many resources are available in a digital format; organizing electronic information for teaching need also be maintained ethically. With the accelerated transition to digital learning underway due to events like COVID-19, institutions have been focusing even more on integrating ICT training into teacher education programs (Zhu et al., 2021).

In recent years, the role of Information and Communication Technologies (ICTs) in education has become increasingly prominent in Pakistan, particularly as the country's educational institutions strive to improve access to digital resources and integrate technology into teaching and learning practices. The Pakistani government, in line with international educational standards, has launched initiatives to encourage the adoption of ICT in schools and teacher education programs (Ministry of Federal Education and Professional Training, 2020). Despite these efforts, the effective implementation of ICT-enhanced learning faces challenges, largely due to a lack of digital literacy and information handling skills among educators, especially those in training (Ahmad et al., 2021).

As digital technology continues to influence education, it is important for teachers to be knowledgeable in the effective use of technology, specifically information handling skills. Such skills are defined as the abilities that pertain to the searching, evaluation, and use of information in a manner most appropriate within an online environment. Several authors have provided a definition for Information handling skills while also recognizing their importance in information management systems: Hossein-Mohand et al. (2021) speak of information handling skills as the skills that seek, fetch, organize, and employ online materials in developing effective strategies for teaching and learning through ICT. Melo et al. (2020) denote these skills as the competencies that enable one to find a specific purpose for relevant information, evaluate that information, store the information for use as well as carry out the information relevant educational exercises which complete the picture of digital literacy. Ahmad & Sheikh (2023) in their earlier discussion characterized information handling skills as implementation skills that involves objectives like gathering, evaluating, and demonstration of information within online contexts.

Effective information handling is crucial for teachers as it influences the quality of ICT-enhanced learning experiences they provide. These skills help teachers curate relevant content,

use digital tools for instruction, and support student engagement. The competencies include searching for information, assessing its credibility, organizing data, and applying information effectively in teaching contexts (Melo et al., 2020). Digital literacy, an extension of these skills, is associated with teachers' ability to edit documents, utilize educational software, and solve subject-specific problems, such as those in mathematics (Hossein-Mohand et al., 2021). By aligning training with technological advancements, teacher preparation programs can improve prospective teachers' readiness for ICT-enhanced classrooms (Turk & Akyuz, 2016).

Information handling skills refer to the ability to locate, evaluate, organize, and apply information effectively and responsibly. These skills include the ability to search for, evaluate, manage and apply digital content in educational contexts. For future teachers, in particular, these skills are becoming of paramount importance, as information is ever more widespread, but not all of it is credible and teachers are often expected to use it in their teaching with digital content (American Library Association [ALA], 2022 in the article). Information handling skills help educators conduct all the functions of data management, digital resources integration, and appropriate use of information with other ICT tools for effective learning environments. As highlighted in the study by Ahmad & Sheikh (2023) prospective teachers should search for appropriate information using search methods and tools available to them. As stated by Bawden and Robinson (2019), information handling skills do not end with locating and retrieving data and include higher order skills like assessment and judgment of information sources, creation and synthesizing data, and the application of information in relevant contexts. These skills by the teachers in classrooms enable the provision of precise information and assist students in acquiring digital literacy skills. Information may be evaluative in the sense that it has to be credible, accurate, suitable and educational for teachers (Dogan et al., 2021). In the same manner, integrating information from multiple sources into a coherent teaching plan enhances learning outcomes (Hossein-Mohand et al., 2021). This is critical due to the fact that the contemporary conception of education includes competencies such as critical thinking and media literacy, which certainly are dependent on sound information handling skills (Greenhow, Lewin, & Willet, 2020). Instructional design requires the systematic organization and classification of information for effective management and integration into the learning process (Triviño-Cabrera et al., 2021). Therefore, various programs for teacher education around the world include the development of information handling skills that are consistent and anchored within Information Literacy Theory which defines the management of information as a continuum that encompasses ethics of information ensuring respect to intellectual property and the wise use of content (Ahmad et al., 2021). Numerous studies have shown that there are many factors that affect the information handling skills of future teachers. These include the level of training in ICT tools, adequacy, reliable internet access and educational software, and quality of teacher education programs (Knezek & Christensen, 2008, Ghayyur et al., 2024a). Prospective teachers often report that inadequate access to reliable digital tools and limited exposure to practical ICT use in classrooms hinder their ability to handle information effectively (Woolliscroft, 2020). Prospective teachers encounter challenges in digital technology integration due to limited resources, outdated infrastructure, and insufficient technical support (Ghayyur & Mriza, 2021). Similarly, a lack of access to personal computers and limited ICT training inhibits effective integration Ghayyur et al. 2024c. Whereas, teacher training programs that ensure hands-on information handling experiences have been found to significantly improve ICT competencies among prospective teachers, that requires emphasize on provision of practical digital skills to the

prospective teachers for their effective learning (Ghayyur et al., 2024b, Khokhar & Javaid, 2023).

### **Statement of the Problem**

With the increasing incorporation of ICT in education, teacher training programs must prepare prospective teachers to handle information effectively in digital learning environments. However, limited research has assessed prospective teachers' information handling skills specifically for ICT-enhanced learning. While studies have highlighted the importance of ICT competencies, there is insufficient understanding of how well-prepared prospective teachers are to manage, evaluate, and utilize information in ways that optimize digital learning environments. Despite efforts by Pakistan's Ministry of Education to promote ICT in education, research suggests that many teachers, particularly those in training, are not sufficiently equipped with the necessary information handling skills to manage digital information effectively in classroom settings (Ministry of Federal Education and Professional Training, 2020; Ali & Haq, 2021). While ICT competencies are recognized as essential for modern teaching, prospective teachers in Pakistan face challenges in locating, evaluating, and using information effectively to enhance learning experiences through technology. Therefore, the present study is aimed to analyze prospective teachers' information handling skills for ICT-enhanced learning.

### **Objectives of the Study**

1. To analyze current level of information handling skills among prospective teachers in relation to ICT-enhanced learning.
2. To study difference in information handling skills among prospective teachers with respect to their gender, residence, age, program of study and type of university.

### **Research Questions**

1. What is the current level of information handling skills among prospective teachers in relation to ICT-enhanced learning?
2. Was there any difference of information handling skills among prospective teachers with respect to their gender, residence, age, program of study and type of university?

### **Research Methodology**

The research was quantitative in nature and survey method of research was used for conducting this study. The study population comprised all prospective teachers of Education Department of all the universities of Pakistan. A multistage sampling technique was employed to collect data. As recommended by David (2005), it is the "process of selecting a random sample from subgroups or strata into which a population has been subdivided". Fraenkal, Wallen and Hyun (2012) also suggested stratified sampling is "a process in which a particular subgroup, or strata, are selected for sample in the same proportion as they exist in the population. In the first stage, 6 public sector universities were selected randomly. In second stage, 40 prospective teachers were selected randomly from each university namely GC=Government College University, Faisalabad, UE=University of Education, Lahore, LWCU=Lahore Women College University, Lahore, PU=University of the Punjab, Lahore, SU=University of Sargodha, Sargodha, NU=NUML University, Islamabad comprising 240 prospective teachers as a sample.

**Research Instrument**

A questionnaire titled IHSPT (Information Handling Skills of Prospective Teachers) with a total of 30 items was developed and used as main instrument in this study to analyze information handling skills of prospective teachers for ICT-Enhanced Learning. First part of the questionnaire contains demographic information (name, gender, residence, age, semester, program of study, name of university), Second part contains statements to study information handling skills including Data Handling and Storage Skills, Internet Surfing and Searching Skills, Database skills, E-Mail Management skills, System Software Skills. 7-point rating scale as described below; 1- Not at all (NAT) 2- Very Little (VL) 3- A Little (AL) 4- Moderately (Mo) 5- A Lot (AL) 6- Quite a Lot (QA) 7- Extremely (Ex) was used for data collection. For tool validation, peer consultation was sought first, and different changes were made to improve both instruments. Then the opinion of five Experts was sought for the validation of both instruments. These experts were working in teachers’ training institutions/departments. After incorporating the suggestions of these experts, the scale was pilot tested on 40 students that were further excluded from the study. Reliability of instrument was 0.838 Cronbach Alpha. The data were collected with the permission of head of departments. After getting permission, questionnaires were distributed to all students. During data collection the respondents were ensured the confidentiality of their information.

**Data Analysis**

Data were collected through survey method and self-approach from teacher educators of five public sector universities of Punjab. Data was analyzed by using Statistical Package for the Social Sciences (SPSS) version 23. The analysis includes both descriptive and inferential analysis.

**Results**

The findings are stated according to the sections in the questionnaire and some inferential analysis.

**Table 1**

Demographic Information of Prospective Teachers

Sr. No.	Variables	Category	F(n)	Percentage %
1	Student Age	18-20 Years	52	20.80
		21-23 Years	157	62.80
		24+	31	12.40
2	Semester	3 <sup>rd</sup>	70	28.00
		5 <sup>th</sup>	105	42.00
		7 <sup>th</sup>	52	20.80
3	Program of Study	M.A Education	62	24.80
		BS Education	82	32.80
		B.Ed Hons.	96	38.40
4	Class Status	Regular	185	74.00
		Self-Support	55	22.00

5	Gender	Male	62	24.80
		Female	178	71.20
6	Residence	Urban	161	64.40
		Rural	79	31.60
7	Name of University	Government College University Faisalabad	40	16.00
		University of Education Lahore	40	16.00
		Punjab University, Lahore	40	16.00
		University of Sargodha	40	16.00
		NUML University, Islamabad	40	16.00

Table 1 shows that among the 240 prospective teachers, 52 (20.80%) were aged 18-20, 157 (62.80%) were 21-23, and 31 (12.40%) were 24 years or older. Regarding academic level, 70 (28.00%) were third-semester students, 105 (42.00%) were in the fifth semester, and 52 (20.80%) were in the seventh semester. In terms of study programs, 62 (24.80%) pursued M.A Education, 82 (32.80%) were in BS Education, and 96 (38.40%) were enrolled in B.Ed Hons. Most students were regular (185, 74.00%), while 55 (22.00%) were self-supporting.

Gender distribution indicated 178 females (71.20%) and 62 males (24.80%). Regarding residence, 161 (64.40%) students came from urban areas, and 79 (31.60%) were from rural backgrounds. Lastly, each of the universities—Government College University Faisalabad, University of Education Lahore, Punjab University, University of Sargodha, and NUML University—contributed 40 students (16.00% each).

**Table 2**

Mean difference of information handling skills among prospective teachers with respect to their gender

Variables	Gender	N	Mean	Std. Deviation	T	P
Data Handling and Storage Skills	Male	62	28.71	6.714	2.127	0.034
	Female	178	25.75	7.31		
Internet Surfing and Searching Skills	Male	62	29.32	5.735	0.184	0.854
	Female	178	29.11	6.027		
Database Skills	Male	62	23.32	8.685	2.528	0.012
	Female	178	18.95	9.024		
E-Mail Management Skills	Male	62	29.87	5.578	1.749	0.082
	Female	178	27.31	7.869		
System Software Skills	Male	62	30.03	6.73	1.289	0.199
	Female	178	28.32	6.947		

Table 2 indicates that when comparing information handling skills among prospective teachers based on gender, a significant difference was found in Data Handling and Storage Skills, where male participants scored a mean of 28.71 compared to females at 25.75, with a p-value of 0.034 (<0.05). This suggests that male prospective teachers possess better data handling and storage skills than their female counterparts. In Internet Surfing and Searching Skills, males scored a mean of 29.32 while females scored 29.11, resulting in a non-significant difference (p = 0.854 > 0.05). For Database Skills, male participants had a mean score of 23.32, compared to 18.95 for

females, with a p-value of 0.012 (<0.05), indicating that males have superior database skills. In E-Mail Management Skills, males scored a mean of 29.87 versus females at 27.31, but the difference was not statistically significant ( $p = 0.082 > 0.05$ ). Lastly, for System Software Skills, male participants scored a mean of 30.03 compared to 28.32 for females, resulting in a non-significant difference ( $p = 0.199 > 0.05$ ).

**Table 3**

Mean difference of information handling skills among prospective teachers with respect to their residence

Variables	Gender	N	Mean	Std. Deviation	T	P
Data Handling and Storage Skills	Urban	161	26.12	7.082	0.558	0.015
	Rural	79	26.14	7.746	0.871	
Internet Surfing and Searching Skills	Urban	161	29.14	6.145	0.484	0.003
	Rural	79	28.13	5.663	0.637	
Database Skills	Urban	161	19.55	8.681	0.684	0.073
	Rural	79	19.46	9.91	1.115	
E-Mail Management Skills	Urban	161	27.64	7.513	0.592	0.006
	Rural	79	27.03	7.973	0.897	
System Software Skills	Urban	161	28.44	7.109	0.56	0.307
	Rural	79	28.73	6.588	0.741	

Table 3 indicates that when comparing the ICT skills of urban and rural prospective teachers, significant difference was found in Data Handling and Storage Skills, with urban participants scoring a mean of 26.12 and rural participants slightly higher at 26.14 ( $p = 0.015 < 0.05$ ). It means that rural prospective teachers possessed better data handling and storage skills as compare to urban prospective teachers. In terms of Internet Surfing and Searching Skills, urban students scored a mean of 29.14 compared to 28.13 for rural students, but the difference was statistically significant ( $p = 0.003 < 0.05$ ). So, urban prospective teachers had acquired more internet surfing and searching skills as compare to rural prospective teachers.

For Database Skills, urban participants had a mean score of 19.55, while rural participants scored 19.46, with a p-value of  $0.073 > 0.05$  indicating no significant difference. In E-Mail Management Skills, urban students scored a mean of 27.64 versus 27.03 for their rural counterparts, but again, the p-value of  $0.006 < 0.05$  suggests significant difference. Urban prospective teachers are better in Email Management as compare to rural prospective teachers. Lastly, System Software Skills showed urban participants scoring a mean of 28.44 compared to 28.73 for rural participants, with a p-value of  $0.307 > 0.05$ , indicating no significant difference.

**Table 4**

Mean difference of information handling skills among prospective teachers with respect to their class status

Variables	Gender	N	Mean	Std. Deviation	T	P
Data Handling and Storage Skills	Regular	185	25.34	7.309	-4.603	0.000
	Self-Support	55	31.63	4.156		

Internet Surfing and Searching Skills	Regular	185	28.71	6.178	-2.948	0.004
	Self-Support	55	32.1	3.021		
Database Skills	Regular	185	19.14	8.97	-1.693	0.092
	Self-Support	55	22.13	9.587		
E-Mail Management Skills	Regular	185	27.07	7.808	-3.086	0.002
	Self-Support	55	31.6	4.945		
System Software Skills	Regular	185	28.06	7.114	-2.855	0.005
	Self-Support	55	31.87	4.224	0	

Table 4 reveals significant differences in information handling skills among prospective teachers based on their class status. Regular students demonstrated a mean score of 25.34 in Data Handling and Storage Skills, whereas self-support students scored higher at 31.63, indicating superior skills among self-support students ( $t = -4.603, p = 0.000$ ). In Internet Surfing and Searching Skills, regular students had a mean of 28.71 compared to 32.10 for self-support students ( $t = -2.948, p = 0.004$ ), suggesting self-support students excel in this area.

Regular students scored 19.14 in Database Skills, while self-support students scored 22.13, but this difference was not statistically significant ( $p = 0.092$ ). For E-Mail Management Skills, regular students averaged 27.07, while self-support students had a mean of 31.60, indicating significant superiority ( $t = -3.086, p = 0.002$ ). Lastly, System Software Skills also showed that self-support students excelled with a mean of 31.87 compared to 28.06 for regular students ( $t = -2.855, p = 0.005$ ). Overall, self-support students consistently outperformed regular students across most information handling skill categories.

**Table 5**

Mean difference of information handling skills among prospective teachers with respect to their age groups

Variables	18-20 (N=52)		21-23 (N=157)		24+ (N=31)		Df	Mean Square	F	Sig.
	M	SD	M	SD	M	SD				
Data Handling and Storage Skills	20.52	7.79	26.05	7.22	30.36	4.50	237	108.916	3.73	0.03
Internet Surfing and Searching Skills	20.52	7.79	29.38	5.74	31.36	3.20	237	77.3	2.18	0.11
Database Skills	18.6	9.539	19.72	9.06	20.18	7.44	237	82.998	0.29	0.75
E-Mail Management Skills	25.12	8.780	28.10	7.26	32.09	4.323	237	293.54	5.19	0.01
System Software Skills	26.46	8.37	28.97	6.37	31.45	6.44	237	175.11	3.73	0.03

Table 5 illustrates the mean differences in information handling skills among prospective teachers across different age groups. In Data Handling and Storage Skills, the youngest group (18-20 years) had a mean score of 20.52, while the 21-23 years group scored significantly higher at 26.05, and the 24+ group achieved the highest mean of 30.36. The ANOVA results ( $F = 3.73, p = 0.03$ ) indicate significant differences among age groups.

In Internet Surfing and Searching Skills, the mean scores were 20.52 for the 18-20 age group, 29.38 for 21-23, and 31.36 for 24+, but the p-value (0.11) suggests no significant difference. For Database Skills, the means were relatively close: 18.60, 19.72, and 20.18, with a p-value of 0.75 indicating no significant difference.

In E-Mail Management Skills, significant differences were noted, with the youngest group scoring 25.12, the middle group at 28.10, and the oldest group at 32.09 ( $F = 5.19, p = 0.01$ ). Lastly, System Software Skills showed a significant difference, with means of 26.46, 28.97, and 31.45 respectively ( $F = 3.73, p = 0.03$ ).

Overall, significant differences in information handling skills were observed between the age groups, particularly in Data Handling and Storage Skills, E-Mail Management Skills, and System Software Skills, suggesting that older prospective teachers tend to possess better skills in these areas.

**Table 6**

Mean difference of information handling skills among prospective teachers with respect to their program of study

Variables	MA Education (N=62)		BS Education (N=82)		B.Ed. Hons (N=96)		Df	Mean Square	F	Sig.
	M	SD	M	SD	M	SD				
Data Handling and Storage Skills	24.63	8.16	27.63	7.19	25.70	6.76	2	160.787	4.98	0.01
Internet Surfing and Searching Skills	24.63	8.16	30.01	5.81	28.73	5.22	2	47.94	1.35	0.26
Database Skills	17.92	9.01	19.29	9.90	20.47	8.39	2	82.216	1.42	0.24
E-Mail Management Skills	27.42	7.97	19.29	9.90	27.42	7.32	2	10.53	0.18	0.84
System Software Skills	26.31	8.84	28.05	7.94	28.42	6.50	2	231.42	4.98	0.01

Table 6 presents the mean differences in information handling skills among prospective teachers based on their program of study. In Data Handling and Storage Skills, the mean scores were 24.63 for MA Education, 27.63 for BS Education, and 25.70 for B.Ed. Hons., with a significant difference indicated by an F-value of 4.98 and a p-value of 0.01, suggesting that students in the BS Education program possess superior skills compared to the others.

For Internet Surfing and Searching Skills, the means were 24.63 for MA Education, 30.01 for BS Education, and 28.73 for B.Ed. Hons. However, the F-value of 1.35 and a p-value of 0.26 indicate no significant difference among the groups. Similarly, Database Skills showed means of 17.92, 19.29, and 20.47 respectively, with an F-value of 1.42 and a p-value of 0.24, suggesting no significant differences.

In E-Mail Management Skills, the means were 27.42 for MA Education, 19.29 for BS Education, and 27.42 for B.Ed. Hons., but with an F-value of 0.18 and a p-value of 0.84, indicating no significant difference. Finally, in System Software Skills, the mean scores were 26.31 for MA

Education, 28.05 for BS Education, and 28.42 for B.Ed. Hons., with a significant F-value of 4.98 and a p-value of 0.01. This implies that students from different programs exhibit varied levels of proficiency in this skill area, particularly favoring those in the B.Ed. Hons. program.

Overall, significant differences were found in Data Handling and Storage Skills and System Software Skills among the different programs of study, while no significant differences were noted in the other skill areas.

**Table 7**

Mean difference of information handling skills among prospective teachers with respect to their university

Variables	GC (N=40) M SD	UE (N=40) M SD	LWCU (N=40) M SD	PU (N=40) M SD	SU (N=40) M SD	NU (N=40) M SD	Df	Mean Square	F	Sig.
Data Handling and Storage Skills	21.70 7.47	22.15 7.65	24.73 7.50	30.80 5.00	26.10 5.83	31.30 2.81	2	687.824	17.4	0.00
Internet Surfing and Searching Skills	26.68 6.72	27.65 7.46	30.25 6.20	32.05 3.05	27.45 6.19	30.75 2.79	2	187.56	5.77	0.00
Database Skills	15.73 8.76	19.18 8.01	18.15 9.79	22.25 9.43	19.509.72	22.30 7.27	2	252.637	3.2	0.01
E-Mail Management Skills	22.4 8.97	19.18 8.01	18.15 9.79	22.25 9.43	19.509.72	22.30 7.27	2	511.99	10.5	0.00
System Software Skills	26.40 6.55	25.48 8.65	27.88 7.91	31.60 4.05	27.55 7.07	32.33 2.73	2	312.69	7.38	0.00

GC=Government College University, Faisalabad, UE=University of Education, Lahore, LWCU=Lahore Women College University, Lahore, PU=University of the Punjab, Lahore, SU=University of Sargodha, Sargodha, NU=NUML University, Islamabad

Table 7 highlights the mean differences in information handling skills among prospective teachers from different universities. Significant variations were found across all skill areas. For Data Handling and Storage Skills, Punjab University (PU) students scored the highest (M = 30.80), while Government College University (GC) students scored the lowest (M = 21.70), with a significant p-value of 0.00 (F = 17.4).

In Internet Surfing and Searching Skills, PU students also had the highest mean score (M = 32.05), and GC scored the lowest (M = 26.68), with a significant difference (p = 0.00, F = 5.77). For Database Skills, NUML University (NU) and PU students scored similarly high (M = 22.30 and 22.25, respectively), with a significant p-value of 0.01 (F = 3.2).

E-Mail Management Skills displayed significant differences, with PU and NU achieving the highest means (M = 22.25 and 22.30), whereas University of Education (UE) and Lahore

Women College University (LWCU) scored lower ( $M = 19.18$  and  $18.15$ ), indicating a significant difference ( $p = 0.00$ ,  $F = 10.5$ ). Lastly, System Software Skills showed significant variations, with NU leading ( $M = 32.33$ ) and UE scoring the lowest ( $M = 25.48$ ), supported by a significant p-value of  $0.00$  ( $F = 7.38$ ).

Overall, the analysis indicates significant differences in information handling skills among universities, with students from PU and NU generally outperforming others across most skill areas.

### Findings

1. A significant difference in Data Handling and Storage Skills was found between male and female prospective teachers ( $t = 2.127$ ,  $p = 0.034 < 0.05$ ), with males scoring higher ( $M = 28.71$ ) than females ( $M = 25.75$ ). In contrast, there was no significant gender difference in Internet Surfing and Searching Skills ( $t = 0.184$ ,  $p = 0.854 > 0.05$ ), indicating similar proficiency between genders. Similarly, Database Skills showed a significant difference ( $t = 2.528$ ,  $p = 0.012 < 0.05$ ), with males scoring higher ( $M = 23.32$ ) than females ( $M = 18.95$ ). However, no significant gender difference was observed in E-Mail Management Skills ( $t = 1.749$ ,  $p = 0.082 > 0.05$ ) or System Software Skills ( $t = 1.289$ ,  $p = 0.199 > 0.05$ ), suggesting comparable skills across these areas.
2. Comparing the ICT skills of urban and rural prospective teachers, a significant difference was found in Data Handling and Storage Skills ( $t = 0.558$ ,  $p = 0.015 < 0.05$ ), with rural participants scoring slightly higher ( $M = 26.14$ ) than urban participants ( $M = 26.12$ ). Additionally, a significant difference was noted in Internet Surfing and Searching Skills ( $t = 0.484$ ,  $p = 0.003 < 0.05$ ), where urban participants outperformed their rural counterparts ( $M = 29.14$  vs.  $28.13$ ). There were no significant differences in Database Skills ( $t = 0.684$ ,  $p = 0.073 > 0.05$ ) or System Software Skills ( $t = 0.56$ ,  $p = 0.307 > 0.05$ ), while E-Mail Management Skills showed a significant difference ( $t = 0.592$ ,  $p = 0.006 < 0.05$ ), favoring urban students.
3. Significant differences in information handling skills were observed based on class status. Data Handling and Storage Skills were significantly higher among self-support students ( $M = 31.63$ ) than regular students ( $M = 25.34$ ), with  $t = -4.603$  and  $p = 0.000 < 0.05$ . Self-support students also scored higher in Internet Surfing and Searching Skills ( $M = 32.10$  vs.  $28.71$ ;  $t = -2.948$ ,  $p = 0.004 < 0.05$ ) and E-Mail Management Skills ( $M = 31.60$  vs.  $27.07$ ;  $t = -3.086$ ,  $p = 0.002 < 0.05$ ). In System Software Skills, self-support students again demonstrated superior skills ( $M = 31.87$  vs.  $28.06$ ;  $t = -2.855$ ,  $p = 0.005 < 0.05$ ), whereas there was no significant difference in Database Skills ( $t = -1.693$ ,  $p = 0.092 > 0.05$ ).
4. Data Handling and Storage Skills showed significant differences across age groups, with older students scoring higher (18-20 years:  $M = 20.52$ , 21-23 years:  $M = 26.05$ , 24+ years:  $M = 30.36$ ;  $F = 3.73$ ,  $p = 0.03 < 0.05$ ). However, no significant differences were observed in Internet Surfing and Searching Skills ( $F = 2.18$ ,  $p = 0.11 > 0.05$ ) or Database Skills ( $F = 0.29$ ,  $p = 0.75 > 0.05$ ). Significant differences were found in E-Mail Management Skills ( $F = 5.19$ ,  $p = 0.01 < 0.05$ ) and System Software Skills ( $F = 3.73$ ,  $p = 0.03 < 0.05$ ), with higher scores among older students.

5. When comparing information handling skills based on the program of study, significant differences were found in Data Handling and Storage Skills ( $F = 4.98$ ,  $p = 0.01 < 0.05$ ), with BS Education students scoring the highest ( $M = 27.63$ ). Similarly, significant differences were observed in System Software Skills ( $F = 4.98$ ,  $p = 0.01 < 0.05$ ), favoring students from BS Education and B.Ed. Hons. programs. However, no significant differences were found in Internet Surfing and Searching Skills ( $F = 1.35$ ,  $p = 0.26 > 0.05$ ), Database Skills ( $F = 1.42$ ,  $p = 0.24 > 0.05$ ), or E-Mail Management Skills ( $F = 0.18$ ,  $p = 0.84 > 0.05$ ).
6. Significant differences in information handling skills were evident across universities. Data Handling and Storage Skills showed the highest scores at Punjab University ( $M = 30.80$ ), with significant differences across institutions ( $F = 17.4$ ,  $p = 0.00 < 0.05$ ). For Internet Surfing and Searching Skills, the highest scores were also recorded at Punjab University ( $M = 32.05$ ), indicating a significant difference ( $F = 5.77$ ,  $p = 0.00 < 0.05$ ). Database Skills showed significant differences ( $F = 3.2$ ,  $p = 0.01 < 0.05$ ), with the highest scores at NUML and Punjab University. Lastly, E-Mail Management Skills ( $F = 10.5$ ,  $p = 0.00 < 0.05$ ) and System Software Skills ( $F = 7.38$ ,  $p = 0.00 < 0.05$ ) revealed significant variations, with NUML students demonstrating the highest proficiency.

### **Conclusions and Discussion**

Based on the findings of the study, it was concluded that a substantial gender gap was found whereby males did significantly better than females when it came to handling skills related to information handling skills, particularly in the areas of data and database management. Such findings have also been established by a number of other studies indicating that men are more likely to use ICT tools and do so confidently (Levin & Arafeh, 2020; Reimers, 2021).

ICT performance between urban and rural students represents the degree of availability of technology and resources. The students in urban areas managed to perform better in Internet Surfing and E-Mail Management Skills perhaps owing to the improved digital resources in urban settings (Woolliscroft, 2020). On the other hand, slightly better Data Handling Skills among rural students point out the possibility of other factors within the environment such as local educational systems to be responsible for possession of some specific skills (Ahmad & Sheikh, 2023). These interactions highlight the necessity of equitable resource distribution in order to foster digital infrastructure customization in rural areas.

Several information handling skills of Self-support prospective teachers were significantly higher than those of their peers in regular teacher education programs. It has been established in previous investigations that self-support students often have greater motivation for self-improvement due to external pressures (Triviño-Cabrera et al., 2021). The research proved, as the students grew older, their ability in various special information handling skills improved, which was a desire of many. This could be because as people age, they become more familiar with their environment, which helps them learn practical skills (Abdillah et al., 2021).

Prospective teachers studying in BS Education program had better information handling skills as compare to prospective teachers studying in MA Education and B.ED Hons. Program that highlight the potential benefits of a curriculum that emphasizes practical ICT applications (Hossein-Mohand et al., 2021).

Universities with a better ICT infrastructure appear to produce better qualified teacher graduates. Their training is also effective when adequate investment in ICT resources and teacher training is made. The quality of ICT education within these universities also varies, thus leading to differences in graduate competencies, especially when limited knowledge and skills in ICT integration were implemented in their training (Levin & Arafeh, 2020). Therefore, investment in ICT resources and teacher training across institutions can help standardize ICT skills development.

### **Recommendations**

Based on the findings and discussion, the following recommendations are proposed to enhance the information handling skills of prospective teachers:

1. Gender-sensitive ICT training programs that encourage male and female participation should be developed by educational institutions. It can help to counteract trends we see of gender differences in data handling and database skills.
2. In order to alleviate the gap in skill acquisition between urban and rural students, educational authorities need to work on enhancing digital infrastructure based especially for those who stay at their own hometowns (eg: improving internet speed or renewing computer labs) that allows them not only surf the net but also master email as well so all will have almost the same opportunities regardless of where they live.
3. Peer learning programs may be offered where older students mentor younger ones, promoting knowledge transfer and collaborative learning.
4. To ensure a thorough preparation of the future teachers, universities must invest in ICT infrastructure such as up-to-date software, e-learning, and appropriate teaching laboratories at teacher education institutions.

### **References**

- Abdillah, A., et al. (2021). Assessment of ICT skills and its role in modern education. *Journal of Information Technology Education Research*, 20(1), 45-67.
- Ahmad, R., & Sheikh, Z. (2023). ICT skill development among university students: Barriers and strategies. *International Journal of Educational Technology*, 50(3), 33-45.
- Ahmad, T., Hussain, S., & Mahmood, F. (2021). *The effectiveness of ICT integration in teacher education programs in Pakistan*. *Asian Journal of Education and Training*, 7(1), 15–22. <https://doi.org/10.20448/journal.522.2021>
- Ali, R., & Haq, M. (2021). *Prospective teachers' information handling skills for ICT-based instruction in Pakistan*. *Journal of Education & Research*, 9(2), 29–42. <https://doi.org/10.22492/journal.13202>
- American Library Association. (2022). *Framework for information literacy for higher education*. ALA Editions.
- Anderson, R. E., & Dexter, S. (2020). *The role of ICT in fostering innovative teaching practices*. *Educational Technology Research and Development*, 68(4), 1247–1270. <https://doi.org/10.1007/s11423-020-09758-5>
- Bawden, D., & Robinson, L. (2019). *Information and digital literacies: A review of concepts*. *Journal of Documentation*, 75(1), 29–50. <https://doi.org/10.1108/JD-07-2018-0115>
- David, F. (2005). *The essentials of research design and methodology*. John Wiley & Sons, Inc.
- Dogan, S., et al. (2021). Digital competence frameworks in teacher education.

- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.
- Greenhow, C., Lewin, C., & Willet, K. (2020). *Prospective teachers' digital practices and implications for education*. *British Journal of Educational Technology*, 51(5), 1482–1497. <https://doi.org/10.1111/bjet.12973>
- Hosseini-Mohand, A., Melo, A., & Turk, N. (2021). Digital competencies and information handling in ICT-enhanced learning. *Journal of Teacher Education*, 42(1), 15-28.
- Hussain, S., & Mahmood, S. (2022). *Digital literacy in Pakistan's teacher education programs: A case study*. *Pakistan Journal of Digital Education*, 4(2), 123–138. <https://doi.org/10.5678/pjde.2022.402>
- Khokhar, A., & Javaid, M. (2023). ICT integration and prospective teachers' perceptions.
- Knezek, G., & Christensen, R. (2008). *Teacher readiness for information and communication technology (ICT) literacy in the information age*. *Educational Research and Reviews*, 3(8), 262-272.
- Levin, D., & Arafeh, S. (2020). The digital disconnect: The widening gap between internet-savvy students and their schools. *Pew Internet & American Life Project*.
- Melo, A., & Turk, N. (2020). Assessing digital competencies in teacher education: A review. *Educational Technology Research*, 38(4), 109-122.
- Ministry of Federal Education and Professional Training. (2020). *ICT policy in education: Pakistan's approach to digital learning*. Islamabad: Ministry of Federal Education and Professional Training.
- Reimers, F. M. (2021). *Educating students to improve the world*. Springer.
- Selwyn, N. (2021). *Digital education: A critical introduction*. Routledge.
- Ghayyur, T. S., & Mirza, N. A. (2021). *Exploring TPACK skills of prospective teachers and challenges faced in digital technology integration in Pakistan*. *Journal of Development and Social Sciences*, 2(4), 226-241. [http://doi.org/10.47205/jdss.2021\(2-IV\)19](http://doi.org/10.47205/jdss.2021(2-IV)19)
- Ghayyur, T. S., Shamim-ur-Rasul, S., & Parveen, A. (2024a). Effect of 21st century skills on academic achievement of trainee teachers. *Social Science Review Archives*, 2(2), 1-10. <https://policyjournalofms.com/index.php/6/about>
- Ghayyur, T. S., Parveen, A., & Shamim-ur-Rasul, S. (2024b). Exploring literacy skills among trainee teachers and their effect on academic achievement. *Journal of Applied Linguistics and TESOL*, 7(4), 262–278.
- Ghayyur, T. S., Hasan, S., Nasreen, S., Malik, G. M., & Iqbal, K. (2024c). *Trainee Teachers' Readiness for English Language Learning through Digital Technology*. *Migration Letters*, 21(S10), 1-13.
- Triviño-Cabrera, A., et al. (2021). Digital competence during the COVID-19 pandemic: Lessons learned and future perspectives. *Computers & Education*, 169, 104221.
- Turk, M., & Akyuz, H. I. (2016). The readiness of Turkish teachers in information and communication technologies: A case study. *Education and Information Technologies*, 21(6), 1835–1846. <https://doi.org/10.1007/s10639-015-9430-7>
- Woolliscroft, J. O. (2020). Technology adoption in education: Lessons from the pandemic. *Journal of Digital Learning in Teacher Education*, 36(2), 67-74.
- Zhu, C., Wang, D., & Cai, Y. (2021). Enhancing ICT competencies in teacher education programs: A comparative study. *Journal of Educational Technology Development and Exchange*, 13(2), 31–47. <https://doi.org/10.18785/jetde.1302.04>
- Ghayyur, T. S., Parveen, A., & Shamim-ur-Rasul, S. (2024). Exploring literacy skills among trainee teachers and their effect on academic achievement. *Journal of Applied Linguistics and TESOL*, 7(4), 262–278.