



International Journal of Agriculture Extension and Social Development

ISSN Print: 2618-0723
 ISSN Online: 2618-0731
 NAAS Rating (2026): 5.04
 IJAESD 2026; 9(10): 34-39
www.extensionjournal.com
 Received: 25-07-2026
 Accepted: 19-09-2026
 Published: 02-10-2026

Rajni Kumari

Ph D Scholar, Department of
 Extension Education &
 Communication Management,
 CCS Haryana Agricultural
 University, Hisar, India

Santosh Rani

Assistant Scientist,
 Department of Extension
 Education & Communication
 Management, CCS Haryana
 Agricultural University, Hisar,
 India

Manju Dahiya

Professor, Department of
 Extension Education &
 Communication Management,
 CCS Haryana Agricultural
 University, Hisar, India

Digital competence of postgraduate students: Evidence from computer knowledge and training experiences

Rajni Kumari¹, Santosh Rani², Manju Dahiya³

DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i10a.4353>

ABSTRACT

The rapid integration of digital technologies into higher education has transformed the mode of teaching learning processes, necessitating adequate computer knowledge and training experiences among students. The present study was undertaken to assess the level of computer knowledge and training experiences of postgraduate students in a selected agricultural university of Haryana. The study followed an ex-post facto research design and was conducted among 120 postgraduate students selected through proportionate random sampling from two constituent colleges. Data were collected using a structured interview schedule comprising statements related to basic and advanced computer knowledge, along with training experiences. Descriptive statistical tools such as frequency, percentage, mean score, and categorization were used for data analysis. The findings revealed that an overwhelming majority of respondents possessed a high level of basic computer knowledge, while most students exhibited a medium level of advanced computer knowledge. Tasks related to routine academic use, such as document preparation, presentations, email communication, and online information search, were widely practiced, whereas advanced functions such as database creation, multimedia editing, and software installation showed comparatively lower proficiency. The study further revealed limited participation in formal computer training programs, with most trainings being short-duration and basic in nature. The results indicate a clear disparity between foundational and advanced digital competencies, highlighting the need for structured and advanced ICT capacity-building initiatives in higher education institutions. The study provides empirical evidence useful for curriculum planners and academic administrators to strengthen digital skill development among postgraduate students.

Keywords: Computer knowledge, ICT skills, Training experiences, Postgraduate students, Online education

Introduction

The integration of information and communication technologies (ICTs) has significantly reshaped the landscape of higher education across the globe. Digital tools and online platforms have become indispensable components of teaching, learning, and academic communication, thereby demanding adequate computer knowledge and digital competence among students. In contemporary higher education settings, students are expected not only to possess basic operational skills but also to demonstrate advanced competencies such as data handling, problem-solving using digital tools, and independent learning through online resources. Computer knowledge is widely recognized as a foundational requirement for effective participation in online and technology-mediated education. It encompasses a range of skills, from basic functions such as file management and document preparation to advanced tasks including data analysis, troubleshooting, and content creation. Studies conducted in diverse educational contexts suggest that while university students generally exhibit strong basic computer skills, proficiency in advanced ICT applications remains uneven (Ng, 2012; Ilomäki *et al.*, 2016; Spante *et al.*, 2018) [2, 1, 3]. This gap is often attributed to limited formal training opportunities and insufficient integration of advanced digital skills within academic curricula. In the Indian higher education context, several studies have reported that postgraduate students possess satisfactory levels of basic digital literacy due to frequent exposure to computers for academic and personal use (Biradar, 2017; Sharadamma *et al.*, 2025; Boro *et al.*, 2023) [4, 5, 6]. However, advanced computer skills such as database management, multimedia editing, and specialized software use are often underdeveloped. Panda *et al.* (2024) [7] and Kumari *et al.* (2022) [8] observed that the lack of structured ICT training programs contributes significantly to moderate levels of advanced digital competence among students.

Training experiences play a crucial role in enhancing computer knowledge and digital confidence. Formal training programs provide structured learning environments that facilitate the acquisition of both basic and advanced ICT skills. International studies have demonstrated that students who participate in organized ICT training exhibit higher levels of digital competence and self-efficacy compared to those relying solely on informal learning methods (Margaryan *et al.*, 2011; Tondeur *et al.*, 2017) [9, 10]. In India, however, access to systematic and advanced ICT training for students remains limited, often restricted to short-term or introduc-

Corresponding Author:

Rajni Kumari

Ph D Scholar, Department
 of Extension Education &
 Communication
 Management, CCS Haryana
 Agricultural University,
 Hisar, India

tory programs (Rathod *et al.*, 2021; Rafi *et al.*, 2023) [12, 11]. Despite the growing reliance on online education systems, empirical studies focusing specifically on the combined assessment of computer knowledge and training experiences among postgraduate students in agricultural universities are limited. Agricultural education increasingly incorporates digital tools for data analysis, extension communication, and research dissemination, making digital competence particularly relevant for students in this domain. Understanding students' existing levels of computer knowledge and their exposure to training programs is therefore essential for designing effective educational interventions.

Significance of the study

The present study holds significance in several ways. First, it provides a comprehensive assessment of both basic and advanced computer knowledge among postgraduate students, offering insights into their readiness for online and technology-mediated education. Second, by examining training experiences alongside computer knowledge, the study identifies gaps between skill acquisition and formal capacity-building efforts. Third, the findings are particularly relevant for agricultural universities, where digital competence is increasingly linked to research efficiency, extension services, and professional development. Finally, the study offers evidence-based inputs for curriculum developers, academic planners, and policymakers to strengthen ICT integration and design targeted training programs aimed at enhancing advanced digital skills among postgraduate students.

Materials and methods

The present study was undertaken to examine the determinants of postgraduate students' competency and attitude towards online education, with a focus on their computer knowledge and prior training experiences related to ICT tools. An ex-post facto research design was employed, as the phenomena under investigation had already occurred and could not be manipulated by the researcher. This design was deemed appropriate for understanding the influence of pre-existing skills and training on students' engagement with online learning platforms. The study was conducted at Chaudhary Charan Singh Haryana Agricultural University (CCS HAU), Hisar, Haryana, India, which was purposively selected due to its comprehensive academic structure and the extensive adoption of online teaching and learning practices. To ensure representation from different academic disciplines, two constituent colleges of the university, namely the I.C. College of Home Sciences and the College of Agriculture, were included in the study. Both colleges offer a wide range of postgraduate programmes, and their students had substantial exposure to online learning, making them suitable for the investigation. The target population consisted of postgraduate students attending online classes. A total of 120 students were selected using a proportionate random sampling technique, with 60 students drawn from each college. The final selection was carried out through simple random sampling, ensuring that each student had an equal opportunity to participate and minimizing potential selection bias. To assess students' abilities and prior exposure, a structured interview schedule was developed, comprising 27 statements designed to evaluate their current level of computer literacy and knowledge as well as prior experiences with ICT-related training. Computer knowledge was measured across basic and advanced skills, including fundamental operations, commonly used applications, and higher-order digital tasks relevant to online learning. Responses were recorded in a dichotomous format, with 'Yes' scored as 1 and 'No' as 2, and total scores were calculated for each respondent. Based on the minimum and maximum obtainable scores, students were categorized into low, medium, and high levels of computer knowledge, with separate scoring ranges for basic and advanced competencies. An overall level of computer knowledge was derived by combining these dimensions. In addition, the study captured information regarding students' prior training experiences with ICT tools. Respondents who had attended training were further assessed on several parameters, including the duration, organization, type, mode, sat-

isfaction, and quality of the training environment. Each parameter was assigned a score to quantify the extent and quality of training received. A higher composite score reflected greater exposure and more comprehensive training experience, which could potentially influence students' competency and attitudes toward online education. Data were collected through structured interactions, ensuring accurate recording of responses. The gathered information was carefully coded, classified, and tabulated. Descriptive statistics, including frequency and percentage, were employed to describe the distribution of students according to their computer knowledge and training experiences.

Results

The analysis of postgraduate students' computer knowledge and training experiences revealed significant patterns in both foundational and advanced digital competencies, as well as exposure to formal ICT training. These factors collectively provide insights into students' ability to engage effectively with online education platforms.

Basic Computer Knowledge: Data presented in Table 1 indicate that respondents possessed a strong grasp of fundamental computer functions. All respondents demonstrated proficiency in performing file management tasks, creating basic Word documents, copying and pasting text, preparing simple PowerPoint presentations, and conducting web-based information searches. High percentages of respondents were also proficient in sending and receiving email attachments (93.33%) and in starting and exiting computer programs (93.33%). Turning on and shutting down a computer properly (91.67%), changing font style and size in a document (90.00%), and downloading and saving files from the web (90.00%) were also common skills among the students. Moderate proficiency was observed in changing monitor brightness and contrast (75.83%), minimizing, maximizing, and moving windows on the desktop (86.67%), moving files from a hard drive to a USB drive (84.17%), and searching for files using the search command (85.83%). Skills such as creating Excel spreadsheets (67.50%) and printing documents (62.50%) were less common, suggesting limited familiarity with certain routine applications.

Table 1. Basic computer knowledge of the respondents $N = 120$

Sr. No.	Knowledge Statement	F (%)
1.	Properly turn on and shut down a computer	110 (91.67)
2.	Start and exit a computer program	112 (93.33)
3.	Change monitor brightness and contrast	91 (75.83)
4.	Minimize, maximize and move windows on the desktop	104 (86.67)
5.	Perform file management including deleting and renaming files, etc.	120 (100.00)
6.	Use a 'search' command to locate a file	103 (85.83)
7.	Move a file from a hard drive to a USB drive	101 (84.17)
8.	Create a basic word document	120 (100.00)
9.	Copy, cut and paste text in a document	120 (100.00)
10.	Change font style and size in a document	108 (90.00)
11.	Create a basic excel spreadsheet	81 (67.50)
12.	Create a simple presentation using power- point	120 (100.00)

(continued on next page)

Sr. No.	Knowledge Statement	F (%)
13.	Send and receive attachments through e-mail messages	112 (93.33)
14.	Search for information online using a web search engine	100 (83.33)
15.	Print a document using a printer	75 (62.50)
16.	Download and save files from the web (e.g., text, graphic, pdf files)	108 (90.00)

Table 2 summarizes the overall categorization of basic computer knowledge. The vast majority of students (98.33%) demonstrated high-level basic computer skills, while only 1.67% exhibited medium-level competency. The mean scores were 14.1 for the I.C. College of Home Sciences and 13.9 for the College of Agriculture, with scores ranging from 11 to 16. Figure 1 visually supports this distribution, clearly indicating that almost all respondents attained high-level basic computer knowledge. The high proficiency in basic computer operations could be attributed to routine exposure to computer use in academic tasks, personal use, and prior informal practice. These findings suggest that students are well-prepared to perform fundamental digital tasks required for participation in online learning environments.

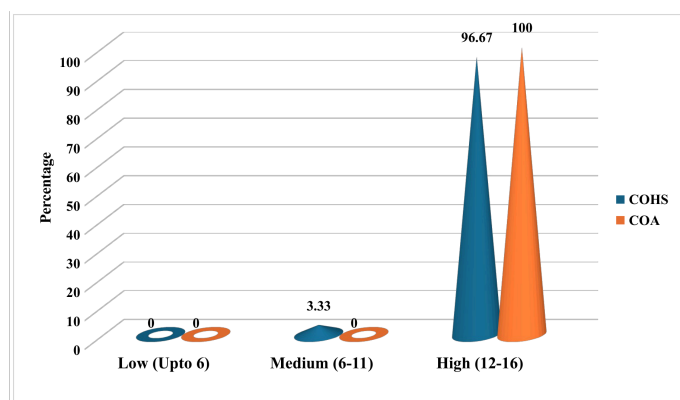


Figure 1. Basic computer knowledge level of the respondents

Advanced Computer Knowledge: Data in Table 3 show the respondents' performance in more complex computer functions. A substantial proportion of students were confident in troubleshooting computer problems (75.83%), resizing photographs (75.00%), understanding hardware-related terminology (74.17%), and learning advanced skills within specific software programs (73.33%). Writing files onto a CD was also a skill demonstrated by 73.33% of respondents. In addition, 69.17% could use Microsoft Excel for data analysis, and 58.33% could create simple web pages. However, lower proficiency was observed in scanning disks for viruses (50.83%), installing software programs (25.00%), recording and editing sounds (20.83%), and creating simple databases using Access (19.17%).

Table 2. Overall basic computer knowledge of the respondents $N = 120$

Categories	COHS $n = 60$	COA $n = 60$	Total $N = 120$
	F (%)	F (%)	F (%)
Low (Upto 6)	-	-	-
Medium (6-11)	2 (3.33)	-	2 (1.67)
High (12-16)	58 (96.67)	60 (100.00)	118 (98.33)
Mean score	14.1	13.9	14.04
Minimum obtained score = 11 Maximum obtained score = 16			

Table 3. Advance computer knowledge of the respondents $N = 120$

Sr. No.	Knowledge Statement	F (%)
1.	Install a software program	30 (25.00)
2.	Scan disks for viruses	61 (50.83)
3.	Create a simple Web page	70 (58.33)
4.	Write files onto a CD	88 (73.33)
5.	Resize a photograph	90 (75.00)
6.	Record and edit sounds	25 (20.83)
7.	Create a simple database using Access	23 (19.17)
8.	Use the Microsoft excel for analyzing the number data	83 (69.17)
9.	Confident learning advanced skills within a specific programme	88 (73.33)
10.	Confident troubleshooting computer problems.	91 (75.83)
11.	Confident understanding the terms/words related to hardware.	89 (74.17)

Table 4 presents the overall categorization of advanced computer knowledge, showing that the majority (85.84%) had medium-level proficiency, 12.50% had high-level skills, and only 1.66% fell into the low-level category. Mean scores were 6.11 for the College of Home Sciences and 6.8 for the College of Agriculture, with scores ranging from 3 to 9. Figure 2 provides a visual representation of this distribution, highlighting that most students had moderate advanced computer skills, with only a small fraction achieving high proficiency. The lower performance in certain advanced tasks may reflect limited formal training opportunities, infrequent use of specialized software in routine academic work, or lack of practical exposure to complex ICT applications. These findings suggest that while students are well-equipped for basic online tasks, there may be constraints in performing advanced operations that could enhance productivity or learning outcomes.

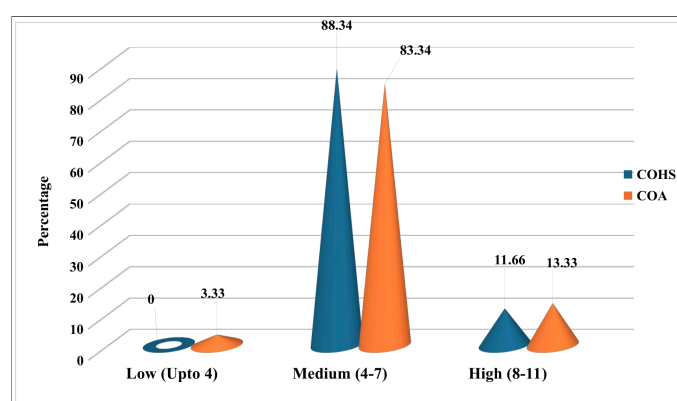


Figure 2. Advance computer knowledge of the respondents

Training Experiences: Participation in formal ICT training among the respondents is summarized in Table 5. The majority of students (79.17%) had not attended any computer training, while only 20.83% reported prior training experiences.

Table 4. Overall advance computer knowledge of the respondents $N = 120$

Categories	COHS $n = 60$ F (%)	COA $n = 60$ F (%)	Total $N = 120$ F (%)
Low (Upto 4)	-	2 (3.33)	2 (1.66)

Medium (4-7)	53 (88.34)	50 (83.34)	103 (85.84)
High (8-11)	7 (11.66)	8 (13.33)	15 (12.50)
Mean score	6.11	6.8	6.15
Minimum obtained score = 3 Maximum obtained score = 9			

Table 5. Computer training attended by the respondents $N = 120$

Training experience		COHS $n = 60$		COA $n = 60$		Total $N = 120$	
		F	%	F	%	F	%
Training/s	Attended	12	20.00	13	21.67	25	20.83
	Not attended	48	80.00	47	78.33	95	79.17

Table 6. Computer training experience of the respondents $N = 25$

Training experience		COHS $n = 12$		COA $n = 13$		Total $N = 25$	
		F	%	F	%	F	%
1. Duration of training/s	Less than 1 month	12	100.00	13	100.00	25	100.00
	1-2 months	-	-	-	-	-	-
	More than 2 months	-	-	-	-	-	-
2. Organization of training/s	Govt.	11	91.67	11	84.62	22	88.00
	Private	1	8.33	2	15.38	3	12.00
3. Type of training/s	Basic	12	100.00	12	92.31	24	96.00
	Advance	-	-	1	7.69	1	4.00
4. Mode of training/s	Online	10	83.33	9	69.24	19	76.00
	Offline	2	16.67	4	30.76	6	24.00
5. Satisfaction	Yes	12	100.00	13	100.00	25	100.00
	No	-	-	-	-	-	-
6. Training Environment	Excellent	-	-	2	15.38	2	8.00
	Good	12	100.00	11	84.62	23	92.00
	Poor	-	-	-	-	-	-

Among those who participated, Table 6 details the characteristics of the training programs. All respondents attended short-duration programs of less than one month. Most training sessions were conducted by government institutions (88.00%), with the remainder from private organizations (12.00%). The majority of training was basic in nature (96.00%), with only 4.00% representing advanced-level training. Regarding the mode of training, 76.00% attended online sessions, while 24.00% participated in offline training. All respondents reported satisfaction with the training received, and most rated the training environment as good (92.00%), with a small proportion indicating an excellent environment (8.00%). The limited participation in formal training may explain the moderate level of advanced computer knowledge observed among respondents. Despite high proficiency in basic skills, the lack of structured, in-depth training programs likely constrained the development of advanced competencies, such as software installation, database creation, and multimedia editing. The predominance of short, basic-level training programs primarily online may have been sufficient to reinforce fundamental skills but insufficient to develop higher-order technical abilities.

Discussion

This study investigated postgraduate students' levels of computer knowledge and training experiences as determinants of competency and attitudes toward online education. The results reveal distinct patterns across basic and advanced digital skills, as well as limited formal training exposure. These findings are discussed below in relation to relevant studies.

Computer knowledge level

The results presented in Table 1 and Table 2 (supported by Figure 1) indicate that postgraduate students exhibited high levels of basic computer knowledge. Nearly all respondents demonstrated proficiency in fundamental computer functions such as file management, document preparation, email use, and web-based information search. This finding is consistent with multiple studies reporting high levels of basic digital literacy among higher education students internationally. For example, Ng (2012) [2] reported that university students generally possess strong foundational ICT skills, particularly in document creation and internet use. Similarly, Spante *et al.* (2018) [3] found that basic operational digital competence is widespread among tertiary students across contexts, supporting effective engagement with learning technologies. In the Indian context, studies by Sharadamma *et al.* (2025) [5], Boro, Laltlanzova, and Chanchinmawia (2023) [6], and Kaushal Kishor Chaudhary (2024) similarly found that postgraduate students demonstrate high proficiency in basic computer tasks such as word processing and internet browsing. These studies suggest that regular academic requirements and personal use of computers contribute to strengthened basic skills. Goswami and Deka (2022) also reported that undergraduate and postgraduate students in North Eastern universities exhibited strong basic computer literacy, indicating that such competencies are widespread across regions. Despite strong performance in most basic tasks, lower proficiency in specific functions such as creating spreadsheets and printing aligns with findings by Selwyn (2016) and Gebru *et al.* (2021) [13], who reported variability in digital task mastery depending on the frequency and context of use. In line with these outcomes, researchers such as

Ilomäki *et al.* (2016) [1] and Krumsvik (2014) [14] emphasize that skills not routinely practiced tend to remain underdeveloped. The pattern of moderate advanced computer knowledge (Table 3 and Table 4; Fig. 2) observed in this study is congruent with broader literature that distinguishes between basic and advanced digital competencies. Although many respondents could troubleshoot problems, resize images, and understand hardware-related terms, skills such as database creation and multimedia editing were less prevalent. This aligns with studies by Gebru *et al.* (2021) [13] and Getenet, Cante, and Redmond (2024) [15], which found that advanced digital tasks are less frequently mastered by general student populations without targeted training. Research in India by Biradar (2017) [4] and Panda *et al.* (2024) [7] revealed that while postgraduate students are proficient in routine ICT tasks, advanced competencies such as programming, database management, and data analysis require deeper learning and exposure. These findings corroborate the notion that advanced skills are contingent upon structured instruction and hands-on practice. International research likewise supports this interpretation. Margaryan, Littlejohn, and Vojt (2011) [9] found that university students across Europe and North America often display moderate competence in advanced ICT skills unless specifically taught. Similarly, digital literacy frameworks developed by Helsper *et al.* (2013) [16] and Hatlevik, Guðmundsdóttir, and Loi (2015) [17] emphasize that advanced digital competencies develop more slowly and unevenly compared to basic skills.

Training experiences

The distribution of training experiences in this study (Table 5 and Table 6) reveals that a majority of postgraduate students had not attended formal computer training, and those who did were primarily exposed to short, basic-level programs. This observation reflects similar patterns in the literature. For instance, Tondeur *et al.* (2017) [10] and Sang, Valcke, van Braak, and Tondeur (2010) reported that formal ICT training among university students is often limited in scope and duration, leading to gaps in advanced digital proficiency. In the Indian setting, research by Rathod *et al.* (2021) [12] found that less than one-third of students participated in structured ICT skill-development programs, with a significant reliance on informal learning strategies. Similarly, Kumari *et al.* (2022) [8] reported that postgraduate students' moderate digital skills were linked to the lack of comprehensive training modules within academic curricula. Positive evaluations of training environments and satisfaction levels in the current study echo findings by Rafi *et al.* (2023) [11], who noted that students value ICT training opportunities even when they are basic in nature. However, the predominance of online modes and short durations suggests that training may reinforce only basic competencies, rather than fostering advanced, transformative digital skills.

Relationship between skills and training

The overall pattern of results high basic skills, moderate advanced skills, and limited formal training parallels findings in both Indian and international research. For example, Adewale and Awodele (2022) reported that students who lacked extended ICT training were less confident in advanced computer tasks despite strong foundational skills. In contrast, studies by Balwant (2016) and Dwivedi and Lal (2018) demonstrate that structured, sustained training significantly enhances higher-order ICT competencies. Further, studies focusing on digital competence frameworks suggest that higher education institutions play a crucial role in facilitating progression from basic to advanced digital skills. For instance, Mishra *et al.* (2021) [18] emphasized integration of digital literacy modules within syllabi to support holistic competence development.

Implications of findings

Taken together, the findings suggest that postgraduate students are well-equipped with basic digital skills necessary for routine academic tasks but may require enhanced training interventions to develop advanced competencies. The moderate level of advanced computer

knowledge and limited exposure to formal training underscore the need for curriculum enhancements, targeted workshops, and sustained capacity-building efforts, supported by evidence from both Indian and global research.

Conclusion

The present study examined the level of computer knowledge and training experiences of postgraduate students in relation to online education systems. The findings revealed that postgraduate students possessed a high level of basic computer knowledge, enabling them to effectively perform routine academic tasks such as document preparation, presentations, email communication, and online information retrieval. However, the level of advanced computer knowledge was predominantly moderate, indicating limited proficiency in specialized ICT applications such as database creation, software installation, and multimedia editing. The study further revealed that only a small proportion of students had participated in formal computer training programs, and most of these trainings were short-term and basic in nature. While students expressed satisfaction with the training received, the limited duration and scope of such programs appear insufficient to support the development of advanced digital competencies. The disparity between strong foundational skills and moderate advanced competencies underscores the need for systematic and structured ICT capacity-building initiatives within higher education institutions. Overall, the study highlights the importance of strengthening advanced digital skills through targeted training and curriculum integration to enhance students' preparedness for technology-mediated learning environments. The findings offer valuable insights for educators, institutions, and policymakers to design effective interventions aimed at fostering comprehensive digital competence among postgraduate students.

Major conclusions

- The majority of postgraduate students demonstrated a high level of basic computer knowledge, indicating adequate preparedness for routine academic activities in online learning environments.
- Advanced computer knowledge among students was largely at a medium level, reflecting limited exposure to complex ICT applications and specialized digital tools.
- Participation in formal computer training programs was relatively low, and the trainings attended were predominantly short-term and basic in nature.
- A clear gap exists between basic and advanced digital competencies, suggesting the need for structured and continuous ICT skill development.

Recommendations

For students

- Postgraduate students should actively engage in self-directed learning and enrol in advanced ICT skill development programs to enhance competencies beyond basic computer operations.
- Students should regularly practice advanced digital applications such as data analysis software, multimedia tools, and problem-solving platforms to strengthen hands-on skills.
- Students are encouraged to utilize available institutional digital resources, online tutorials, and open learning platforms to continuously upgrade their digital proficiency.

For institutions and policymakers

- Higher education institutions should integrate advanced ICT skill modules into postgraduate curricula to ensure systematic development of digital competencies.
- Institutions should organize regular, structured, and practice-oriented computer training programs focusing on advanced applications relevant to academic and professional needs.

- Policymakers should promote institutional support mechanisms, including infrastructure enhancement and faculty-led digital skill training, to foster a digitally competent student community.

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How to cite this article: Kumari R, Rani S, Dahiya M. Digital competence of postgraduate students: Evidence from computer knowledge and training experiences. *International Journal of Agriculture Extension and Social Development*. 2026;9(10):34–39. doi: <https://www.doi.org/10.33545/26180723.2026.v9.i10a.4353>