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Assessment of Teachers Digital Literacy: Theory of Change during COVID-19 in Rural Located Universities of Pakistan

Farhan Ullah Khan ¹ Sajjad Ali ² Akhtar Ali ³ Abdul Shakoor ⁴

Abstract: *This research focuses on delineating the initial profile of digital education abilities among instructors at Malakand and Swat universities. Employing a quantitative methodology, a survey assessed the digital literacy landscape, gathering data from 56 instructors through a meticulously designed questionnaire and simple random sampling. Findings revealed a prevailing trend where a significant majority of instructors primarily used laptops, complemented by external earphones and the Zoom application for online classes. Additionally, the study identified that instructors, on average, demonstrated a moderate understanding of online and digital tools. This research not only illuminates the current state of digital literacy among instructors but also underscores the need for targeted interventions to enhance their proficiency in navigating the contemporary digital education landscape.*

Key Words: Teachers, Digital Literacy, COVID-19, Rural Universities, Pakistan

Introduction

In the current advanced society, we are more and more reliant on the digital world. New concepts and platforms are expanding daily and expanding in scope. More than ever, it's crucial to be digitally literate (Cheuk, T. 2019). This is especially true if we take into account all the difficulties we have faced as a result of the environment shift. Additionally, this exchange takes place between in-person courses and emergency remote instruction. The way we learn and teach has undergone several changes as a result of technological advancements. Education has become simpler as a result of digital technology (Rashid & Usman, 2013).

The emergence of the "knowledge society" implies societal change, necessitating the development of new skills and capacities among people. On the one hand, the accessibility of technology has encouraged world-class colleges to create advanced programmes and novel ideas to speed up and broaden both teaching and learning (Jonrand and Dwyerand, 2020). Research indicates that implementing new educational technologies without tracing them does not improve teaching and learning outcomes (pupils, 2007). University professors should be experts in digital literacy in the context of the growth and expansion of the digital society, but this is frequently seen as something that is taken for granted (Poore, 2011).

Nowadays, we have the abilities and tools to help us with the compassionate mission of creating, producing, authoring, and growing ourselves. But without a general level of digital literacy, we won't be able to collect liberating intelligence. Digital education is described as the development of technological skills for using knowledge and information technology, together with all media-related industries and skills (Pero, 2014). A collection of interconnected abilities or capabilities essential for accomplishment in the digital era that has unfolded and altered in multiple techniques and is addressed in a paradigm that is recognised by governments and countries is known as digital literacy (Perez and Tornero, 2019).

¹ Undergraduate Student, Department of Journalism & Mass Communication, University of Malakand, KP, Pakistan.

² Assistant Professor, Department of Journalism & Mass Communication, University of Malakand, KP, Pakistan.

³ Independent Researcher, Based in Peshawar, KP, Pakistan.

⁴ Assistant Professor, Department Mass Communication, Lahore Leads University, Punjab, Pakistan.

▪ **Corresponding Author:** Sajjad Ali (sajjadjmc@uom.edu.pk)

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Teachers frequently consider how to effectively manage, use, and communicate online teaching materials. Being an active user of these tools is not a requirement for using them to support meaningful learning (Poore, 2011). In order to instruct and assist their pupils, teachers must learn new abilities in order to use the same technology in addition to enabling children to add to their own knowledge and to enable them to comprehend what to do with the information that is offered to them in so many various ways. When working on their lessons, teachers must be able to feel comfortable in the online environment, especially when selecting online resources and digital tools that have value for them and their pupils. New technologies demand new ways of thinking and teaching since human-machine contact differs greatly from the kind of engagement that is encouraged in communicative language schools. Being an adept user of new technologies as a teacher is not a requirement for understanding how to use and fully implement them to create relevant environments.

The emphasis on greater-order understandings and outcomes in higher education calls for a significant shift in the communication- and information-based society (Thomas, 2011). Therefore, the traditional e-learning approaches are no longer sufficient to meet the demands of modernised learning processes, particularly in higher schooling. The high demand for e-learning content, particularly multimedia components, necessitates abrupt storage development and dynamic coexistence requirements, which cannot be supplied by traditional e-learning approaches. The ability of the e-learning topic to be utilized and sorted is crucial to enhancing the development of multimedia content since creating multimedia e-learning topics is time-wasting and unreasonable.

Additionally, the learning materials used in traditional teaching methods are rigid and cannot contribute to the widely dispersed learning resources. As a result, traditional approaches are unable to handle the problems of cost distribution, managing the tremendous expansion in storage needs for multimedia elements and optimising resource allocation.

The Framework of Electronic Learning

According to Brandon Hall Research Reports' definition (Clarey, 2009), e-learning is teaching that is somewhat or entirely supplied electronically on a network browser, such as Netscape, through the Internet or media platforms, like Compact disk or Digital video disk. Electronic learning, or online learning, is a technique that uses the Internet (Riahi, 2015). A crucial component of service-oriented computing, cloud computing continuously demonstrates exceptional abilities in scalability, adaptability, and accessibility (Wang, Shi, & Zhang, 2017, June). The ability to distribute computing and repository reserves as actions has made cloud computing a popular technology in education (Dong, Zheng, Qiao, Shu, Yang, Jaatun, Zhao, Rong, 2009).

E-learning can improve its learning process by implementing cloud computing. When cloud computing technology is used in the field of online education, all available computing hardware and software resources can be used to provide e-learning services (Riahi, 2015). A private Cloud architecture and its modules, including a Monitoring Management component, Security component, and others, were well demonstrated in 2009. (Sulistio et al., 2009). For students to have their own Java environment for experimentation, CCloudIA offers on-demand creation and configuration of virtual machine images. These images contain MySQL, PHP, and an Apache web server. The BlueSky Cloud framework was introduced as another prominent e-learning framework in the same year (Dong et al., 2009). The problems with the use and scalability of e-resource learning were resolved by BlueSky. Ethiopian Universities Hybrid Cloud (EUHC) was introduced by Shaik Saidhbi (2012).

In order to maximize resource utilisation and support quality of service (QoS) goals like high availability, performance, reliability, scalability, load balancing, and security in Cloud service models, their framework specifies the virtualization technology to be used to build an academic Cloud over the current university infrastructure. The next year, Kaur and Chawla presented a Cloud E-Learning (CEL) platform as a means of implementing advanced Java e-learning in the Cloud. The learning application layer of the frameworks described clear learning material.

A five-layer Cloud system for e-learning with three Cloud services was proposed by Rajput and Deora, (2020). The receptacle also utilized virtual technologies to create a cloud-based academic infrastructure



over top of the infrastructure already in place at the universities. A concept leveraging social Cloud was proposed that same year (Siegle, R. F., Roscoe, R. D., Schroeder, N. L., & Craig, S. D. (2020, December).

The stability of the current cloud learning frameworks was implemented to add value to the current research based on the findings of the literature investigations. The development of a new educational domain that shares cloud properties, particularly reusability and shareability, has since been proposed using a cloud e-learning architecture. The user interface layer, application layer, cloud management layer, data information layer, and virtual infrastructure layer are the five levels that make up the proposed cloud e-learning framework. Each layer of the structure is composed of a number of parts serving various functions.

E-Learning Teaching Application

Online learning resources are now widely used in colleges and institutions. By employing eLearning web apps, you may give your students a productive learning experience. E-learning web apps support students' academic growth. It has eliminated time and space limitations, enabling communication between parents, instructors, and learners from anywhere in the world. Online education has changed considerably since the launch of Electronic learning web apps (Salman, 2012). A learning web app is an interactive online application that enables users to input data and receive anticipated outcomes via instructions. The app can be seen by students using a web browser and an effective internet connection.

This study's goal is to develop and test a theoretical model for predicting IT students at a public university in Malakand and Swat's continued intent to use electronic learning applications. An extensive Cloud e-learning application is created, integrating a number of Web and Cloud learning capabilities.

Frequently Used E-Learning Web Applications

Finding the right educational web apps for students will make learning enjoyable despite the abundance of options. Our skilled creators of website applications have selected a few of the student-friendly e-learning website applications that have been created with noteworthy characteristics. Such mechanisms will motivate your learners to prioritise their academics and manage their time effectively. Below is a list of awesome online apps for e-learning. Depending on your needs, you are free to select anybody you like;

Mobile supported Applications

- Google Classroom
- Zoom
- Whatsapp
- Kahoot
- Seasaw

Computer-based Applications

- Photomath
- Edmodo
- Socratic
- Scratch
- Prezi

Statement of the Problem

Most research pertaining to the significance of teachers' digital literacy for online teaching applications (Fawley & Neely, 2014) has predominantly concentrated on developed nations, with a limited number of studies extending their focus to underdeveloped countries. The available literature reveals a scarcity of research on Pakistan, as evident in the works of Cooper (2013) and Rjoub and Civcir (2017), and there is either an absence or an inadequacy of research conducted in this region. This study endeavors to address this research gap by examining the importance of teachers' digital literacy in the context of online teaching applications within the academic settings of the universities of Malakand and Swat.

Significance of the Study

This study seeks to evaluate the digital literacy proficiency of teachers from Malakand and Swat Universities. Digital literacy, in this context, denotes the acquisition of skills necessary for teachers to navigate, learn, and engage in a digitally-driven society where communication and information access predominantly occur through technologies such as internet platforms, social media, and mobile devices. Proficiency in digital literacy empowers teachers to transcend a mere procedural understanding of technology, enabling them to creatively integrate digital resources into their instructional methodologies. These skills extend beyond conventional literacy, fostering the use of contemporary teaching methods through online applications. Additionally, this study endeavors to underscore the significance of integrating digital technology into educational policies, advocating for its inclusion in the curriculum to meet the needs of both teachers and students in the modern era.

Objectives of the Study

- To evaluate the digital literacy of UOM and UOS teachers.
- To analyze the challenges to the teachers in the selected universities.
- To determine the applications they used.
- To find out the drawbacks of online teaching
- Look for the most convenient e-learning applications.

Research Questions

RQ1: What is the teachers' knowledge about online teaching applications?

RQ2: What application did they use for online teaching in their respective universities?

RQ3: What were the most convenient E-learning applications for a teacher in the mentioned universities?

RQ4: What were the challenges and problems of online teaching applications faced by teachers?

RQ5: How do teachers manage it?

Literature Review

Educational frameworks utilizing Electronic Learning Cloud systems are pertinent within the context of e-learning, as defined by Brandon Hall Research Reports (Hall, 2005). E-learning, as articulated in this definition, encompasses pedagogical methods delivered partially or entirely through electronic means, employing network browsers (e.g., Netscape) and multimedia platforms such as Compact and Digital video disk, facilitated via the Internet. The nomenclature "electronic learning" or "online learning" is interchangeably employed, the latter denoting a modality leveraging the Internet (Riahi, 2015). Within the paradigm of service-oriented computing, cloud computing emerges as a pivotal constituent, consistently manifesting noteworthy attributes in terms of scalability, adaptability, and accessibility (Zhang et al., 2017).

To optimize resource utilization and uphold Quality of Service (QoS) objectives such as high availability, accomplishment, reliability, scalability, load balance, and security in Cloud services, the framework underscores the selection of hypervisor technology for constructing an academic Cloud within the existing institutional infrastructure. The structure encompasses a Data Information Layer and a Cloud Management Layer.

Addressing the dynamics of behavior modification within the context of technology adoption, the theoretical framework posits the significance of internal and external variables. Self-efficacy, a fundamental construct within Social Cognitive Theory (SCT), emerges as a pivotal factor influencing the acceptance of technology. According to Bandura (1986), SCT posits that technology adoption depends not only on the perceived advantages it offers but also on the user's competence and comfort level with the technology.

Computer self-efficacy, a key predictor in technology acceptance, is defined as an individual's belief in their ability to effectively utilize new technology and applications (Bandura, 1977, 1989; Compeau and Higgins, 1995). The study asserts that an individual's ability to mobilize motivation, cognitive resources, and requisite courses of action to meet situational demands is contingent upon their level of self-efficacy



(Bandura, [1989](#)).

Citing Liew et al. ([2014](#)), the research highlights empirical evidence suggesting that computer self-efficacy significantly influences behavior in simulation-based learning contexts. The study by Gan and Balakrishnan ([2017](#)) further corroborates that computer self-efficacy moderately predicts behavioral intention in the context of mobile technology adoption. In the educational domain, existing literature (Alqurashi, [2016](#); Chester et al., [2011](#); Domenech-Betoret et al., [2017](#); Hillier et al., [2013](#); Schunk, [1985](#); Shank and Cotten, [2014](#); Valencia-Vallejo et al., [2016](#)) consistently demonstrates the positive impact of computer self-efficacy on students' acceptance of technology for learning purposes.

The notion of motivation has aided various studies in behavioural explanation in the field of motivational psychology. Two main motivational elements are included in motivation theory: external inspiration theory.

In their study of user behaviour intention in the workplace, Davis et al. ([1992](#)) examined the effects of extrinsic (such as perceived usefulness) and intrinsic (such as enjoyment) motivation and discovered that both were significant predictors of behaviour intention to use technology. Since then, numerous researchers have used and investigated motivation theory to comprehend how people accept and use new technologies (Davis et al., [1992](#); Koo et al., [2015](#); Park et al., [2014a](#); Venkatesh and Speier, [1999](#)). The degree to which a person feels content while carrying out a work without the need for external reinforcements is referred to as enjoyment (Davis et al., [1992](#); Scott et al., [1988](#); Vallerand, [1997](#)). One of the fundamental motives that propels people to accomplish something because they enjoy doing it is always portrayed as enjoyment. Numerous studies have shown that enjoyment.

The development of electronic learning utilising Cloud technology is motivated by the readiness of cutting-edge Internet and Cloud technologies. This is done in order to support the flexibility of learning subjects and to deal with problems with conventional understanding techniques. Based on the cloud computing environment and the evolution of the computer fundamentals contents in institutes, cloud computing has been embraced to facilitate collaborative learning and distant e-learning (Lin, [2011](#)). A five-layer Cloud system for e-learning with three Cloud services was proposed by Rajput and Deora in [2017](#). (Rajput and Deora, [2017](#)).

The user interface layer, application layer, cloud management layer, and data information layer are the five levels that make up the recommended cloud electronic learning. Behaviour implies that alterations in human behaviour are influenced by both internal and external causes. The idea of self-efficacy is a key tenet of SCT. According to SCT, adoption necessitates not only the advantages offered by the technology but also the user's aptitude and level of comfort with it (Bandura, [1986](#)). A key predictor of technology acceptance is computer self-efficacy, which refers to one's belief in one's ability to use new technology and applications (Bandura, [1977](#), [1989](#); Compeau and Higgins, [1995](#)). An individual's capacity to find motivation, access cognitive resources, and choose the appropriate courses of action depends on their level of self-efficacy.

Research Methodology

The research, as per Creswell's ([2014](#)) framework, encompasses methodologies and strategies that guide the progression from generalizations to comprehensive approaches in data collection and analysis. It amalgamates theoretical presumptions, tactics, and precise methodologies, with qualitative and quantitative research methods representing two primary avenues. The present investigation adopts a quantitative methodology, employing a research design for data collection. Participants in this study consist of educators affiliated with the University of Malakand and the University of Swat, both situated in the rural and hilly regions of Khyber Pakhtunkhwa, Pakistan. Notably, these institutions operate in crisis-prone areas affected not only by natural disasters like floods and earthquakes but also by manmade crises such as terrorism and talibanization.

Data acquisition occurred through a self-developed questionnaire aligned with pertinent literature, objectives, and research questions. The arduous nature of data collection spanned nearly three months, encountering numerous challenges. The University of Malakand, as per its official website, employs 570 individuals, with 284 serving as teaching faculty across 28 departments, catering to approximately 7,000

enrolled students. The University of Swat offers 35 degree programs, boasts 133 faculty members, and accommodates 8,230 students across two campuses. Despite disseminating the Google Questionnaire through official university-created WhatsApp groups with repeated requests for timely completion, challenges arose due to delayed responses attributed to faculty members' busyness or limited digital literacy.

Responses were meticulously recorded in Excel and subsequently exported to SPSS for in-depth analysis. As an exploratory study, data presentation assumes a descriptive format, aligning with the study's investigative nature.

Results

The findings of the study indicate that the extensive sample of teachers from Malakand and Swat universities exhibits markedly low average scores in the attainment of digital education. While teachers demonstrated relative ease in accessing digital literacy indicators for information retrieval, the proficiency in utilizing knowledge to implement practical applications remains notably deficient. The academic community faces a considerable task in enhancing its competency in digital technology.

The comprehensive dataset underscores a limited inclination among teachers to acquire digital technology skills, signaling a concerning trend for both educators and their students. This is particularly noteworthy given the challenges posed by the sudden shift to online teaching during the Covid-19 pandemic, where a rapid transition from traditional to exclusively online instructional methods occurred, relying heavily on Internet and digital technologies.

Classes Location in COVID-19

Table 1

Frequency	Percent	Valid Percent	Cumulative Percent
Away from workplace	27	48.2	48.2
In the same city of work place	19	33.9	82.1
In university	10	17.9	100.0
Total	56	100.0	100.0

The table shows that 48.2% of respondents were away from university, 33.9% were living in the same city, and just 17.9% of them were living in their respective universities during COVID-19.

Have you ever Taught a Course online before COVID-19

Table 2

Frequency	Percent	Valid Percent	Cumulative Percent
Yes	20	35.7	35.7
No	36	64.3	100.0
Total	56	100.0	100.0

Regarding the query, 35.7 % of teachers said that they taught a course online before Covid 19, while 64.53% of teachers never taught a course online before.

I Taught a course Online when the COVID-19 Pandemic Started

Table 3

Frequency	Percent	Valid Percent	Cumulative Percent
Yes	44	78.6	78.6
No	12	21.4	100.0
Total	56	100.0	100.0

According to this, 78.6% said that they had taught a course online when Covid-19 started.



In which Area

Table 4

Frequency		Percent	Valid Percent	Cumulative Percent
Practical Sessions	13	23.2	23.2	23.2
Theoretical Sessions	41	73.2	73.2	96.4
Others	2	3.6	3.6	100.0
Total	56	100.0	100.0	

This data can be interpreted in a way that 73.2% of online classes are conducted in the Theoretical area, 23.2% in the Practical area and only 3.6% in other areas.

What was the Duration?

Table 5

Frequency		Percent	Valid Percent	Cumulative Percent
Valid	Less than one year	31	55.4	55.4
	1-2 years	21	37.5	92.9
	more	4	7.1	100.0
	Total	56	100.0	100.0

The duration graph indicates that 55.4% of teachers conducted online classes for less than two years, 37.5 1-2 years, and 7.1% recorded more than the mentioned time span.

Usage of Various Devices for Online Teaching during COVID-19 How do you use the following Devices for your Online classes?

Table 6

Variables	Count	Very often, Row Valid N%	Count	Often, Row valid N %	Count	Sometimes, Row valid N%	Count	Rarely row valid N%	Count	Never row valid N%.
Laptop	29	51.8	14	25.3%	9	16.3%	4	7.1%	0	0.0%
Desktop	10	17.7	15	26.6%	15	26.3%	5	8.9%	11	19.11%
Smartphones	28	50.0	17	30.2%	9	23.4%	1	1.8%	1	3.5%
Tablets	5	8.9	21	37.4%	13	23.4%	4	8.9%	12	23.4%
Smart display	13	23.22	14	25.7%	9	16.1%	5	8.9%	8	16.7%

Furthermore, the results of the t-test of digital literacy of teachers in Malakand and Swat universities showed a significant difference ($p < 0.05$, where $p = 0.000$). These results show that the level of digital literacy of teachers in different classes shows that higher-level classes have better digital literacy skills than lower classes. It is also seen that the digital literacy of teachers dominates in indicators of finding information compared to other digital literacy indicators. The average level of digital literacy of teachers is based on different classes. It shows that most of the teachers used laptops for online teaching as compared to other devices like tablets, smartphones, etc. Teachers use tablets very little for online teaching applications.

Usage of Various Devices with Modern Accessories for Online Teaching during COVID-19: What Additional Equipment or Accessories do you use for your Online Class?

Table 7

Variables	Count	Very often, Row Valid N%	Count	Often, Row valid N %	Count	Sometimes, Row valid N%	Count	Rarely row valid N%	Count	Never row valid N%.
Earphones	29	51.3%	17	30.3%	6	10.4%	3	5.3%	1	1.9%
Headsets with microphone	17	30%	21	37.1%	10	17.3%	7	8.3%	1	1.9%
External microphone	4	17.2%	18	32.4%	11	19.2%	9	16.1%	4	7.3%
Additional speakers	7	25.3%	18	32.3%	14	19.3%	5	12.4%	11	19.3%

The above table shows what additional equipment is used by teachers in online teaching. This equipment includes a microphone, earphones, an external microphone, additional speakers, etc. 51.3 shows that

teachers mostly used earphones for online teaching. At the same time, 17.2% show that they often used an external speaker for online teaching.

Usage of different Applications for online Teaching during COVID-19 which Applications do you use most to Conduct Online classes?

Table 8

Variables	Count	Very often	Count	often	Count	sometimes	Count	Rarely	Count	Never
Zoom	23	42.2%	21	41.2%	8	37.2%	2	3.2%	2	3.6%
WhatsApp	12	10.3%	7	23.3%	15	32.3%	1	2.3%	2	3.6%
WeChat	14	21.4%	9	27.4%	16	23.2%	12	23.6%	9	16.1 %
Facebook Messenger	7	14.1%	4	14.4%	13	17.3%	4	12.5%	14	25.2%
Google Meet	8	17.2%	12	23.3%	16	12.2%	7	17.3%	20	33.3%

From the result, it was found that the value of the Zoom application was high(42.2), which means that most of the teachers use Zoom as compared to others for online teaching. The teachers very often use Zoom for online teaching applications. After Zoom, the ratio of Google Meet is high as compared to other applications. They often use Google Meet for online teaching applications.

Usage of Various Applications with Extensions for Online Teaching during COVID-19: How much have you used the Following Features?

Table 9

Variables	Count	Very often	Count	often	Count	sometimes	Count	Rarely	Count	never
Screen share	13	23.2%	24	42.9%	15	26.8%	1	1.8%	3	5.4%
Chat	19	33.9%	20	35.2%	12	21.4%	3	5.4%	2	3.6%
Backdrop and effects	03	5.4%	19	33.9%	17	30.4%	8	14.3%	9	16.1%
Microphone	11	19.6%	16	28.3%	16	28.6%	4	7.1%	9	16.1%
Framing images	20	35.7%	25	44.6%	7	12.5	2	3.6%	2	3.6%
Microphone	19	23.2%	19	33.9%	13	23.2	4	7.1%	1	1.8%

This table indicates that most of the teachers used screen sharing and chat while conducting online classes with their students.

Do you Think Online Teaching has any Drawbacks?

Table 10

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	26	46.4	46.4	46.4
Neutral	10	17.9	17.9	64.3
Valid Disagree	4	7.1	7.1	71.4
Strongly disagree	16	28.6	28.6	100.0
Total	56	100.0	100.0	

This table demonstrates that among 56 teachers, more than 50% of teachers agreed that online teaching has significant drawbacks and suggested that it could not be a better option for our students and teaching system.

Do you Think Students can Learn Better from Online Teaching as Compared to Traditional Methods?

Table 11

	Frequency	Percent	Valid Percent	Cumulative Percent
Agree	14	25.0	25.0	25.0
Neutral	9	16.1	16.1	41.1
Valid Disagree	24	42.9	42.9	83.9
Strongly disagree	9	16.1	16.1	100.0
Total	56	100.0	100.0	



This table demonstrates that 25% of teachers strongly agreed that students could learn better from online teaching as compared to the traditional method, 16.1 % agreed, 42.9% disagreed, and 16.1 strongly disagreed regarding the question asked.

Do you Think Teachers should be Equipped with Digital Literacy?

Table 12

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not at all	5	8.9	8.9	8.9
	To some extent	24	42.9	42.9	51.8
	Very much	27	48.2	48.2	100.0
	Total	56	100.0	100.0	

This table reveals that among 56 teachers, 8.9% think that teachers should not be equipped with digital literacy, 42.9% think that they need to be equipped to some extent with digital literacy, and 48.2% think that the teachers need to be very much equipped with digital literacy.

Conclusion

In remote and underdeveloped regions, both students and educators are often categorized as possessing introductory or rudimentary levels of digital literacy. In comparison to rural counterparts, urban areas exhibit slightly superior proficiency in digital literacy. The capacity of educators to impart digital literacy skills is significantly influenced by disparities in socioeconomic status, class, and gender. Notably, male educators exhibit greater efficacy in teaching digital literacy, and those in higher academic levels demonstrate a more adept capability.

Distinct expectations are observed in urban and rural settings concerning digital literacy skills. Urban areas anticipate students and instructors to acquire proficiency in digital literacy, whereas rural areas anticipate educational institutions to invest in technology. Individuals with high socioeconomic status tend to possess enhanced digital literacy empowerment, attributing to their reduced exposure to digital literacy resources compared to those with lower socioeconomic status.

The comprehensive study indicates that, on average, university educators exhibit moderate levels of digital literacy, highlighting the ongoing need for substantial efforts to enhance digital technology proficiency within their respective academic institutions.

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