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Revisiting the impact of digital literacy on the healthcare employee's performance: Evidence of the multiple mediating effects

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Abstract---The objective of the was study to investigate the impact of digital literacy on the healthcare employee's performance. The study used theoretical network approach to conceptualize the topic from review of the previous studies whereas, a quantitative deductive cross-sectional survey was employed for primary data administering 07-point scales from HEIs in Pakistan. Pilot study was conducted to establish the reliability and validity of scales inter alia determining the sample size, i.e., 163. The study found significant t-value for TDL while for rest of the group's ADL, UDL, and EX, it was found insignificant. This study discloses partial mediation by ADL between TDL, UDL and TDL between ADL and UDL. The relation of TDL & EP was insignificant. Full mediation was found for TDL on relationship between UDL and EP. The study also reveals full mediation for ADL for UDL and EP while no mediating effect of UDL was found for ADL and EP. Out of seven mediation models, three emerged with full mediation while three were rejected because of insignificance. One model did partial mediation. The findings suggest the use of customization of digital technology in accordance with the native conditions. The study is different for previous studies, it investigated the digital literacy with regards to the healthcare administrative staff of in Pakistan. The findings will be helpful to the decision makers to review and formulate policies for digitization to resolve the issues associated with conventional mode of operations.

Keywords---Digital Literacy; Employee Performance; Awareness in Digital Literacy' Training in Digital Literacy; Use of Digital Literacy; HEIs.

1 Introduction

In 21st century, people who fail to unlearn and relearn are considered illiterate (Martin & Dunsworth, 2007). The term computer literacy transformed eventually with the improvement

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of technology as today's societies are depending more on the computers. Some 50 years ago, computer literacy implies if a person is incapable to understand and program a computer system (Hassan & Fook, 2012). Today, computer literacy refers to the command on a computer system inter alia the capability to use and generate knowledge in a skillful way (Kundi & Nawaz, 2011). People interchangeably use terminologies like computer competency, computer proficiency, and computer literacy (Soliman, 2014). The need for a widespread computerliteracy is imperative because ICTs today have dominant role in the contemporary business. The experts believe and accept the social aspects of ICTs that will lead to acceptance of electronic literacy thus it could resolve the issue of digital divide (Ezziane, 2007). Different segments of society for example, students, teachers, and employers have disagreement on what computer literacy implies. Since 25 years, numerous models and approaches on computer and information literacy were introduced (Hsu et al., 2011). Today, skills for digital literacy are recognized for active learning. Where people are getting technology literacy either formally in schools or informally at workplace (Khan, 2013). The term Digital literacy generally refers to using the blend of cognitive, emotional, social, technical, and procedural skills while delivering lectures in non-conventional class. This involves the use of a computer, internet, and the procedural skills (Kundi & Nawaz, 2010), likewise, cognitive skills imply the talent to instinctively comprehend the visual contents through the user's graphic interface. With the growing acceptance of digital technologies for learning, it is believed that digital literacy is disposed to constant changes and hence it is imperative for the educators to regularly review and update the courses i.e., inclusion of advanced technology (Khan, 2013). Digital technologies can enhance the performance of employees in HEIs. Despite huge investments by the HEIs in establishing technological infrastructure, the raise in performance of employees have not been witnessed. In order to take full advantage of digital techniques, some of the perquisites have to be fulfilled. Among these prerequisites digital literacy is of foremost significance. The objective of the study to investigate the impact of digital literacy on the employee's performance. It was aimed to get knowledge and skills about Digital-Literacy [DL] and Employee Performance [EP], statistically compute the relationships between DL and EP using correlation, regression, mediation.

Literature Review

Digital literacy crafts a platform where information users can access information via internet instantly they need that consequently changes users' the information searching behavior (Oye *et al.*, 2012). It involves more than the ability to operate a digital gadget or use a software. It includes a variety of complex skills like, cognitive, sociological, and emotional skills. These skills are needed to get command on effectively use of digital settings. Unluckily, studies on digital literacy lack a well-documented theoretical under pinning (Soliman, 2014). Digital literacy is the effective and critical navigation, evaluation, and the creation of information with the help of digital machineries. It demands recognition and power to manipulate and convert digital media to dispense extensively since it is easy to adapt and innovate (Hsu *et al.*, 2011). Digital literacy. The concept of digital literacy refers to the mix of two terms i.e., digital and the literacy, likewise, digital information is the figurative demonstration of data, whereas literacy stands for the capability to read and attain knowledge, logical writing, and critical thinking (Oye *et al.*, 2012).

Digital literacy requires certain skills that are interdisciplinary in nature. The 21st century skills include information skills, media skills, and technology skills, learning and modernization skills, and career skills needed by an individual to be digitally literate and to lead the organization. To achieve these skills, a person is required to be competent in information and media literacy and information & communication technologies (ICTs) (Hassan & Fook, 2012). Furthermore, within learning and modernization skills, a person must be competent to use his creativity, problem solving skills, skills of critical thinking, and skills of communication and teamwork. It is imperative to apply flexibility, adaptability, crossculture, and social skills efficiency with accountability, responsibility, and leadership. EshetAlkalai proposed five kinds of literacies in digital age (Hargittai, 2008), these include information, reproduction, photo-visual, branching, and socio-emotional literacies.

Currently digital literacy is the prominent feature of the jobs and a person with digital literacy can easily communicate and retrieve information inter alia disseminate it to improve his/her life. Academic administrative staff excessively needs these technological skills since they become the basic requirement of their jobs. It is therefore very important that they need to be encouraged to learn and professionally grow (Oye et al., 2012). The existing view of new generation as being digitally literate is not only false rather it also results in serious issues with regard to their approach for the technology-driven education. Although users in the age group of 13-16 are considered experts in use of technology however, it is recorded that they are doing little since they just use it to find some facts and figures. Thus, they are deficient to evaluate information and solve the problems with technology because they apply very little critical thinking while using digital platforms (Soliman, 2014). The young users hold basic awareness and word recognition, yet they lack the ability to read a text, create sense from it, evaluate and analyze it. They are functionally illiterate but on other hand this also demonstrate' their ability to handle a variety of gadgets in order to reinforce their digital literacy (Hsu et al., 2011). Digital literacy could guarantee place for a student in jobs market since it develops right skills to develop new a business, product, or a service. In several countries, emphasis is given to these skills from the very early age. Once a person equips himself with correct skills, there are more chances for growth in the professional life (Fox, 2012). Explosion of technologies during the digital era confronts individuals with situations that require the use of technical, cognitive, and sociological skills that are necessary to perform effectively in digital environments. These skills are termed as 'digital literacy' (Lankshear & Knobel, 2008). Digital literacy is the technical ability of users' to operate digital gadgets adequately; it comprises a diversity of skills that are employed in executing tasks in digital environments such as building knowledge during browsing the net, decoding user interfaces, searching databases, creating, and sharing content, chatting, and communicating in social networks, etc. (Hassan & Fook, 2012).

Digital literacy in HEIs

If this handy technology is used rightfully it can be a powerful tools for administration and academic staff to accomplish the objectives of education at anytime, anywhere and for anyone. The ICTs overcome the learning constraints in terms of time and space (Haddad & Jurich, 2006). Studies have found interdependence between ICTs and academic results like improved behavior to education (Hassan & Fook, 2012). For instance, computer-based teaching can enhance the level of motivation and feelings of affiliation. E-Learning is used generally for distance education by substituting the face-to-face instructional settings (Soliman, 2014). Therefore, the role of eLearning is quite evident from the changing priorities of HEIs i.e., satisfying the needs of diverse learners, lifelong learning, and better connection between teaching and research inter alia engaging the end-users (Nawaz & Kundi, 2010). ICTs are driving force that are transforming the way through which HEIs are welcoming the new digital

platforms (Hassan & Fook, 2012). There is a misunderstanding that ICT essentially has to end up in the commercialization of educational; however, it is not true as some of the traditional institutions, teachers, and students strongly disagree with this notion in higher education (Nawaz & Kundi, 2010; Nawaz, 2010). They are of the view that strategic application of IT is also helpful to preserve the old and creating the new teaching, learning and management. Many traditional HEIs are using ICTs without any intention of commodification of higher education. During the last decade, the expectations in commercial prospects of online higher education remained frustrating. Huge funds were lost, several significant projects entirely failed. Whilst these digital platforms made accessible all digital resources to the users without charge, this shows a clear, 'de-commodification' (Hsu *et al.*, 2011). Below is the discussion on the elements of digital literacy.

Awareness of Digital Literacy [ADL]

It is imperative that decision-makers have to understand the ICTs since their knowledge about computers and associated technologies is helpful in decisions and policies, otherwise the gap will increases between the user perceptions about the use of ICTs. Generally administrative staff in HEIs is given computer-training to perform office functions by using office automation tools (Soliman, 2014). In the developed countries, administrative staff is given training for use of EMIS, EDSS, and LMS, etc. (Nawaz, 2011). Comparatively, developing nations still needs to train the decision makers to use basic and preliminary office automation tools in dispensing their assignments, and even, maximum of them learn it informally from their colleagues inter alia self-training (Hsu *et al.*, 2011). Awareness of the growing importance of digital literacy in today's workplace coexists paradoxically with apparent foot-dragging on the part of many HEIs in assessment and amplification of these important competencies. The digital literacy about computer awareness does not only include computer hardware and software rather it also includes the information about the orgware and peopleware. Awareness also includes knowledge, skills, and attitudes; aptitude captures reflection and intention; generativity brings the potential for creativity. The overlay of literacy, aptitude, and creativity is meant to give meaning to the complex iterative processes by which users learn about, interact with, assimilate, and transfer information technology artifacts and concepts processes that are neither linear nor deterministic (Murray & Perez, 2014). Today, most of the users have computers where computer literacy is considered as the knowhow of computer system (Sattar at al., 2010). The awareness people enable them to effectively communicate especially with people having knowledge and skills (Sainz at al., 2008). Current trends indicate that most computing skills will be learned informally (Ezziane, 2007), likewise according to Hoffman & Blake (2003), lack of awareness is one of the causes of low penetration of digital gadgets into the academic environments of HEIs in the developing countries.

Training in the Digital Literacy [TDL]

The application of these new technologies requires proper training of the users in line with their job demands (Uzma Hafeez, 2015). Teachers, students, and administrative staff needs to learn how to use these gadgets for teaching and also different operations performed by them (Nawaz, 2010). The management gets training and formal qualification in computer literacy mostly through on-the-job training (Hsu *et al.*, 2011). One can get it through an informal training extended by the colleagues, etc. (Hassan & Fook, 2012). The formal as well as informal training is essential to generate an aggregate influence of digital learning to support the work. The personnel are presumed to keep on learning computers to be equipped to deal with changes in hardware and software in addition to their expertise and digital knowledge (Soliman, 2014). The reality of delivering institutional-wide training programs to staff with differing need-based

skills and attitudes (Ascilite, 2014), which demands staff development program to deliver competency training using a multi-layer approach. The process of identifying training requirements by the way the needs assessment relied on staff to accurately assess their own training needs against a set of job role competencies which is designated by their manager (Halla *et al.* (2014; Liu, 2013).

Why are Digital Literacy Skills Important?

Digital literacy is a key 21st century skill, which significantly enhances graduate employability (Labbo *et al*, 2011). It is consistently reported by the employers that it is hard to find and recruit ICT skilled personnel. Since mid-2008, the shortage of skills is evident in some areas and will get more severe in the next ten years with an increasing demand of the industry, and the advancement of technology. The old workers are getting retired with decline in ICT graduates. In occupations where university education is required, the shortages will persist because of a shortage in the supply. This could be bridged through supply of local graduates and through international talent hunts. The vicissitudes of digital economy also result into concerns since digital literacy divide is evident, it has been observed that some of the groups are lagging behind in their skills because they have limited or no access to the new gadgets. It is not essential that digitally literate must be experts in a specific software, yet they generally get expertise when they use the programs. This belief is alike to the on-the-job training. On the job training includes learning the job-related skills while using those skills to get work done assigned to them (Labbo, 2008). Based on these evidence, learning digital skills will be a strategic objective for educational institutions. Thus, basic technology skills and knowledge are viewed as necessary employment tools for the workforce (Abha Gupta & Hassan Ndahi, 2002), thus institutions need to devise plan to meet the growing urge of digitally literate graduates.

Use of Digital Literacy [UDL]

The digital literate has the economic security since new jobs demand knowledge of computers for perform the basic office tasks (Hsu *et al.*, 2011).White collar office functions are now days performed via computers and other portable gadgets. These jobs need the proof of digital literacy at the time hiring or promotion. Sometimes organizations have their own tailor-made for their employees, or otherwise an official certification is required (Soliman, 2014). Since technology is getting cheaper and handy, readily available, the blue-collar jobs also demand digital literacy too (Oye *et al.*, 2012; (Kate Watson, 2015).

Use is the necessary technical fluency needed to engage with computers and the Internet. Essential technical skills include the ability to use common and specialized technologies, software, and platforms. In order to develop these skills, people must have access to, and be comfortable utilizing, equipment, and knowledge resources such as computers and mobile devices, a range of software, platforms, and online databases (Kate Watson, 2015; Ozdamar *et al.*, 2015). Ddigital literacy might contribute to a more efficient use of educational software and of computer programs, such as word processors or spreadsheets, for completing school assignments (Argentin *et al.*, 2014). Knowing about and understanding computer use refers to a person's declarative and procedural knowledge of the generic characteristics and functions of computers. The developers need such computing curriculum that must covers the technological aspects of computer hardware and software as well as the human and organizational dimensions may also be placed in use (Sattar *et al.*, 2010). Computer as a contrivance can enhance thoughts. A student can be given opportunities to engage in the digital composing and reading that will allow him to discover new ideas, realize the communicative goals, and develop digital setting. To investigate the utilization of digital literacy by computer users under different

digital circumstances, a task-oriented research approach, in which participants are required to perform with real-life authentic tasks need to prefer (Alkali *et al.*, 2004).

Employees' Performance [EP]

Every organization performs its task with the help of resources like men, machine, materials, and money. Manpower utilizes other resources and gives output, has the highest priority, and is the most significant factor of production (Anjum *et al.*, 2011). Ignoring the human resource can be disastrous. In wording of Oliver Sheldon "no industry can be rendered efficient so long as the basic fact remains unrecognized that is human". The human resource is critical and difficult to manage since human behavior is highly unpredictable. Every organization has been established with certain objectives to achieve, which can be achieved by utilizing the resources. The contribution of employees on job is the most important factor for development and excellence in business, where performance of employees on different jobs in close coordination is needed for success (Manzoor, 2012).

Employees' Performance and Digital Literacy

Digital literacy (DL) has several aspects for example, DL awareness, DL training as well as DL usage has been considered by several studies as the predictors of employee's performance. All these plays significant role at the workplace. Likewise, TDL is given to employees with the expectation to increase the UDL. Thus, it plays a role of catalyst for change in the performance. Noway, digital literacy is considered "survival skill" - a vital force that assists the end users to work intuitively while doing complex digital assignments (Nawaz & Kundi, 2011). Recently, enormous efforts are under way to conceptualize the cognitive skills to be used by the employees in digital platforms (Hargittai, 2008). However, it is unfortunate that these efforts are generally local, and focus only on the selected with inadequate diversity of skills, largely information-exploring skills (Bawden, 2008; Lankshear & Knobel, 2008). It is because of this; it does not cover the required scope of digital literacy. Eshet-Alkalai (2004) has developed a comprehensive conceptual model, he argues that his model covers almost most all main cognitive skills which the user can apply (Soliman, 2014). He derived his model after explored large amounts of qualitative and empirical data user's behavior in digital environments.

Eshet & Amichai-Hamburger (2004) have tested the performance of various groups of users whose tasks need the application of digital skills. Hsu *et al.* (2011) and (Aviram & Eshet (2006) reported positive relationship between the digital literacy and performance of the employees whereas Hassan & Fook (2012) supported the findings of Hsu *et al.* (2011). Performance indicators simply represent management information (Anninos, 2007). It is obvious that criteria are suitable tools but promoting continuous quality improvement is a main issue (Carin & Good, 2004). Performance indicators are measures of inputs, processes, outputs, outcomes, and impacts for development projects, programs, or strategies (Manzoor, 2012). Performance of the organizations are evaluated against different criteria (Razavi, 2007). Performance of governmental organizations is sometimes defined in relation to governmental goals where process control is more important that output indicators (Abdulkareem & Oyeniran, 2011; Anjum *et al.*, 2011).

The concepts of efficiency, effectiveness and adaptability are considered significant indicators of employee performance (Anninos, 2007). However, gradually, new concepts and models were introduced to measure the satisfaction of stakeholders. Therefore, performance should be evaluated according to development strategy (Anjum *et al.*, 2011). Effectiveness is the concept of how effectual an organization is in realizing the results the organization planned to generate.

It plays an important role in accelerating organizational development. Organizational effectiveness is defined as the extent to which an organization, by the use of certain resources, fulfills its objectives without depleting its resources and without placing undue strain on its members and/or society (Carin & Good, 2004). It is linked with the employee individual performance (Ishaq *et al.*, 2009). Likewise, efficiency improvement is now the important goals of reforms in the developing countries. Accordingly, organizations concentrate on their employee's efficiency and efforts more (Li, 2011). Similarly, the concept of responsiveness is built-in regarding customer service that is why it is considered as an indicator and tool for customer's service excellence. Furthermore, innovations and creativity are the driving forces of today's organizations to survive the cutthroat competition, digital literacy is associated with innovations since it rebuilds thinking and minds towards more flexible, dynamic, and vibrant organizations (Anjum *et al.*, 2011). Based on the relationship between IVs, MVs and DV, the study proposed the below hypotheses:

H₁: All the predictors (factors of digital literacy) are highly associated with the employees' performance.

H₂: Digital literacy brings variation in the employees' performance.

 $H_{3\mathchar`-10}$ Mediators bring significant changes in the relationship between predictors and a criterion variables.

H₁₁₋₁₆: The demographic modifies the subjects' opinion.

Demographic Impacts

The studies reports that the views of the sample respondents are changing for the research variables due to demographic differences, for example age, experience, and qualification etc. This study employed t-test and ANOVA to study the significant mean difference on five demographic attributes of the sample respondents.



Theoretical Framework



Figure 1: Schematic Presentation of Theoretical Framework

The figure 1 demonstrates the schematic model of the research model which was built on nine different models including one main and eight mediation models. Main model displays association between predictors and a mediator inter alia the demographics impacts tested through H₁, H₂, and H₁₁ to H₁₅. The models one and two 2 are 'internal' where mediation process was tested through three predictors using UDL between the criterion i.e., H₃ & H₄. Likewise, from models three to eight, all three predictors were used interchangeably to test their influence on the criterion variable i.e., employees' performance (EP) i.e., H₅-H₁₀.

2 Materials and Methods

A quantitative deductive cross-sectional survey was employed to gather primary data via questionnaire from the sample respondents recommended by Babbie (1993: 257 and Yin, 1994:6; Sekaran, 1999: 257). Two public and private sector healthcare education institutions i.e., Gomal medical college DIKhan and Rahman medical Institute Peshawar were elected for data collection from the sample respondents. All employees of these two institutes were the target population. A pilot study was initiated to test the instrument and to determine the sample-size. Data of pilot study were put in the formula to determine the sample size. With use of formula for the finite population i.e., 650 employees, it gave 163 as sample size.

Table	1
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Sample Size Calculation from Pilot Study

z-Value	SD	Е	Ν	n	
1.96	0.67	0.096	652	163	

Variables and their attributes were extracted previous studies and a structured questionnaire was developed. There demographic variables covering all the related attributes of the respondents that are anticipated to affect their responses. Six variables were used to measure the attitude. Instrument on 7-point scale was administered. The used study theoretical network

approach to conceptualize the topic from review of the previous studies for data collection, analysis, interpretation and reporting the findings since theory is an established principle to perform these functions (Goode & Hatt, 1952:9; Babbie, 1993: 49; Sekaran, 1999:103). Likewise, an Argumentation by (Toulmin, 1858), 'Grounded-theory' by (Glasser & Strauss, 1967) were also used for thematic-analysis, illustrated in figure 2.



Figure 2: Theoretical Network Approach for QDA Mediation-Analysis

In mediation, a variable if carries the influence of a given predictor on the given criterion variables is considered as a mediator (Kenny, Kashy, & Bolger, 1997). It happens if predictor influence the mediator; the predictor significantly influences the criterion in the absence of a mediator. Whereas a mediator exerts significant unique impact on the criterion variable. Finally, influence of predictor on criterion variable shrinks when mediator is added in the regression-model, it is used to informally judge whether or not there is any mediation (Baron & Kenny, 1986).



Figure 3: Baron, & Kenny (1986) Mediation-Model

3 Results and Discussions

Both descriptive and inferential analyses were done; the results of the empirical data analysis are as follows:

Descriptive Results

Table 2

	Qualification				
Designation	B.A-M.A	M-PHIL./ PH-D.			
5-16	49	19			
17-18	22	41			
19 & above	05	27			
Total	76	87			

Designation & Qualification

Table 3

Designation & Computer-Qualification

Designation	Computer's Qualification					
	Informal-Learning	Trained-User				
5-16	50	42				
17-18	17	39				
19 & above	06	09				
Total	73	90				

Table 4

Descriptive Facts (n = 163)

		Min.	Max.	Mean	SD
1	Awareness of the D.L.	1	5	4.31	.693
2	Training in the D.L.	1	5	3.45	.614
3	Use of D.L. at workplace	1	5	4.01	.958
4	Employees' Performance	1	5	3.54	.618
5	Employees Experience	1	5	16.57	12.80
6	Employees Age	25	58	41.34	11.27

Hypotheses Testing

Analysis of the Association

H1: There is a significant association between all the predictors and the criterion variable. Table

5

Correlation Analysis (H₁)

Variables	CR	A.D.L	T.D.L	U.D.L
Awareness of the Digital Literacy (ADL)	r	1		
Training of the Digital Literacy (TDL)	r	.381**	1	
Use of the Digital Literacy (UDL)	r	.693**	.427**	1
Employees' Performance (EP)	r	.324**	.513**	.233*

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

It could be seen in Table 5 that significant association exist between all the predictors and a criterion variable which is evident on the statistical significance. Training in digital literacy demonstrates powerful association with employees' performance, likewise, awareness of digital literacy is the second in r-weight, followed by the use of digital literacy r .233 at p-value .001. H₁ is therefore substantiated since it is apparent that all the variables are mutually associated.

Cause-n-Effect Analysis

H₂: Predictors explain significant influence on the criterion variable.

Table 6

Summary of Model (H₂)

Model	R	R ²	R ² Adjusted	SE of the	F	р
				Estimate		
1	.515a	.462	.358	.535	38.761	.000a

Excluded Variables (H₂)

	Model	Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	1.812	.287		6.292	.000
	TDL	.489	.085	.524	6.135	.000

Table 6c

Excluded Variables (H₂)

Мо	Model β In		βIn t p r		Collinearity Statistics	
						Tolerance
1	ADL	.144a	1.588	.112	.156	.863
	UDL	.022a	.237	.811	.023	.817

Results for regressions are presented in table 6, 6a, and 6b. Multiple regression was run for all the predictors on the criterion variable. R² is 0.462 is explaining 46% of variance being described by the predictors, yet, in coefficients, one predictor i.e., training in digital literacy is significant at p-value of +< 0.001 with big β weight 0.524. Likewise, awareness about digital literacy and use of digital literacy appeared with small β weights also insignificant at p-values 0.112 and 0.811. Result suggests accepting the hypothesis for explaining 46% of variance in use of digital literacy.

Mediation-Analysis

Mediation is a statistical process to compute the 'intermediate role' of the factor that explain change in the relationship between the predictor and the criterion variable. Below are the criteria for assessment of mediation models:

- 1. 'a' needs to be significant (IV-MV).
- 2. 'b' needs to be significant (MV-DV).
- 3. 'c' needs to be significant (IV-DV).
- 4. 'ć' might/might not to be significant (IV-MV-DV).

a. Mediation Model-1

H₃: The training in digital literacy was claimed as a significant predictor for use of digital literacy, and awareness of digital literacy was assumed as a mediator.



Figure 4: Mediation Model-1

a. Computing 'a' Model-1

Table 7

Summary of Model (H₃)

Model	R	R ²	R ² Adjusted	SE of the Estimate	F	р
1	.372a	.148	.139	.646	16.767	.000a

Table 7a

Coefficients (H₃)

Model		Un- Coeff.		S-Coeff.	t	Sig.
		β	SE	β		
1	(Fixed)	2.792	.452		7.924	.000
	TDL	.401	.198	.372	4.195	.000

a. IVs: (Fixed) TDL

b. DV: ADL

b. Computation of 'b, c, & ć' for Model-1

Table 7b

Summary of Model (H₃)

Model	R	R ²	R ² Adjusted	SE of the Estimate	ΔR2	F	р
1	.427a	.175	.167	.884	.175	22.189	.000a
2	.715b	.508	.501	.683	.345	53.919	.000b

Table 7c

Coefficients [H₃]

Model		Un-Co	oeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	1.781	.483		3.692	.000
	TDL	.618	.144	.418	4.703	.000
2	(Fixed)	653	.473		-1.381	.171
	TDL	.281	.112	.187	2.511	.015
	ADL	.862	.104	.624	8.418	.000

a. IVs: (Fixed), TDL

b. IVs: (Fixed), TDL, ADL

c. DV: UDL

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Results of stepwise multiple regression (SMR) for IV-DV and IV and MV-DV, results illustrate that R² changes from 17 percent 51 percent i.e., 0.175 to 0.508 because of the mediating effect Likewise, weight for β 'c' decreased from .618 to .281 as well as p-value from .000 to - .015 substituted by a big weight of β for mediator 'b', i.e., .862. Furthermore, e 'ć' is also significant which confirms partial mediation, so H³ is substantiated.

b. Mediation Model-2

H₄: Awareness of digital literacy was supposed as a predictor of use of digital literacy, and training in digital literacy was used as a mediator.



Figure 5: Mediation Model 2

a. Computing 'a' Model-2

Table 8

Summary of Model (H₄)

Model	R	R ²	β	t-value	F	р					
1	.378a	.248	.372	4.193	16.749	.000a					

a. IVs: (Fixed), ADL; b. DV: TDL

Table 8a

Coefficients (H₄)

Model			Jn-Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.101	.369		5.863	.000
	ADL	.345	.085	.372	4.194	.000

b. Computing 'b, c, & ć' Model-2

Table 8b

Summary of Model (H₄)

Model	R	R ²	R ² Adjusted	SE of Estimate	ΔR^2	F	р
1	.693a	.498	.475	.711	.498	96.682	.000a
2	.715b	.529	.501	.685	.030	52.939	.000b

a. IVs: (Fixed), ADL

b. IVs: (Fixed), ADL, TDL

c. DV: UDL

Table 8c	
Coefficients (H4)	

Model		Un-C	Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	064	.421		156	.878
	ADL	.958	.099	.693	9.832	.000
2	(Fixed)	652	.472		-1.383	.170
	ADL	.872	.103	.623	8.427	.000
	TDL	.283	.111	.186	2.510	.015

Table 8c

In the SMR for IV-DV and IV and MV-DV, R² increased from 50% to 53% (0.498 to 0.529) because of the mediator effect. Moreover, weight for β of 'c' decreased from .958 to .872 at p-value did not change i.e., +< 0.001. The weight of β for mediator 'b' is .283. Since 'ć' is 'significant' thus, it gives partial mediation, therefore, we accept our hypothesis H₄.

c. Mediation Model-3

H₅: Training in digital literacy was taken as a predictor of employee's performance, and awareness of digital literacy was taken as a mediator.



Figure 6: Mediation Model 3 (Mediator = ADL)

a. Computing 'a' Model-3

Table 9

Summary of Model (H₅)

Model	R	R ²	R ² Adjusted	SE of the	F	р
				Estimate		
1	.373a	.159	.139	.655	16.774	.001a

Table 9a

Coefficients (H₅)

Model		Un-C	Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.895	.365		7.933	.000
	TDL	.401	.098	.373	4.086	.000

a. IVs: (Fixed), TDL

b. DV: ADL

b. Computing 'b, c, & ć' Model-3

Table 9b

Summary of Model (H₅)

Model	R	R ²	R ² Adjusted	SE of the Estimate	ΔR^2	F	р
1	.513a	.278	.258	.53513	.266	38.761	.000a
2	.532b	.314	.269	.52352	.018	21.423	.000b

Table 9c

Coefficients (H₅)

Model		Un-C	Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	1.812	.287		6.291	.000
	TDL	.489	.078	.514	6.145	.000
2	(Fixed)	1.451	.369		4.036	.000
	TDL	.448	.083	.461	5.156	.000
	ADL	.137	.078	.143	1.597	.114

a. IVs: (Fixed), TDL b. IVs: (Fixed), TDL, ADL

c. DV: EP

In the SMR for IV-DV and IV and MV-DV, R² raised from 28% to 31% (0.278 to 0.314) due to role of mediator. Likewise, weight of β of 'c' decreased nominally from .489 to .448 at p-value +< 0.001. Weight of β for mediator 'b', .137, yet insignificant at p-value of .114, exhibiting no mediation, so we reject hypothesis H₅.

d. Mediation Model-4

H₆: It was supposed that training in digital literacy significantly predicts the employee's performance, and use of digital literacy mediates significant relationship between training in digital literacy and employee's performance.



Figure 7: Mediation Model 4 (Mediator = UDL)

a. Computing 'a' Model-4

Table 10

Summary of Model (H₆)

	Mod	el R	R2	R	² Adjusted		SE of the	F			р	
					-		Estimate				-	
	1	.418a	.176		.168		.878	22.197			.000a	
Т	Fable 10a: Coefficients (H6)											
	Model		T	Un-Coeff.			S-Coeff.		t		р	
		β		SE		β						
	1 (Fixed)		1.872		.485				3.68	4	.000	
		TDL	.638		.154		.428		4.72	3	.000	

a. IVs: (Fixed), TDL

b. DV: UDL

b. Computing 'b, c, & ć' Model-4

Table 10b

Summary of Model (H₆)

Model	R	R ²	R ² Adjusted	SE	ΔR^2	F	р
1	.513a	.266	.259	.536	.266	37.753	.000a
2	.516b	.272	.253	.538	.000	18.742	.000b

Table 10c

Coefficients (H₆)

Model		Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	1.804	.289		6.292	.000
	TDL	.489	.087	.515	6.245	.000
2	(Fixed)	1.779	.316		5.823	.000
	TDL	.483	.089	.507	5.456	.000
	UDL	.016	.059	.024	.238	.821

a. IVs: (Fixed), TDL b. PIV: (Fixed), TDL, UDL c. DV: EP

In the SMR for IV-DV and IV and MV-DV, the R² increased from 26% to 27% (0.266 to 0.272) because of the mediator. Likewise, the weight of Beta for 'c' also decreased from .489 to .483 at p-value +< 0.001. Weight of Beta for mediator 'b', is .016 is insignificant at p-value .821, thus results show no mediation, hence hypothesis H₄ is not substantiated and rejected.

e. Mediation Model-5

H₇: The use of digital literacy in workplace was claimed to be a determinant of employee's performance, and training in digital literacy was used as mediator between use of digital literacy and employee's performance.



Figure 8: Mediation Model 5 (Mediator = TDL)

a. Computing 'a' Model-5

Tał	ole	11

Summary of Model (H7)

Model	R	R ²	R ² Adjusted	SE of the	F	р
				Estimate		
1	.683a	.487	.475	.513	96.701	.000a

Table 11a

Coefficients (H7)

Model		Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.325	.209		10.716	.000
	UDL	.497	.052	.693	9.843	.000

a. IVs: (Constant), UDL b. DV: ADL

b. Computing 'b, c, & ć' Model-5

Table 11b

Summary of Model (H7)

Mode l	R	R ²	R ² Adjusted	SE of the Estimate	ΔR^2	F	р
1	.233a	.054	.046	.597	.055	5.973	.017a
2	.516b	.265	.252	.538	.212	18.746	.000b

Model		Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.958	.248		11.967	.000
	UDL	.147	.061	.233	2.451	.017
2	(Fixed)	1.779	.307		5.823	.000
	UDL	.014	.059	.022	.236	.831
	TDL	.483	.089	.507	5.455	.001

Coefficients (H7)

a. IVs: (Fixed), UDL

b. IVs: (Fixed), UDL, TDL

c. DV: EP

In the SMR for IV-DV and IV and MV-DV, the R² has been raised from 5 percent to almost 27 percent (0.054 to 0.265) because of the role of a mediator. Moreover, weight of Beta of 'c' decreased down from .147 to .014 at p-value = 0.831, whereas weight of Beta for mediator 'b' is .483 significant at p-value of .000 clearly indicates powerful mediating effect. As 'ć' is insignificant, thus it shows full mediation for H₅, thus our hypothesis is substantiated.

f. Mediation Model-6

H₈: The use of digital literacy significantly predicts the employee's performance, and awareness of digital literacy mediates relationship between use of digital literacy and employee's performance.



Figure 9: Mediation Model 6 (Mediator = ADL)

a. Computing 'a' Model-6

Table 12

Summary of Model (H₈)

Model	R	R ²	R ² Adjusted	SE of the	F	р
				Estimate		
1	.418a	.173	.167	.586	23.198	.000a

a. IVs: (Fixed), UDL

b. DV: TDL

Table 12a

Coefficients (H₈)

Model		Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.441	.244		10.148	.000
	UDL	.277	.059	.418	4.721	.000

a. IVs: (Fixed), UDL

b. DV: TDL

b. Computing 'b, c, & ć' Model-6

Table 12b

Summary of Model (H₈)

Model	R	R ²	R ² Adjusted	SE of	ΔR^2	F	р
				Estimated			
1	.233a	.064	.046	.596	.055	5.963	.016a
2	.314	.098	.083	.584	.046	5.712	.004b
	b						

Table 12c Coefficients (H₂)

Model		Un-Coeff.		S-Coeff.	t	р				
		β	SE	β						
1	(Fixed)	2.948	.257		11.958	.000				
	UDL	.147	.062	.233	2.343	.016				
2	(Fixed)	2.372	.351		6.782	.000				
	UDL	.016	.082	.038	.235	.801				
	ADL	.268	.124	.296	2.386	.023				

a. IVs: (Fixed), UDL

b. IVs: (Fixed), UDL, ADL

c. DV: EP

In the SMR (IV-DV and IV and MV-DV) R² raised from six percent to nine percent (0.064 to 0.098) due to role of the mediator. Likewise, the weight of β of 'c' decreased from .147 to .016 at with p-value = 0.801. Similarly, weight of the β of the mediator 'b' = .268 with p-value of .023 shows significant role of the mediator. As it could be seen that 'ć' is insignificant, thus, we found full mediation and accept the hypothesis H₆.

g. Mediation Model-7

H9: The use of digital literacy significantly influences the employee's performance while awareness of digital literacy mediates the relationship between awareness of digital literacy and employee's performance.



Figure 10: Mediation Model 7 (Mediator = TDL)

a. Computing 'a' Model-7

Table 13

Summary of Model (H₉)

Model	R	R2	R ² Adjusted	SE of the Estimate	F	р
1	.362a	.145	.138	.588	16.764	.000a

a. IVs: (Fixed), ADL

b. DV: TDL

Table 13a

Coefficients (H₉)

Model		Un-Coeff.		S-Coeff.	t	р
		β	SE	β		
1	(Constant)	2.101	.368		5.844	.000
	ADL	.354	.085	.375	4.085	.001

b. Computing 'b, c, & ć' Model-7

Table 13b

Summary of Model (H9)

Model	R	R ²	R ² Adjusted	SE of Estimate	ΔR_2	F	р
1	.315a	.098	.091	.582	.099	11.485	.001a
2	.532b	.285	.269	.531	.185	20.403	.000b

Table 13c

Model		Un-C	Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.372	.349		6.811	.000
	ADL	.276	.083	.315	3.379	.001
2	(Fixed)	1.452	.358		4.045	.000
	ADL	.126	.078	.144	1.589	.113
	TDL	.448	.086	.462	5.254	.001

a. IVs: (Fixed), ADL

b. IVs: (Fixed), ADL, TDL

c. DV: EP

In the SMR (IV-DV & IV&MV-DV), the R² increased from 9 percent to 28 percent i.e., 0.098 to 0.285 because of the mediator. Likewise, weight of the β for of 'c' decreased .277 to .128 at p-value 0.114. Moreover, weight of β of mediator 'b' = .448 at p-value of .001 confirms significant mediation. Since 'c' path is insignificant therefore results show full mediation, thus we accept the hypothesis H₇.

h. Mediation Model 8

H ₁₀ : The use of digital literacy is the significant determinant of employee's performance while awareness of digital literacy mediates relationship between awareness of digital literacy and employee's performance.	UDL a ADL_c_EP Mediation
	Model-8

Figure 11: Mediation Model 8 (Mediator = UDL)

a. Computing 'a' Model-8

Table 14

Summary of Model (H10)

Model	R	R ²	R ² Adjusted	SE of the Estimate	F	р
1	.683a	.486	.475	.711	96.672	.000a

Table 14a

Coefficients (H₁₀)

Model		Un-C	Coeff.	S-Coeff.	t	р
		β SE		β		
1	(Fixed)	066	.421		165	.801
	ECA	.968	.099	.693	9.842	.001

a. IVs: (Fixed), ADL

b. DV: UDL

b. Computing 'b, c, & ć' Model-8

Table 14b

Summary of Model (H10)

Model	R	R ²	R ² Adjusted	SE of Estimate	ΔR^2	F	р
1	.315a	.088	.091	.583	.088	11.475	.002a
2	.316b	.088	.083	.593	.000	5.723	.001b

Table 14c

Coefficients (H₁₀)

Model		Un-C	Coeff.	S-Coeff.	t	р
		β	SE	β		
1	(Fixed)	2.371	.349		6.811	.000
	ADL	.277	.083	.315	3.289	.000
2	(Fixed)	2.373	.351		6.782	.000
	ADL	.269	.115	.285	2.286	.023
	UDL	.018	.082	.029	.217	.621

a. IVs: (Fixed), ADL

b. IVs: (Fixed), ADL, UDL

c. DV: EP

In the SMR (IV-DV and IV and MV-DV), the R² remains unchanged 8% (0.088), likewise, the weight of β value for 'c' path decreased from .277 to .269 at p-value 0.023. Yet, a very low weight of β for mediator path 'b' i.e., .018 at p-value of .621 bring into fore the insignificance, thus, no mediation was found, thus, hypothesis H₉ is not substantiated and rejected.

Testing the Group Mean Differences

- 1. Work-Domain Groups and ADL, TDL, UDL, and EP (H₁₁).
- 2. Designation and ADL, TDL, UDL, and EP (H₁₂).
- 3. Qualification and ADL, TDL, UDL, and EP (H₁₃).
- 4. Computer Qualification and ADL, TDL, UDL, and EP (H₁₄).
- 5. Experience and ADL, TDL, UDL, and EP (H₁₅).
- 6. Age and ADL, TDL, UDL, and EP (H₁₆).

Variables	ADL		TDL		UDL			EP				
Work	F	t	р	F	t	р	F	t	р	F	t	р
Domain group	0.028	-0.35	0.868	8.157	6.37	0.005	1.121	0.23	0.292	0.124	0.59	0.725
Designation	F	t	р	F	t	р	F	t	р	F	t	р
Designation	0.131	-0.94	0.718	13.765	2.94	0.000	0.076	0.37	0.784	1.323	2.61	0.253
Qualification	F	t	р	F	t	р	F	t	р	F	t	р
Quanneation	9.488	-3.63	0.003	0.132	-0.71	0.717	21.284	-4.09	0.000	3.692	2.02	0.057
Computor	F	t	р	F	t	р	F	t	р	F	t	р
Qualification	0.187	-0.96	0.666	0.179	-0.72	0.673	3.335	-1.66	0.071	0.108	0.47	0.743
F	F	t	р	F	t	р	F	t	р	F	t	р
Experience	13.646	-3.47	0.000	9.784	-2.84	0.002	10.505	-6.06	0.002	10.763	-0.57	0.001
A	F	t	р	F	t	р	F	t	р	F	t	р
Age	14.942	-1.99	0.000	4.703	-2.78	0.032	30.277	-5.04	0.000	10.034	-0.02	0.002

Table 15 Results for t-Test

The decision for mean difference among two groups was based on t-values +1.960 and significance value 0.05, since t-value for TDL are significant, while for rest of the group's results show insignificance against the respected t-values i.e., insignificant for ADL, UDL, and EX, therefore we partially accept H₁₁. The same results are also reflected for designation, qualification, and computer qualification, hence hypotheses 12, 13 and 14 are also partially accepted, while ADL, TDL, UDL, and EX were found significant for experience and age, thus hypotheses 15 and 16 has been substantiated and accepted.

Baharuddin & Fazli (2016) studied the relationship between awareness of digital literacy and employee performance and reported significant relationship. Tabusum, Saleem, & Batcha, (2014); West (2016) and Colbert, Yee, & George (2016) in their study found positive relationship between digital literacy awareness and employee performance. Likewise, Nawaz (2011), Nawaz & Kundi (2010a), and Nawaz & Kundi (2010b) investigated relationship between user's training, digital literacy, and employee's performance, they reported significant relationship. Huyler & Ciocca (2015) also reported significant relationship between use of digital literacy and E-Learner's employee performance. Digital literacy and its relationship with employee performance was investigated by Abas (2019); Raia (2017) and Nawaz & Kundi, 2010c) and reported significant relationship. Whereas this study discloses partial mediation by ADL between TDL and UDL. Likewise, TDL also reported partial mediation between ADL and UDL. Similarly, the relation of TDL & EP was insignificant, since result were reported for UDL did not found mediating relationship between TDL and EP. However, the study reported full mediation for TDL on relationship UDL and EP. Next. The study reveals full mediation for ADL on the relationship between UDL and EP. As for as mediating role of TDL is concerned, the results show full mediation of RDL for ADL and EP. Moreover, no mediating effect of UDL were found on the relationship between ADL and EP.

Likewise, t-test +1.960 at 0.05 level of significance for mean difference among two groups was significant for TDL, however, it was insignificant for ADL, UDL, and EP. The study also reported same evidence for designation, qualification, and computer qualification, yet, the study finds significant mean difference of ADL, TDL, UDL, and EP for experience and age. Thus, out of 7 mediation models, three have emerged with full mediation statistics (models 4, 5, and 6)

likewise, three of the models have been rejected since no significant mediation was found i.e., models 2, 3, and 7. One of the models has given partial mediation by the mediator (model 1). The partial inconsistency of findings for ADL mediation between the relations of TDL and UDL, and TDL on mediation between ADL and insignificant relationship of TDL & EP for UDL point to the contextual difference of the study in hand and that of the previous studies, which suggest the use of customization / alignment of digital technology in accordance with the native conditions.

4 Conclusion

Awareness about the ICTs help the management and employees to accept the infusion of ICTs into the organizational operation to reduce the response time with more innovative and timely decision making about the curriculum, teaching, and assessment. The training of the employee add value to the employee's knowledge and skills, effectively use digital gadgets for learning thereby it improves their overall performance. Employees feel valued to be part of those organization which provide continuous training to their employees to enhance their performance and is considered instrumental by the employees for their professional growth. The users' acceptance of the technology driven learning systems show the minimum resistance on part of users so a smaller number of complaints could be found. It is, therefore, imperative for management of HEIs to raise awareness about use of digital technologies, devise proper training mechanism, this could triple the effect of digital literacy to achieve the desire level of employee's performance. To a great extent organizational environments vary, therefore, for the success, digital technologies need to be design that meet the indigenous needs.

Implications for Research

The study is different for previously conducted research as it has investigated the digital literacy with regards to the administrative staff of HEIs in Khyber Pakhtunkhwa Pakistan. Since Higher Education Commission of Pakistan is emphasizing on the computerization of HEIs for which huge funds have been allocated to develop the infrastructure and ensure the supporting staff availability. This study provides the real picture of digitalization efforts made by the HEIs. The findings will give an insight and could be helpful to the decision makers in HEIs to review, reconsider, and formulate new policies for digitization to resolve the issues associated with conventional mode of operations. This study is a contribution to the existing body of knowledge on the relationships between digital literacy and employee's performance in the context of local environment.

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