

RESEARCH SUPERVISEES' PRACTICES AND CHALLENGES REGARDING THE INTEGRATION OF INFORMATION AND COMMUNICATION TECHNOLOGY DURING THE RESEARCH PROCESS

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ABSTRACT

The integration of Information and Communication Technology (ICT) has become a significant facility in postgraduate research with regards to getting use of better storage media, improved data analysis technologies, citation, and compiling bibliographies along with publishing. The purpose of the study was to examine the practices and challenges of research supervisees regarding the integration of Information and Communication Technologies during the research process at the postgraduate level in public sector universities of Pakistan. The population of the study includes all M. Phil and Ph.D. supervisees. A sample of 319 research supervisees was selected using a multi-stage sampling technique. The research instrument used for data collection was a questionnaire. The scale reliability index was found alpha .892 whereas the component-wise range of reliability was .795 to .846. The findings of the study showed that research supervisees have moderate positive perceptions but have low levels of basic skills regarding ICT. Due to lacking appropriate ICT skills, results

in low practices of ICT during the research process. The main challenges that supervisees face include lack of training, lack of infrastructure, lack of financial resources and unavailability of guiding material. Recommendations of the study include the provision of necessary training to supervisees, arrangement for the provision of appropriate infrastructure, financial aid, and availability of guiding material.

KEYWORDS

ICT, Supervisees, Perceptions, Basic Skills, Practices, Challenges

INTRODUCTION

The advent of Information and Communication Technology (ICT) has heralded remarkable progress across all spheres of life, particularly in developing countries, fundamentally reshaping the roles of educators, learners, and revolutionizing the processes of teaching and learning. The latest ICT applications play a pivotal role in shaping the global economy and driving significant advancements for humanity, providing unparalleled access to global knowledge, communication, entertainment, and information (Daniels, 2002; Birgin et al., 2020).

The widespread adoption of ICT devices has diversified communication methods, leading to transformative changes in various sectors such as engineering, education, medicine, and business. In the field of education, ICT tools have completely revolutionized teaching methods and the roles of teachers and learners (Yusuf, 2005). While developed countries extensively integrate ICT across various domains, developing nations like Pakistan encounter challenges due to limited resources, hindering the full integration of ICT applications (Baridam et al., 2019; Stein et al., 2020). In research and supervision, ICT plays a crucial role, ushering in significant advancements in research methodologies compared to previous decades (Manathunga & Lant, 2006; Sim, 2016).

However, a significant challenge lies in the lack of awareness and adequate training, particularly among senior researchers who often rely on traditional methods (Castles, 2004; Birgin et al., 2020). Addressing this issue necessitates tailored training sessions and support networks to encourage the adoption of ICT in research practices (Linton, 2009). Embracing ICT not only enhances research proficiency but also ensures reliability and accessibility in research work. Before the widespread use of ICT and the internet, research endeavors in public sector universities of Pakistan faced numerous hurdles, including limited access to relevant literature and manual data processing. The introduction of ICT tools like computers and smart devices has greatly

streamlined research practices, making the research process more efficient and accessible for both supervisors and scholars (Murray, 2011; Aminu et al., 2019).

This study revealed the practices and challenges while using ICT in the entire research process consisting on preparation, analysis, field work, report writing and the supervision process. In addition, the current study seeks to get a coherent understanding about the role of ICT in the process of research at public sector university level.

LITERATURE REVIEW

Information and Communication Technologies (ICT) is a comprehensive term used in information technology (IT). It refers to all areas of communication technology such as, internet, wireless networks, cell phones, processer, software, middleware, video-conferences, social interacting, television, radio, and many other mass media applications (Basri et al., 2018). Information communication technology's services enable users to access, transmit, retrieve, and store information in a digital form. ICT (Information Communication Technologies) are also applied to discuss the convergence of media tools like, audio-visual, telephone networks and computer networks with the support of a combined system of cabling or link system, these systems include signal distribution and management system (Dijk, 2005; Aminu et al. 2019). Although, there is no definite definition of Information communication technology accepted throughout the world. ICTs reflect that the theories, approaches, and tools involved in ICT are inch by inch progressing on daily basis (Venkatesh, 2003; Liburd et al., 2021).

Perceptions regarding ICT integration in the Research Process

The acceptance of advanced ICT within academic institutions can be influenced by the attitudes and perceptions of students, researchers, and faculty towards it. The integration of ICT in academic pursuits has led to substantial changes within our contemporary society, not only because it facilitates time and cost savings during and after research but also because it mitigates the challenges associated with handling large datasets or information resources that were previously insurmountable. This integration has propelled the analysis of research findings forward (University of Cape Town, 2016).

Hence, the attitude of users towards employing ICT in scientific endeavors plays a crucial role in its adoption. The perceived benefits extend not only to individual users but also to research cohorts or institutions (Kang et al., 2015). These benefits encompass a wide array of improvements, ranging from enhancing the standing of institutions to fostering research communication and collaboration among researchers

both within and across institutions, devising data management policies for research projects, and providing support to researchers in data storage and sharing, including metadata records and data files (Adeagbo et al., 2016; Arcila-Calderón, Piñuel-Raigada, & Calderín-Cruz, 2013; Bradbury & Borchert, 2010; Dutton & Meyer, 2009; Markauskaite et al., 2009; Meyer & Dutton, 2009).

Basic Skills related to ICT in Researchers

According to Pearson et al. (2002), computer literacy entails grasping the broader technological landscape and leveraging technological knowledge to interact with technology. However, the scope of proficient computer usage might be broader than what much existing research supposes (Gallardo-Echenique et al., 2015), despite findings in some studies labeling today's students as part of the "digital generation" or "digital migrants" (Dobbins, 2005; Kennedy et al., 2009; Prensky, 2001).

There is a prevailing assumption that students entering graduate studies, particularly PhD programs, possess sufficient computing skills for research purposes, thereby obviating the need for them to participate in computer training programs (Dange, 2010), except in cases where specialized discipline-specific or task-related software or hardware is involved. Consequently, the ability of researchers to incorporate ICT into their research activity is often presumed, based on perceived or assumed readiness stemming from their undergraduate or Master's study experiences (Siddiquah et al., 2017). Nonetheless, numerous studies indicate that a considerable number of graduates encounter challenges in fulfilling the requirements of postgraduate education, specifically in their utilization of ICT (Nair & Pillay, 2004; Henderson et al., 2015). Additionally, research suggests that university students frequently lack proficiency in utilizing fundamental software like learning management systems or office applications such as "Microsoft Excel, PowerPoint, and Access" (Dange, 2010). One more study pointed out that despite owning various types of applications, students seldom use them (Shaw, 2000).

Integration of ICT in Research Process

Advanced software and applications tailored for research have significantly simplified the complex research process. These tools encompass online data collection platforms, software for analyzing both quantitative and qualitative data, reference management systems, and databases providing access to high-caliber research (Rahman, 2011). Here's an overview of the applications used across each stage of the research process.

Identification of Research Problem

Selecting a research problem is the initial step, requiring a thorough understanding of relevant background information (Basri et al., 2018). Researchers refine or define their

topics by accessing pertinent research through various ICT applications, including” databases, digital libraries, online journals, and research repositories” (Bulman & Fairlie, 2016; Digambarrao, 2012).

Review of Related Literature

Researchers then examine previous studies to inform their work. ICT tools like “digital libraries, online databases, journals, and research repositories” facilitate this phase, eliminating the need for extensive physical library visits (Digambarrao, 2012). Access to top-tier knowledge is now conveniently available with just at one click (Nakhaei et al., 2016).

Development of Research Instrument and Determining Sample Size

During the research design phase, researchers craft instruments and determine sample sizes. Various websites and applications assist in creating research tools such as “questionnaires, interview protocols, and psychological tests, as well as automatically calculating sample sizes” (Rahman, 2011; Bulman & Fairlie, 2016).

Data Collection and ICT Applications

Data collection has transitioned from traditional methods to virtual ones using specialized applications and software like SurveyMonkey, Google Forms, and messaging platforms such as WhatsApp and email (Digambarrao, 2012; Nakhaei et al., 2016).

Data Analysis and ICT Applications

Processing diverse data forms, including quantitative and qualitative data, occurs in the data analysis phase. Software like SPSS, SAS, R, SmartPLS, AMOS, NVivo, MAXQDA, QUIRKOS, and MATLAB are commonly used for analyzing different data types, simplifying the analysis of large datasets (Bulman & Fairlie, 2016; Digambarrao, 2012).

Preparing Research Report and Publications

The final stage involves writing findings and preparing research reports, demanding academic writing skills. ICT applications designed for this purpose, such as MS Word, offer formatting assistance according to journal requirements, streamlining the publication process (Bulman & Fairlie, 2016; Szymkowiak et al., 2019; Nakhaei et al., 2016).

Challenges in the Incorporation of ICT during Conducting Research

In Pakistan, researchers at most universities encounter numerous challenges during the research process (Abbas, 2010). Common issues typically include researchers'

familiarity with technology, supervisor recommendations, time constraints, confidence in using electronic devices, proficiency in technology use, inadequate training, lack of technical support, and the high cost of hardware. The absence of software in classrooms can significantly impede the utilization of ICT by teachers and students (AL-Rashed, 2002). Mumtaz (2005) highlighted the scarcity of technological resources within universities as a major hurdle to research. He noted that in 2002, all Pakistani universities-initiated laptop distribution programs for teachers, resulting in enhanced integration of ICT guidance for students.

Challenge of Insufficient ICT Training

Universities often lack adequate training programs to fully harness the benefits of ICT, a critical issue highlighted in literature (Kay et al., 2019; Hadi et al., 2019). Al-Rashed (2002) emphasized the challenge of ensuring the effectiveness of ICT training, stressing the need to guarantee its benefits for students, teachers, and professionals from various fields. Cox (1999) emphasized the importance of training for university teachers in professional advancement and the incorporation of technology in teaching, as many may merely possess basic computer skills.

Technical Challenges

Researcher often encounter technical hurdles, such as unexpected hardware failures or software glitches, which impede their research progress. These challenges, although daunting, can typically be addressed with existing technical skills and expertise, as they are easily identifiable and their solutions are straightforward (Bala, 2016). Technical challenges also extend to the supervision process, impacting the functionality of machines or systems utilized (Liburd et al., 2021). Researchers may face common technical issues with new hardware, including device compatibility issues, desktop or laptop malfunctions, mobile phone glitches, browser compatibility issues, browsing history challenges, and Adobe Flash Player compatibility issues (Ward, 2010).

Challenges with Device

If a research face challenge with device he/she should restart fixes small errors, installs updates, and stops memory leaks because of these issues the researcher is recommended to restarting his device (Szymkowiak et al., 2019). For restarting, press and hold down the power button. After 6-12 seconds, the device should turn off. Once it is off, wait a few seconds and then turn the device back on. The researcher may use another device. Investigate either the issue is with your device or your system if the issue is with device, he may use another device (Chakraborty et al., 2018). The researcher is recommended to use Internet but he/she is not recommended to use Safari, AOL, or internet explorer version 9.0. Usually, researcher's computers stored old

versions of pages to help them load faster. If the researcher has made changes to his listening and can't see them online, he is needed to refresh his browser (Dange, 2010; George et al., 2006; Liew, Foo, & Chennupati, 2000; Rowlands, Nicholas, Jamali, & Huntington, 2007; Tenopir, 2003).

Financial Issues

Financial challenges such as insufficient funding and inadequate research support services pose significant obstacles to the productivity of researchers (Chakraborty et al., 2018). Pakistani universities need to foster the efforts of their researchers by providing financial assistance to incentivize scholars to conduct high-quality research (Liew et al., 2000). Key requirements for university students include appropriate incentives, reasonable research skills, grants for research. Several researchers have articulated the need for increased support to enhance their research output. They believe that augmenting research output would not only broaden the scope of their studies but also elevate their standing as researchers. Adequate financial backing can boost research productivity and contribute to the advancement of their academic stature (Dange, 2010; George et al., 2006).

Theoretical Framework

The theoretical framework of the present study is based on the "Technology Acceptance Model (TAM)", which was introduced by Davis in 1989 (Davis, 1989). TAM is one of the most utilized models for understanding user acceptance behavior. It is rooted in the theory of social psychology, particularly the "Theory of Reasoned Action (TRA)" (Adams, 1992). TRA posits that human beliefs influence attitudes, which in turn influence intentions, ultimately shaping behavior or performance.

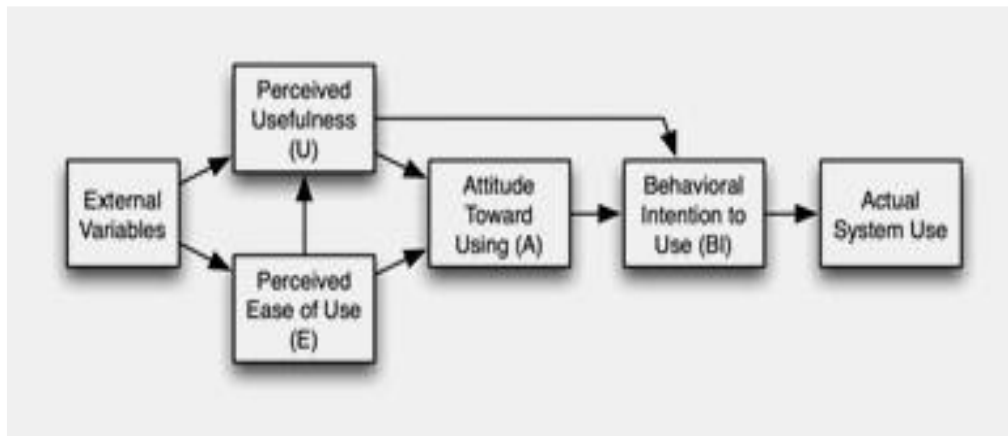


Figure 1: Technology Acceptance Model

• **Perceived Usefulness (PU)** is defined as the degree to which an individual believes that employing a system will improve their job performance (Venkatesh & Bala, 2008).

• **Perceived Ease of Use (PEOU)** is defined as the degree to which an individual believes that utilizing a system will be free from effort (Venkatesh & Bala, 2008).

RESEARCH OBJECTIVES

1. To find out the perceptions of supervisees regarding using ICT during conducting research at postgraduate level.
2. To probe the level of basic skills of supervisees regarding using ICT during conducting research at postgraduate level.
3. To investigate the extent of practices of supervisees regarding using ICT in the process of conducting research at postgraduate level.
4. To dig out the main challenges, supervisees face regarding using ICT in the process of conducting research at postgraduate level.

RESEARCH QUESTIONS

1. What are the perceptions of supervisees regarding using ICT during conducting research at postgraduate level?
2. What are the basic skills of supervisees regarding using ICT during conducting research at postgraduate level?
3. What are the practices of supervisees regarding using ICT in the process of conducting research at postgraduate level?
4. What are the main challenges, supervisees face regarding using ICT in the process of conducting research at postgraduate level?

RESEARCH METHODOLOGY

This study was conducted using quantitative research method. Population of the study include all researchers such as M. Phil and PhD scholars. Sample of the study was selected using multi-stage sampling procedure. As the population of the study was diverse and scattered in various places; multi-stage sampling procedure was employed to draw representative sample for the study. Total 319 supervisees were participated in the research process. For data collection, a questionnaire was developed and piloted on 73 supervisees. Reliability index of questionnaire was alpha .892 although in connection of components, range was .795 to .846.

Table 1: University wise Description of M. Phil and PhD Scholars

University	Frequency		
	M. Phil	PhD	Total

University of Punjab, Lahore	75	53	128
Bahauddin Zakariya University, Multan	56	47	103
Islamia University, Bahawalpur	57	31	88
Total	188	131	319

The table 1 reflects the university wise description of M. Phil and PhD Scholars. It is evident that majority of M. Phil and PhD scholars were from the University of Punjab, Lahore, which is 75 and 53 respectively. Similarly, 56 M. Phil and 47 PhD scholars were from the Islamia University, Bahawalpur. In the same way, 57 M. Phil and 31 PhD scholars were from the Bahauddin Zakariya University, Multan.

Table 2: Stages of Research Work wise Description of Supervisees

Stages of Research Work	Frequency	Percentage (%)
Problem Identification	0	0
Reviewing the Related Literature	9	2.8
Research Design	27	8.5
Data Collection	95	29.8
Analysis and Interpretation of Data	169	53.0
Preparation for Research Report and Publication	19	6.0
Total	319	100

It is obvious from the table 2 that majority of supervisees were at the stage of data analysis and interpretation. They were 169 (53.0% of total respondents). The second highest number of respondents were at the stage of data collection. They were 95 (29.8% of total respondents). 27 (8.5% of total respondents) were at the stage of determining of research design of their dissertation. 19 (6.0% of total respondents) were at the stage of preparation for research report and publication. The minimum numbers of respondents were at the stage of reviewing the related literature. They were 9 (2.8% of total respondents).

FINDINGS

Research Question 1: What are the perceptions of supervisees regarding using ICT in the process of conducting research?

Table 3: Perceptions of Supervisees regarding ICT Applications in the Research Process

Items	Mean	St. Dev	S.D	D.A	N	A	S.A
“Using ICT provides convenience in communication”	4.11	1.140	4.1	8.8	9.1	28.2	49.8

"Using ICT promotes collaboration"	3.67	1.169	5.6	14.7	11.9	42.3	25.4
"Using ICT saves time"	4.16	.837	.9	5.0	7.5	50.2	36.4
"Organizing information is easy by using ICT"	4.22	.980	1.3	8.2	7.2	33.9	49.5
"Using ICT promotes productivity"	4.04	1.147	5.0	9.4	5.3	37.0	43.3
"Using ICT is essential to live and work in 21 st century"	4.07	1.154	2.5	13.5	7.5	27.3	49.2
"Using ICT promote autonomy"	4.04	1.087	2.8	10.7	8.2	36.7	41.7
"Using ICT promote smart work"	4.17	.852	.6	5.6	8.5	46.7	38.6
"ICT plays vital role in research process"	4.27	1.018	2.2	7.8	5.0	30.4	54.5
"Using ICT improve my research skills"	4.18	1.045	2.8	8.5	4.7	35.7	48.3
Total	4.093	.35203					

The table 3 shows the perceptions of supervisees regarding using ICT during conducting research. Majority of supervisees have positive perceptions regarding using ICT during research supervision process. With mean score 4.11 and standard deviation 1.140, 49.8% supervisees strongly agreed and 28.2% agreed that "using ICT provide convenience in communication". With mean score 3.67 and standard deviation 1.169, 25.4% of participants strongly agreed and 42.3% participants agreed that "using ICT promote collaboration".

Thus, overall Mean Score 4.0937 and SD= .35203 shows that majority of supervisees have positive perceptions about the integration of ICT in process of conducting research and consider that ICT plays vital role in the process of research work and improve their research skills.

Research Question 2: What are the basic skills of supervisees regarding using ICT in the process of conducting research?

Table 4: Basic Skills of Supervisees regarding ICT Applications in Research Process

Items	Mean	St. D	S.D	D.A	N	A	S.A
"I can use different search engines"	4.11	1.156	2.5	13.5	6.3	26.0	51.7

such as Google Scholar, Wikipedia, Yahoo, Ask.com, etc.”							
“I can use digital libraries; Internet Archive, Open Library, World Digital Library, etc.”	4.13	1.129	3.8	9.7	6.3	30.7	49.5
“I can use Pakistan Research Repository to access different Thesis, Textbooks and Research Journals”	4.28	.938	1.6	6.0	6.6	35.1	50.8
“I can access different online journals such as JSTOR, ScienceDirect, Taylor & Francis, etc.”	3.64	1.273	6.9	17.2	11.9	32.6	31.3
“I can use online data collection tools such as SurveyMonkey, Typeform, SurveyPlanet, SurveyGizmo, SoGoSurvey, etc.”	1.89	.903	34.2	52.4	6.6	4.1	2.8
“I can use different software for analysis of quantitative data such as, SPSS, STATA, SAS, MATLAB, etc.”	2.03	.985	25.7	61.4	1.3	6.9	4.7
“I can use different software for the analysis of qualitative data such as, NVivo, MAXQDA, Quirkos, Qualtrics, etc.”	2.20	1.017	21.0	56.4	8.2	10.3	4.1
“I can use different software for reference management such as Mendeley, EndNote, Zotero, RefWorks, JabRef, etc.”	1.79	.914	42.0	47.6	2.2	6.0	2.2
“I can use different plagiarism checker software such as Grammarly, Article Checker, Turnitin, DupliChecker, etc.”	2.20	1.054	26.3	44.8	14.7	10.7	3.4

"I can use different ICT applications for submission of my research report for publication such as Elsevier, Wiley, Sage Publications, etc."	1.91	1.081	42.0	41.4	4.4	7.8	4.4
Total	2.817	.3345					

Table 4 reflects the supervisees' basic skills regarding using ICT during research process. 77.7% of supervisees were agreed that they can use different search engines such as "Google Scholar, Weikipedia, Yahoo, Ask.com etc." with (M=4.11, SD=1.156). 80.2% of supervisees agreed that "they can use digital libraries, internet archive, open library and world digital library etc." with (M=4.13, SD=1.129). 85.9% of supervisees agreed that "they can use Pakistan Research Repository to access different thesis, textbooks and research journals" with (M=4.28, SD=.938). 89.6% of supervisees disagreed that "they can use different software for reference management such as Mendeley, EndNote, Zotero, RefWorks, JabRef, etc." with (M=1.79, SD=.914). 71.1% of supervisees disagreed that "they can use different plagiarism checker software such as Grammarly, Article Checker, Turnitin, DupliChecker, etc." with (M=2.20, SD=1.054). 83.4% of supervisees disagreed that "they can use different ICT applications for submission of research report for publication such as Elsevier, Wiley, Sage Publications, etc." with (M=1.91, SD=1.081).

Thus, overall Mean Score 2.8179 and SD=.33453 shows that majority of supervisees have poor or low level of basic skills regarding different functions of ICT being used in conducting research.

Research Question 3: What are the practices of supervisees regarding ICT in the process of conducting research?

Table 5: Practices of ICT Application during Research Process

Items	Mean	St. Dev	S.D %	D.A %	N %	A %	S.A %
"I use different search engines such as Google Scholar, Wikipedia, Yahoo, Ask.com, etc."	3.95	1.022	2.2	9.7	12.2	42.3	33.5
"I use digital libraries; Internet Archive, Open Library, World Digital Library, etc."	3.08	1.156	6.6	30.4	23.5	27.0	12.5

"I use Pakistan Research Repository to access different Thesis, Textbooks and Research Journals"	2.70	1.107	10.7	41.7	22.3	18.2	7.2
"I access different online journals such as JSTOR, ScienceDirect, Taylor & Francis, etc."	3.12	1.118	5.0	30.7	22.9	30.1	11.3
"I use online data collection tools such as SurveyMonkey, Typeform, SurveyPlanet, SurveyGizmo, SoGoSurvey, etc."	3.11	1.538	5.3	32.0	25.7	25.4	11.3
"I use different software for analysis of quantitative data such as, SPSS, STATA, SAS, MATLAB, etc."	4.09	1.001	1.9	7.5	11.9	37.0	41.7
"I use different software for the analysis of qualitative data such as, NVivo, MAXQDA, Quirkos, Qualtrics, etc."	2.29	.913	14.4	57.4	15.7	10.3	2.2
"I use different software for reference management such as Mendeley, EndNote, Zotero, RefWorks, JabRef, etc."	1.79	.881	45.5	35.7	13.5	5.0	.3
"I use different plagiarism checker software such as Grammarly, Article Checker, Turnitin, DupliChecker, etc."	2.21	.943	20.4	51.7	16.6	9.1	2.2
"I use different ICT applications for submission of my research report for publication such as Elsevier, Wiley, Sage Publications, etc."	1.52	.739	61.1	27.3	10.0	1.6	0
Total	2.786	.3635					

Table 5 shows the practices of supervisees regarding integration of ICT during research supervision process. It is evident from the table that there are mixed results regarding the practices of ICT regarding some applications supervisees responded that they use

and majority of supervisees responded that they do not use about many of applications. 75.8% of supervisees agreed that “they use different search engines such as Google Scholar, Wikipedia, Yahoo, Ask.com etc.” with ($M=3.95$, $SD=1.022$). 39.5% of supervisees agreed that “they use digital libraries, internet archive, open library, world digital library etc.” with ($M=3.08$, $SD=1.156$). 81.2 % of supervisees disagreed that “they use different software for reference management such as Mendeley, EndNote, Zotero, RefWorks, JabRef, etc.” ($M=1.79$, $SD=.881$). 72.1% of supervisees disagreed that “they use different plagiarism checker software such as Grammarly, Article Checker, Turnitin, DupliChecker, etc.” with ($M=2.21$, $SD=.943$). 88.4% of supervisees disagreed that “they use different ICT applications for submission of research report for publication such as Elsevier, Wiley, Sage Publications, etc.” with ($M=1.52$, $SD=.739$).

Thus, the overall Mean Score 2.7862 and $SD=36359$ show poor or low practices of ICT functions during conducting research.

Research Question 4: What are the main challenges, supervisees face regarding using ICT in conducting research?

Table 6: Challenges Regarding Incorporation of ICT Applications in the Research Process

Items	Mean	St. Dev	S.D	D.A	N	A	S.A
“I don’t have adequate training in using ICT”	4.42	.789	.6	2.5	7.5	32.6	56.7
“I don’t have pedagogical support for using ICT from supervisor	4.33	1.117	5.0	4.7	6.9	18.8	64.6
I face technical issues such as lack of internet connection, poor infrastructure pirated software, etc.”	4.54	.771	.3	3.4	5.0	24.1	67.1
“I don’t have adequate guiding material for using ICT”	4.32	.916	1.9	4.1	7.5	33.5	53.0
“I face issues in understanding the available guiding material	4.43	.965	2.5	4.4	6.0	21.6	65.5

as the material is not in national language"							
"I don't have confidence to use ICT"	3.58	1.288	7.2	18.5	14.1	29.8	30.4
"I don't have any motivation from supervisors in using ICT"	4.46	.871	.9	4.1	7.5	23.2	64.3
"Frequent use of ICT cause health problems"	4.30	.995	3.1	4.4	6.9	30.7	54.9
"I don't have financial resources for using ICT"	4.01	1.175	6.6	6.3	10.0	33.9	43.3
"Too much time consuming to search relevant material by using ICT"	4.01	1.221	8.5	4.4	10.0	32.3	44.8
Total	4.2395	.35680					

Table 6 reflects the challenges supervisees face regarding using ICT during research process. It is evident from the table that majority of supervisees have almost all type of challenges regarding using ICT such as training, pedagogical, technical, guiding material, health, time, and finance related challenges. 89.3% of supervisees agreed that "they do not have adequate training of using ICT" with (M=4.42, SD=.789). 83.4% of supervisees were agreed that "they do not have pedagogical support for using ICT from supervisors" with (M=4.33, SD=1.117).

Thus, overall Mean 4.2395 and SD=.35680 shows that majority of supervisees face greater challenges regarding using ICT during conducting research.

DISCUSSION

The primary aim of this study was to explore the utilization and obstacles faced by postgraduate research scholars in incorporating modern ICT applications into their research processes within public sector universities in Pakistan. Specifically, the study focused on examining supervisees' perspectives, foundational competencies, practices, and challenges regarding the utilization of ICT tools during the research phase. The results revealed that most supervisees hold favorable views regarding the utilization of various ICT applications. These include search engines such as "Google Scholar, Wikipedia, Yahoo, and Ask.com; digital libraries such as Internet Archive, Open Library, and World Digital Library; online journals like JSTOR, ScienceDirect, and Taylor & Francis"; as well as software for quantitative data analysis such as "SPSS, STATA, SAS, and MATLAB", and qualitative data analysis tools like "NVivo,

MAXQDA, Quirkos, and Qualtrics". Additionally, software for reference management including "Mendeley, EndNote, Zotero, RefWorks, and JabRef", as well as plagiarism detection tools like "Article Checker, Turnitin, and DupliChecker" were also found to be commonly used.

Findings show that supervisees have the perceptions that ICT applications made the research process convenient as compare to before when research process was a complex activity, researcher has to work a lot for getting results, has to travel far off places to access different sources for literature review, deciding methodology, data collection and analysis.

Findings shows that supervisees have the opinion that ICT applications promote productivity, collaboration, and smart work during research supervision process. Findings represent that supervisees have the opinion that integration of ICT applications during research supervision process improve their skills as researcher and plays vital role in the process of research. These findings are aligned with the literature (Dange, 2010; George et al., 2006; Liew, Foo, & Chennupati, 2000; Rowlands, Nicholas, Jamali, & Huntington, 2007; Tenopir, 2003; Akinoso, 2018; Zonneveld et al., 2020; Basri et al., 2018). Study was conducted to investigate the basic skills of supervisees regarding various ICT applications. Findings show that some of supervisees have basic skills regarding some applications but majority have poor basic skills regarding latest ICT applications.

Findings show that majority of participants do not have basic skills regarding various software of quantitative data analysis such as "SPSS, STATA, SAS, MATLAB, etc." and qualitative data analysis software such as "NVivo, MAXQDA, Quirkos, Qualtrics, etc.", they just have some skills about SPSS, they can perform descriptive statistics themselves and inferential statistics with the assistance of expert one. Similarly, it is found that participants do not have basic skills regarding reference management software and different plagiarism checker software etc. Same findings were reported in the literature of (Blignaut et al., 2010; Meerah, 2010; Wallace & Clariana, 2005; Chakraborty et al., 2018; Hadi et al., 2019; Lawal et al., 2020; Shahzad et al., 2020; Siddiquah et al., 2017; Ullah et al., 2019). Study also investigated the practices of supervisees about the incorporation of ICT applications in the research process, it has been tried to explore to what extent supervisees use ICT applications.

Majority of supervisees reported that they do not have training of using specific applications for specific purpose. 2nd challenge which is reported by majority of supervisees is related to technical challenges such as lack of internet connection, poor infrastructure, and pirated software, etc. 3rd challenge was according to majority of

participants was the resistance to change, they became habitual to work on manual methods that's why they consider ICT applications as an extra burden. Other challenges that participants face are; the lack of material for guidance, health issues and financial issues etc. These findings are consistent with other studies such as (Mertala, 2019; Adeagbo et al., 2016; Dutton & Meyer, 2009; Arcila-Calderón et al., 2013; Liburd et al., 2021; Bradbury & Borchert, 2010; Markauskaite et al., 2009; Meyer & Dutton, 2009; Szymkowiak et al., 2019; Kay et al. 2019).

RECOMMENDATIONS

The use of technology must be taught in universities and standard must be improved. It is recommended that training sessions and workshops regarding various ICT applications may be conducted on frequent basis. These training sessions and workshops should be practical and participants to be engaged in practical activities. Well-equipped computer laboratories with latest software may be established at the department level where the research scholars could be guided at various stages of their research work regarding integration of latest ICT applications. Students should manage time to evaluate study problems and explore fresh ideas and concepts, and to value research solutions. The researchers create statistically important association between working with ICT devices and developing critical thinking. The supervisor must encourage new researchers to gain technical skills to facilitate learning in ICT conditions. Concerned authorities should make arrangements for provision of financial resources, infrastructure and necessary training sessions.

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