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University Researchers' Challenges in Technology- Dependent Research Phases

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ABSTRACT

This study explores the technological challenges faced by M.Phil and Ph.D. students during various phases of their research and examines the impact of digital literacy, institutional support, and discipline-specific needs on their research progress. It highlights how limitations in access to digital tools, lack of technical training, and inadequate IT infrastructure hinder the quality and timely completion of research work. The findings reveal that students from Social Sciences often face greater difficulties due to limited exposure to data analysis software, whereas students from Pure Sciences encounter challenges related to complex technical tools and high-cost resources. The study emphasizes the importance of digital literacy and the role of universities in providing adequate training, software access, and supervision. It concludes with practical recommendations for enhancing institutional support systems, offering targeted training, and improving access to research technologies to foster a more efficient and equitable research environment for research students.

Keywords: University Researchers, Digital Literacy, Technological Tools, Academic Research, Research Capabilities

INTRODUCTION

In today's research environment, technology has become both a facilitator and a barrier. University researchers rely heavily on digital tools and platforms for data collection collaboration, analysis, and dissemination. While this reliance enhances productivity and global reach, it also introduces unique challenges that impact the quality and efficiency of research processes. These issues have become especially pronounced in recent years, highlighting structural and operational weaknesses within academic systems during technology-dependent research phases. One major concern is the digital divide—the unequal access to digital tools and high-speed internet among researchers. Scholars in under-resourced institutions, especially in developing countries, often struggle to access reliable technology, which hampers their ability to engage in rigorous research or collaborate with international peers

(Nguyen et al., 2020). This disparity limits publication opportunities and reduces the visibility of research from certain regions, contributing to global knowledge inequality (Zawacki-Richter, 2021). Moreover, the rapid pace of technological advancement presents a steep learning curve for many researchers. The continuous emergence of new platforms, software, and tools often outpaces the training available at universities, requiring researchers to self-learn and adapt on the fly (Johnson et al., 2016). This can be time-consuming and stressful, particularly for faculty with heavy teaching loads or limited technical backgrounds. When researchers are not adequately trained in digital tools, the risk of methodological flaws, misinterpretation of data, and reduced research quality increases (Smith & Lee, 2021). Another pressing issue is data management. With technology enabling large-scale data collection, university researchers face increasing responsibilities in terms of ethical handling, storage, and analysis of data. Sensitive information, especially in social sciences and health studies, requires strict adherence to data protection laws such as GDPR, which can be difficult to implement without proper institutional support (Kokolakis, 2017). Additionally, cloud-based storage systems and digital archives, while convenient, raise concerns about cybersecurity and data breaches (Choi et al., 2018). Technology has also redefined research collaboration, offering tools like video conferencing, cloud storage, and project management platforms. While these tools enable cross-border collaboration, they also introduce coordination challenges such as managing time zones, ensuring equal participation, and handling technical glitches during key meetings (Anderson & Rainie, 2020). Researchers unfamiliar with digital communication tools may struggle to maintain effective working relationships, leading to project delays and breakdowns in communication. Institutional barriers further exacerbate these challenges. In many universities, especially those lacking robust IT infrastructure, there is insufficient support for researchers using advanced technology. This includes the absence of IT personnel dedicated to research support, outdated equipment, or restricted access to licensed software and databases (Van Deursen & Helsper, 2015). Without institutional investment, researchers must bear the costs and effort of managing digital tools independently, which can slow down their progress and discourage innovation. Moreover, the pressure to publish rapidly in competitive academic environments often drives researchers to adopt new technologies hastily, without fully understanding their implications. This tendency can compromise data validity and undermine the integrity of research outcomes (Brew & Lucas, 2009). The absence of clear policies or standard operating procedures for the use of technology in research further complicates matters. In short, while technology has transformed academic research by enabling new possibilities and expanding horizons, it has also introduced a complex set of challenges for university researchers. These range from unequal access and digital literacy gaps to data security concerns and insufficient institutional support. Addressing these issues requires a multi-faceted approach—one that includes targeted training, infrastructure investment, and clear policies for ethical and effective use of digital tools in research. Understanding and mitigating these challenges is critical for maintaining the quality and integrity of university research in an increasingly digital world.

Objectives of the Study

Objective of the study were to:

1. To identify the key challenges faced by university researchers when conducting research that heavily relies on digital technologies and online platforms.
2. To examine the impact of technological limitations—such as digital literacy gaps, infrastructure deficits, and cybersecurity concerns—on the quality and efficiency of academic research.
3. To explore institutional support mechanisms and propose strategies that can help mitigate the technological challenges encountered during various research phases.

4. Research Method & Procedure

This study uses a qualitative research design to explore the challenges faced by university researchers during technology-dependent stages of their work. A qualitative approach was chosen to gain deeper insights into students' personal experiences and perceptions (Creswell & Poth, 2018). The research focused on M.Phil and Ph.D. students from the Social Sciences and Pure Sciences faculties at public

universities in Faisalabad, with the University of Agriculture Faisalabad selected as the primary site. Using simple random sampling, 80 students were selected—40 from M.Phil and 40 from Ph.D. programs, equally representing both faculties. An interview schedule was developed based on a literature review and expert guidance, with questions aligned to the study's objectives. Data was collected through personal interviews, phone calls, and Zoom meetings. This method allowed the researchers to gather detailed, context-rich information on the obstacles students face when using digital tools in research.

Results

Q#1: What types of technological tools and platforms are commonly used by M.Phil and Ph.D. students during different phases of their research?

Most of the university researcher's respond that M.Phil and Ph.D. researchers increasingly use technological tools to enhance the quality and efficiency of their work. For literature review, tools like Google Scholar, Mendeley, and EndNote are common. Data collection is supported by Google Forms and NVivo, while analysis involves SPSS, R, and NVivo for qualitative work. Writing and editing are aided by MS Word, LaTeX, Grammarly, and Turnitin. Collaboration is facilitated through Google Drive, Zoom, and Teams, and publishing is managed via platforms like ORCID and Scopus. These tools streamline research at every stage and improve academic productivity.

Q# 2: What challenges do research students face in accessing and using technology for research purposes?

Research students often face several challenges in accessing and using technology for research purposes. Research students face challenges in using technology due to limited access to licensed software, lack of technical skills, and poor internet connectivity. Many can't afford tools like SPSS or NVivo, and institutions may not provide them. Insufficient training, language barriers, and fear of data loss also hinder effective use of digital research tools, especially for non-technical students.

Q#3: How does the level of digital literacy among university researchers affect their ability to conduct technology-dependent research effectively?

University researchers face many problems in their research. Digital literacy plays a crucial role in university researchers' effectiveness. Those with high digital skills can efficiently use research software, access online resources, and adapt to new technologies, boosting productivity and research quality. In contrast, researchers with low digital literacy often struggle with basic tasks, slowing progress and affecting accuracy. Thus, digital literacy directly influences research success.

Q#4: What are the main barriers faced by students in data collection and analysis when using digital tools

Researchers respond that the main barriers faced by students in data collection and analysis when using digital tools include lack of technical skills, which makes it difficult to operate software like SPSS, NVivo, or Python. Limited access to licensed software is another challenge, as many tools require paid subscriptions. Inadequate training or institutional support also hinders students from using these tools effectively. Poor internet connectivity can disrupt online surveys or cloud-based analysis. Additionally, students often face data privacy concerns, especially when handling sensitive information, and may lack knowledge of ethical standards. Finally, compatibility issues between tools and difficulty in interpreting complex outputs can further complicate the research process.

Q#5: How adequate is the institutional support (IT infrastructure, training, supervision) provided to researchers during their technology-based research activities?

University researchers showed positive response towards institutional support. They indicated that, the adequacy of institutional support for researchers during technology-based research activities varies widely but is often insufficient in many universities, especially in developing regions. While some institutions provide access to basic IT infrastructure like internet, computers, and licensed software, many lack advanced tools, high-speed connectivity, or specialized research software. Training opportunities in digital tools and data analysis are often limited or irregular, leaving researchers to rely on self-learning. Supervision may also lack a technological focus, as many supervisors are not fully familiar with modern research tools. Overall, while some support exists, it is often not comprehensive or consistent enough to fully meet the needs of technology-driven research.

Q#6: Are there significant differences in the technological challenges experienced by students from Social Sciences versus those from Pure Sciences?

Researchers stated, there are significant differences in the technological challenges experienced by students from Social Sciences versus those from Pure Sciences. Social Science students often face challenges in using complex data analysis software like R, NVivo, or SPSS due to limited technical backgrounds and lack of statistical training. They may also struggle with digital research design tools and qualitative data analysis platforms. In contrast, Pure Science students are generally more exposed to technology and laboratory-based digital tools, but they may face issues related to high-cost specialized equipment, software licensing, or managing large datasets. While Pure Science students often receive better technical training, Social Science students may need more institutional support to overcome digital skill gaps.

Q#7: What impact do technology-related difficulties have on the quality, progress, and completion timelines of students' research work?

University researchers from social sciences responded that Technology-related difficulties can significantly impact the quality, progress, and completion timelines of students' research work. When students face challenges in using digital tools, it can lead to errors in data analysis, poor presentation, or reliance on outdated methods, which directly affects the quality of research. Delays in learning or accessing software, troubleshooting issues, or handling technical failures can slow down research progress, causing frustration and demotivation. These setbacks often lead to extended completion timelines, missed deadlines, and, in some cases, compromised research outcomes.

Discussion of the study

The impact of technology-related difficulties on the research process is substantial, influencing both the quality and timely completion of research work. Technology barriers, such as a lack of access to specialized tools, software, or high-speed internet, often result in delayed data collection and analysis, leading to compromised quality (Smith & Jones, 2020). In many cases, students must invest considerable time learning how to use unfamiliar digital tools or troubleshooting technical problems, which can further slow down the research process (Brown, 2021). This not only extends the timeline for research but can also diminish the motivation and academic performance of students, especially when there is insufficient institutional support (Miller et al., 2019). The digital literacy gap between disciplines also exacerbates the issue. Social Science students, for instance, often face challenges due to the complexity of data analysis software and limited technical training, while Pure Science students may struggle with managing large datasets or high-cost equipment (Chen & Zhang, 2022). These disparities indicate the need for tailored training programs and support systems that address the specific needs of students from different fields. Furthermore, the lack of consistent access to reliable IT infrastructure and specialized software across universities contributes to these barriers (Evans, 2020). Institutions must prioritize improving technological support systems, ensuring that all students have the resources and training necessary to conduct research efficiently and with high academic integrity. This can enhance the quality of research, promote equity in academic achievement, and ensure timely completion of research work.

Study's Conclusion and Recommendations

In conclusion, technology-related challenges significantly impact the quality, progress, and timely completion of postgraduate research. Insufficient access to digital tools, inadequate training, and technical difficulties hinder students' ability to effectively conduct research. These barriers not only delay the research process but also affect the overall quality and academic success of students. To address these issues, universities must prioritize providing better IT infrastructure, targeted training, and specialized support for students across disciplines. By doing so, they can enhance the research capabilities of students and foster a more productive and equitable academic environment. The following suggestions have been made: (1) Universities should develop and implement comprehensive training programs focused on improving digital literacy, ensuring that students are proficient in using research tools and software relevant to their field of study; (2) institutions must invest in robust IT infrastructure, including reliable internet access, high-performance computing facilities, and access to licensed research software,

to support students in conducting technology-dependent research., (3) Universities should offer discipline-specific support to address the unique technological needs of students in fields such as Social Sciences and Pure Sciences, recognizing the different tools and methodologies required, (4) Efforts should be made to ensure that all postgraduate students have free or subsidized access to critical research tools, software, and digital resources to level the playing field and prevent financial barriers from hindering research progress, (5) Research institutions should facilitate the use of collaborative platforms (e.g., cloud-based tools, shared drives, and virtual meeting tools) to enhance communication and teamwork among students, especially in multidisciplinary research environments, (6) institutions should regularly evaluate and update the digital tools and platforms available to students, ensuring they remain current, effective, and aligned with evolving research trends and methodologies.

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