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The Role of Digital Technology in Enhancing Teaching Effectiveness and Student Learning Outcomes at the University Level

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ABSTRACT
The integration of digital technology has become an essential element of higher education, shaping the ways in which teaching and learning are conducted. This study investigates the role of digital technology in enhancing teaching effectiveness and student learning outcomes at the university level. The population of the study comprised faculty members of the University of Balochistan and Sardar Bahadur Khan Women's University, from which a stratified random sample of 243 respondents was selected. Data were collected through a structured questionnaire and analyzed to identify trends in device usage, internet accessibility, and daily reliance on digital resources for teaching. Findings reveal that faculty members predominantly prefer laptops and tablets for academic searches, with widespread internet access both at home and within universities. Moreover, faculty dedicate a significant portion of their daily teaching activities to internet-based practices, demonstrating a deep reliance on digital tools in instructional processes. The results suggest that digital technology is effectively integrated into higher education, contributing positively to teaching practices and student learning outcomes, although challenges related to digital literacy and equitable access remain. The study holds significance for policymakers, administrators, and educators by providing evidence-based insights to strengthen digital infrastructure, support professional development, and promote equitable access to technology.

Keywords: Digital technology, higher education, teaching effectiveness, student learning outcomes, faculty members, internet accessibility

Introduction

In this modern era, education without technology is an illusion. Technology is involved in every walk of our lives and so is the case with education. Digital technologies and student performance have been a subject of interest in academic research. Studies have

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shown that the integration of Information and Digital Technologies in learning practices can lead to and improve academic outcomes, particularly in areas like mathematics, education, and science (Caleb & Kaminski, 2022).

Additionally, digital literacy has been identified as a significant factor in enhancing academic performance with a positive relation between literacy and student performance. (Abdul Rasit, Hashim, & Muhammad, 2023). The overuse of mobile devices, especially before bedtime, has been the result of poor sleep quality and decreased academic performance. During the COVID-19 pandemic, when remote teaching methods were implemented. student performance gets much better by using educational technology, especially in the field of research (Valverde-Berrocoso, Acevedo-Borrega, & Cerezo-Pizarro, 2022). Student academic outcomes are much influenced by digital technology. (2022). Therefore, the use of digital technologies can have a positive impact on student performance, it is crucial to balance their use and avoid negative consequences on students' academic outcomes.

Education is the transmission of knowledge, the acquisition , and the improvement of character attributes.The rapid and widespread transfer of knowledge made possible by advanced technologies of digital Era. Knowledge is created and disseminated more quickly and independently in these days and age. Digital age thrives on rapid transformation, enabling ongoing innovation. This trend is best illustrated by the emergence of technologies such as the semantic web, which eliminates the need for direct human interaction by enabling software agents to communicate information autonomously through automated processes. Digital gadgets enabling ongoing innovation according to latest experiments and researches. The digital information insight and ideas typically transforms our human lives . This trend is best illustrated by the emergence of technologies such as the semantic web, AI support eliminates the need for direct human interaction by enabling software agents to communicate information autonomously through automated processes. (Shepherd,J.2004).

Digital technologies and student performance has been a subject of interest in academic research. Studies have shown that integration of Information and digital Technologies like phones and laptops in learning practices can lead and improve academic outcomes, particularly in areas like mathematics, education and science (Caleb & Kaminski, 2022). increased technical skill , critical thinking enhancing academic performance with AI is an effective tool. (Abdul Rasit, Hashim, & Muhammad, 2023). During the COVID-19 pandemic when remote teaching methods were implemented. student performance got much better by using educational technology specially in field of research (Valverde-Berrocoso, Acevedo-Borrega, & Cerezo-Pizarro, 2022).

There is a vast literature on the challenges and effects of digital technologies in higher education in Balochistan. The E governance and digital policy is mending our digital divide. Digital libraries and online researches , data bases and scholarly publications are benefiting our community and higher education system. Digital literacy increases economic growth , e-comers, employment and enhanced learning opportunities for students. (Hillmayr et al., 2020; Attard et al., 2020; McDonald, 2016; Kamal & Ali, 2023).From an evolutionary standpoint, the Digital Era highlights how crucial it is to have long-lasting socioeconomic ties with technology(Shepherd, J. (2004).). In order to maintain long-term survival,students in higher education must figure out how to incorporate the the evolving demands of digital age .

A wide rang, of gadgets like smart phones and computers, and virtual reality VR

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

intended for the creation, storing, processing, or sharing of data collectively referred to as digital technology. In addition to more specialized equipment like cameras, digital augmented or virtual reality systems, increases AI tutors, personalized assessments even with human learning disabilities. Systems like software, apps, and the Internet are also considered to be a part of digital technology, and they are crucial in determining how people interact and have experiences.The Use of mobile devices in education is common now a days screen-based gadgets of digital technologies are ingrained in everyday life through data-driven systems.

Problem Statement

Despite the rapid integration of digital technology in higher education, there remains uncertainty about its actual impact on teaching effectiveness and student learning outcomes. While many universities have adopted digital tools such as Learning Management Systems (LMS), online assessments, and interactive applications, their use does not always translate into improved pedagogy or better academic performance. Some faculty members face challenges in adapting to technology-driven approaches, while students may struggle with digital literacy, accessibility, or distraction. As a result, the potential of digital technology to enhance the quality of education is often underutilized. This gap highlights the need to critically investigate how digital technology influences teaching practices and student performance at the university level.

Objectives of the study

There were following objectives of the study:

To examine the impact of digital technology on teaching effectiveness at the university level

To analyze the influence of digital technology on students' learning outcomes and academic performance

Research Questions

How does the integration of digital technology affect teaching effectiveness at the university level?

In what ways does digital technology influence students' learning outcomes at the university level?

Significance of the Study

This study holds significance for multiple stakeholders in higher education. For **university administrators and policymakers**, the findings can provide evidence-based insights into how digital technology contributes to improving teaching quality and student learning outcomes, helping them make informed decisions about investing in technological infrastructure. For **faculty members**, the study highlights effective ways of integrating digital tools into pedagogy, encouraging professional growth and innovative teaching practices. For **students**, the research emphasizes how digital resources can enhance engagement, accessibility, and academic achievement, thereby improving the overall quality of their learning experience. Additionally, this study contributes to the **existing body of knowledge** by bridging the gap between technological adoption, pedagogical effectiveness, and measurable student performance at the university level.

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

Delimitations of the Study

This study is delimited to university-level students and teachers, focusing only on the impact of digital technology on teaching effectiveness and student learning outcomes. It does not include schools or colleges below the university level. The research is limited to selected universities rather than covering all higher education institutions, which may affect the generalizability of findings. The study specifically examines digital tools such as Learning Management Systems (LMS), online resources, and mobile applications, while other technological innovations like artificial intelligence or virtual reality are not included. Furthermore, the study emphasizes teaching effectiveness and student performance, without exploring other factors such as administrative efficiency or institutional management.

Research Design

This research will examine the universities of Balochistan and Sardar Bahadur Khan Women University where the research paradigm used in the study will be a quantitative survey to capture the practice and experience of the faculty on the use of digital technologies. The target population will consist of all department teachers of the University of Balochistan and Sardar Bahadur Khan University. This section will provide details on the population, sample, sampling methods, validity and reliability measures, data collection procedures, and data analysis methods. The study is based on a descriptive research design in the present time. Descriptive studies analyze the present situation and answer the what, where, and How Questions. At present the study will be conducted to investigate the ` The Use of Digital Technologies and Its Impact on Quality Education, Pedagogical Approaches, And Students' Performance At the University of Balochistan. The quantitative method approach will be adopted as it will be only through this approach that we can investigate the impact of Digital Technologies.

Population of the Study

This study centers on different department teachers of the University of Balochistan. The population includes 385 male and female university teachers of Balochistan and Sardar Bahadur Khan University to examine their perceptions of the use of digital technologies and test their perceptions of digital technology's impact on quality education and their pedagogical approaches and students' performance. The distribution of this population is shown in Table 3.1.

Table3.1: Population of the Teachers.

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

University	Stakeholders				Total
	Professor	Associate Prof.	Assistant Prof.	Lecturer	
University of Balochistan	42	36	170	202	450
Sardar Bahadur University	20	16	70	117	223
Total	62	52	240	319	**673**

Source: http://web.uob.edu.pk/uob/departments/Pakistan-Study-Centre/staff.html

3.3 Sample of the Study

Probability sampling is the standardized methodology for survey research on scientific studies and educational planning and decision-making (Salkind, N. J., 2006). A total of 257 male and female teachers from different departments of the University of Balochistan and Sardar Bahadur Khan University will be selected as participants, to ensure a diverse and representative sample. The breakdown of the sample is detailed below:

Table1: Sample of the Study

the following table is of The University of Balochistan campus Quetta and Sardar Bahadur khan University.

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

University					Total
	Professor	Associate Prof.	Assistant Prof.	Lecturer	
University of Balochistan	12	14	52	97	175
Sardar Bahadur University	10	15	19	25	68
Total	59	51	177	228	243

Source: Balochistan education management information system (emails)http://www.emis.gob.pk

Sampling Techniques

The sample size determination for this study employed the well-established Krejcie & Morgan's (1970) table, widely recognized in social science research for accurately calculating required sample sizes. The Stratified Sampling technique uses population stratification, where the population is divided into separate subgroups or strata, and random samples are taken from each stratum to ensure a proportional representation of individuals of each stratum in our sample. The determination of the sample size of a known population is presented in Khan University using Krejcie& Morgan's 1970 table.

Research Instrument

The researcher will use questionnaire as instruments for collection of data, contain two sections one section shows demo graphical data and the another shows primary content. The researcher will choose 75 questions in questionnaire. Researcher will use 5-point Likert scale questionnaire as research Instrument for the purpose of data collection.

Data analysis

Preferred Digital Device for Online Searches

Survey Item-1: Which digital device do you mostly use to search for online materials?

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

Table 4.7
Preferred Digital Device for Online Searches

	Frequency		Percent	Valid Percent	Cumulative Percent
Valid	Desktop Computer	49	20.2	20.2	20.2
	Laptop	107	44.0	44.0	64.2
	Smart Phone	19	7.8	7.8	72.0
	Tablet	68	28.0	28.0	100.0
	Total	243	100.0	100.0	

The distribution of preferred digital devices used by respondents for online searches is presented in Table 4.7 and below figure 4.7. The laptop (44.0%), tablet (28.0%) and desktop computer (20.2%) were the most commonly used devices. Only 7.8% of respondents reported using a smartphone as their primary device for searching online materials. So, the results shows that majority of respondents prefer to search on larger screen devices like a laptop or a tablet for academic or professional online search.

Internet Access at Home and University Survey Item-2: I have internet access at home.

Table 4.8
Distribution of Faculty Members' Internet Access at Home

	Frequency		Percent	Valid Percent	Cumulative Percent
Valid	Yes	220	90.5	90.5	90.5
	No	23	9.5	9.5	100.0
	Total	243	100.0	100.0	

Table 4.8 and figure 4.8 presents the distribution of faculty members' access to the internet at home. The majority of respondents (90.5%, n = 220) reported having internet access at home, whereas only 9.5% (n = 23) indicated that they do not have access. This high percentage suggests that most faculty members rely on home internet for academic and professional activities.

University Internet Provision
Survey Item-3: The university provides Internet access.

Table 4.9
The university provides Internet access:

Response	**n**	**%**	**Valid**	**Cumulative %**
Yes	236	97.1	97.1	97.1
No	7	2.9	2.9	100.0
Total	243	100.0	100.0	

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DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

This table indicates that 97.1% of respondents (n = 236) have access to internet at their university, while only 2.9% (n = 7) do not. Figure 4.9 provides a visual representation of this data, reflecting the high level of internet provision by the universities.

Daily Internet Usage for Teaching
Survey Item-4: The daily time spent on usage of the internet for teaching.

Table 4.10
The daily time spent on usage of the internet for teaching:

Time	n	%	Valid	Cumulative %
1-2 Hours	70	28.8	28.8	28.8
3-4 Hours	86	35.4	35.4	64.2
Above 5 Hours	39	16.0	16.0	80.2
4.00	48	19.8	19.8	100.0
Total	243	100.0	100.0	

The Daily Time Spent on Internet Usage for Teaching The table shows that 35.4% of respondents spend 3–4 hours daily using the internet for teaching, followed by 28.8% spending 1– 2 hours, 16.0% spending more than 5 hours, and 19.8% spending 4 hours. This data is represented visually in Figure 4.10, which shows the large amount of time spent on internet based teaching activities.

Conclusions
The analysis of data reveals that university faculty members predominantly prefer using larger screen devices, such as laptops and tablets, when searching for academic or professional materials online, while smartphones are the least favored option. This highlights the importance of usability and visibility in digital academic work. In terms of internet access, most faculty members have reliable connectivity at home, which enables them to engage in teaching and research beyond the university environment. The provision of internet facilities by universities is also widespread, ensuring that faculty can depend on institutional support for their academic activities. Furthermore, the results indicate that faculty members spend a considerable amount of time each day using the internet for teaching, showing that digital tools and online resources have become an essential part of their instructional practices. Overall, the findings suggest that digital technology is well integrated into the teaching and learning processes at the university level, with strong support both at home and within institutional settings.

Recommendations
Universities should encourage the use of laptops and tablets for academic searches by ensuring that students and faculty have access to affordable devices and necessary technical support.
Institutions should continue to strengthen internet infrastructure both on campus and off campus, including support for those who may not have reliable home internet.
Training programs should be organized for faculty to enhance their digital literacy and pedagogical use of online resources, making internet-based teaching more effective.

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ISSN Print: 3007-3146

DIALOGUE SOCIAL SCIENCE REVIEW

Vol. 3 No. 9 (September) (2025)

Universities should promote blended and online teaching practices that maximize the potential of digital tools, ensuring active student engagement and improved learning outcomes.

Policy makers and administrators should design strategies to reduce the digital divide, so that all faculty members and students have equitable opportunities to benefit from technology in higher education.

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