



RESEARCH PAPER

The Effect of Modern Technologies on the Efficiency of University Teachers

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ABSTRACT

The primary objective of this study was to examine the effect of modern technologies on teachers' efficiency. It was quantitative research, and the researchers used an ex-post facto (Causal-comparative) research design. This study was conducted at public universities in the Punjab province. The sample consisted of male and female university teachers. The selection was based on the simple random sampling technique. The researchers developed a five-point Likert scale questionnaire for data collection. The ANOVA was used to analyze the data. The findings revealed that there was a significant impact of modern technologies on teachers' efficiency. It was also concluded that teachers' computer literacy significantly impacts teachers' efficiency. Computer-literate teachers perform better. It is recommended that faculty have access to reliable tools for teaching, such as video conferencing software, digital whiteboards, projectors and virtual labs. This allows teachers to efficiently manage classes without compromising quality.

KEYWORDS Educational Gadgets, Modern Technology, Online Classes, Teacher Efficiency, University Teachers

Introduction

In the wake of the COVID-19 pandemic, the education landscape has undergone a profound transformation, catapulting educators into an era where technology has become an integral part of the pedagogical process. As schools and universities worldwide pivoted to online learning, the dependence on modern technology became more pronounced than ever before. This paradigm shift has not only redefined the traditional classroom setting but has also prompted an urgent examination of the impact of modern technology on teacher efficiency (Maheshwari et al., 2021; Ong et al., 2024).

The surge in online classes and the adoption of the flipped classroom model have reshaped education dynamics. Teachers are now tasked with navigating digital platforms, engaging with students virtually, and incorporating technology-oriented teaching methodologies. The swift transition to technology-mediated education has created a pressing need to comprehensively assess its effects on teacher efficiency (Sosa Diaz et al., 2021; Qureshi et al., 2023).

This research aims to delve into various dimensions of the impact of modern technology on teaching effectiveness. From the perspective of teacher adaptation to the integration of technology-based educational gadgets, this study seeks to unravel the intricacies of a pedagogical landscape increasingly dominated by digital tools. Understanding how teachers orient themselves toward technology and whether it affects their efficiency is critical to this inquiry (Maphosa, 2021; Tabbasam et al., 2023; Tabassum et al., 2024).

In this pursuit, this research sheds light on modern technology's impact on teacher efficiency. By addressing the nuances of technology integration in the educational landscape, we aim to contribute valuable insights that can guide educators, policymakers, and institutions in optimizing technology's benefits. This study finds out the impact of modern technologies on teachers' efficiency at the university level.

Literature Review

The COVID-19 pandemic has triggered a rapid and unprecedented shift toward technology adoption in education (Al Lily et al., 2020). Research indicates that the sudden need for remote learning has accelerated the adoption of digital tools and online platforms (Amjad et al., 2024, a, b, c; Hodges et al., 2020). However, studies also highlight challenges such as the digital divide and varying levels of technological readiness among teachers (Bao, 2020). Understanding the implications of this shift is crucial for gauging the long-term impact on teaching methods.

Previous studies on online learning effectiveness emphasize the importance of teacher engagement and student interaction in virtual environments (Amjad et al., 2023, a, b, c; Means et al., 2013). The effectiveness of online classes is influenced by factors such as instructional design, communication strategies, and the use of collaborative tools (Allen & Seaman, 2016). Examining how teachers perceive and adapt to the challenges of online instruction is essential for assessing the overall success of virtual learning experiences.

Research on teachers' technology orientation highlights the significance of professional development in enhancing competence (Amjad et al., 2020, 2021, 2022, a, b; Ertmer et al., 2012). Teachers' perspectives on technology may impact their inclination to incorporate it into their instructional methodologies (Teo, 2009). Investigating the current landscape of technology orientation among teachers is crucial for understanding the factors that contribute to or hinder successful integration.

Studies on integrating technology-based educational gadgets reveal their potential to enhance student engagement and learning outcomes (Becker, 2015). The effective integration of gadgets such as interactive displays and tablets depends on teacher training and support (Zhao et al., 2002). Examining the experiences and challenges faced by teachers in incorporating these gadgets into their classrooms provides valuable insights for optimizing their usage.

Literature exploring the impact of modern technology on teacher efficiency emphasizes the potential for increased productivity through automation and streamlined workflows (Ehlers, 2011; Shafqat & Amjad, 2024). However, concerns regarding increased workload, digital distractions, and the need for continuous skill development also surface (Selwyn, 2016). A nuanced understanding of how technology influences overall teacher efficiency is vital for developing strategies that harness its benefits while mitigating potential drawbacks.

Theoretical Framework of the Study

The theoretical framework for "The Effect of Modern Technologies on the Efficiency of University Teachers" is constructed upon three interconnected theoretical perspectives: Technological Pedagogical Content Knowledge (TPACK), the Community of Inquiry (CoI) framework, and the Unified Theory of Acceptance and Use of Technology (UTAUT). Koehler and Mishra (2009) describe the Technological

Pedagogical Content Knowledge TPACK framework as a foundational perspective that underscores the interaction between technological, pedagogical, and content knowledge. Within the scope of this study, TPACK offers a theoretical basis for comprehending how educators incorporate technology into their teaching methods. The framework helps illuminate the dynamic interactions among teachers' technological competence, pedagogical approaches, and content expertise.

According to Garrison et al. (2000), the Community of Inquiry (CoI) framework contributes a social and collaborative perspective, particularly relevant in examining the online class model. The CoI framework highlights how crucial social, cognitive, and teaching presence are in online education. This framework assists in evaluating the effectiveness of technology-mediated interactions and collaborative learning experiences, providing insights into how teachers can foster a sense of community and engagement in virtual settings.

Venkatesh et al. (2003) stated that the Unified Theory of Acceptance and Use of Technology (UTAUT) provides insights into the factors influencing teachers' acceptance and adoption of technology. The study will explore teachers' attitudes, perceived ease of use, and behavioural intentions toward technology, contributing to a deeper understanding of the drivers behind technology adoption in educational settings. By combining these theoretical viewpoints, the study aims to find the impact of technology on teachers' efficiency. It incorporates TPACK to assess their knowledge base, CoI to evaluate the collaborative and interactive aspects of online classroom settings, and UTAUT to analyze the teachers' acceptance and adoption of technology.

Delimitations of the Study

The study was delimited to (1) public sector universities in the Punjab Province and (2) university teachers (male and female) who have been teaching in BS programs.

Material and Method

Research Design

This research was a quantitative study that used a survey for data collection. It aimed to accomplish its objectives using an ex-post facto (causal-comparative) design, employing a five-point Likert scale. The independent variables were Modern Technology and Teachers' Computer Literacy, while the dependent variable was Teacher Efficiency.

Population and Sample Selection

The study population was male and female public university teachers in the Punjab province. To obtain a sample, 15 universities in Punjab were selected using a simple random sampling technique. The province is divided into three regions: north, central, and south Punjab, with five universities randomly chosen from each region. The sample focused on male and female university teachers teaching BS Programs. From each of the 15 universities, 10 teachers (male and female) were randomly selected based on their informed consent, resulting in a total sample of 150 teachers. Surveys were distributed to these 150 teachers, and the researchers received 134 complete responses.

Research Instruments

The research tool developed for data collection was a five-point Likert scale called the "Teachers' Efficiency Questionnaire".

Validation of Research Instruments

After developing questionnaires for teachers, five university research experts reviewed them to ensure validity. Feedback and suggestions from these experts were considered, leading to necessary modifications. Refinements, additions, and rephrasing were also made based on the received responses. The Teachers' Efficiency Questionnaire was pilot-tested with 30 teachers from the University of Education, Lahore. These respondents were selected from public universities, expanding beyond the initial sample while staying within the same population. The pilot testing was crucial in identifying weaknesses or shortcomings in the research instruments. Based on the pilot study's findings, necessary improvements were made to the instruments before their actual implementation in the research.

Reliability of the Research Instruments

The reliability of the data collection instruments was assessed using Cronbach's Alpha. The Teachers' Efficiency Questionnaire showed a Cronbach Alpha reliability of .85. This value indicates a high level of reliability, making them highly suitable for research purposes.

Data Collection

After the pilot study, data collection was conducted under the authorization of the department head and the respective teachers in the universities under consideration. The researchers personally visited, through email and Google Forms, all the 15 universities included in the sample and administered the tool Teachers' Efficiency Questionnaire. To reach the dispersed sample population, the researchers used various strategies to enhance the response rate: The researcher personally visited different universities and contacted the teachers of public universities to fill out the questionnaire. The researchers made efforts to collect the data themselves. After a short introduction, the researchers informed participants about the research objectives. Participants were explicitly assured that their participation in the data collection process would not affect their employment status or the academic performance of their students. Following this, the researchers distributed the questionnaires to the participants involved in the study. A soft form of the questionnaire was developed through Google Forms and sent through WhatsApp in some universities/institutes where the researchers have strong professional relations with faculty members, with a request that teachers fill it out.

Data Analysis

The collected data for this study was quantitative in nature. The effect of modern technology on teachers' efficiency was calculated by applying ANOVA and Post Hoc LSD. The effect of teachers' computer literacy on teachers' efficiency was also calculated by applying ANOVA.

Ethical Consideration

Informed consent was obtained from all participants, who were fully informed of the study's purpose, procedures, and their right to withdraw. Confidentiality and anonymity were maintained by securely storing data (Amjad & Malik, 2024). The study minimized harm, ensured non-intrusive procedures, and reported data transparently for intended purposes.

Results and Discussion

Table 1
Table Presenting the Effect of Modern Technology on Teachers' Efficiency

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4474.957	3	1491.652	22.104	.000
Within Groups	8772.745	130	67.483		
Total	13247.701	133			

Table 1 divulges the significant effect of the use of modern technologies on teachers' efficiency $F(3,130) = 22.104, p = .000, p < 0.05, p$ is lesser than 0.05. Therefore, the use of modern technology has a significant effect on teachers' efficiency. It can be concluded that modern technologies have caused an effect on teachers' efficiency. The results support the conclusion that the teachers using modern technology perform more efficiently than the other teachers.

Table 2
Post Hoc LSD Test Deciphering the Multiple Comparisons among Teachers on the Use of Modern Technology Based on the Teaching Efficiency

Dependent Variable: Teachers' Efficiency						
LSD						
(I) Modern Technology	(J) Modern Technology	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Multimedia	Social Networks	-21.45946	2.64855	.244	-26.6993	-16.2196
	Academic Software	-15.53333	2.46794	.418	-20.4159	-10.6508
	ICT	-17.88889*	3.56217	.000	-24.9362	-10.8416
Social Networks	Multimedia	21.45946	2.64855	.244	16.2196	26.6993
	Academic Software	5.92613*	1.65034	.000	2.6611	9.1911
	ICT	3.57057*	3.05318	.000	-2.4698	9.6109
Academic Software	Multimedia	15.53333	2.46794	.418	10.6508	20.4159
	Social Networks	-5.92613*	1.65034	.000	-9.1911	-2.6611
	ICT	-2.35556*	2.89790	.000	-8.0887	3.3776
ICT	Multimedia	17.88889*	3.56217	.000	10.8416	24.9362
	Social Networks	-3.57057*	3.05318	.000	-9.6109	2.4698
	Academic Software	2.35556*	2.89790	.000	-3.3776	8.0887

*. The mean difference is significant at the 0.05 level.

Table 2 elaborates on LSD computations, examining the effect of modern technology as an independent variable on teachers' efficiency as a dependent variable. The LSD computation reveals that in group one, the use of Multimedia has a significant difference for the group of ICT users, and all other groups of Multimedia users show no significant difference in effect on teacher efficiency. In group two, there is a significant difference between the groups of Social Networks, Academic Software, and ICT users, and the Multimedia group of social network users shows no significant difference in effect on teacher efficiency. In group three, there is a significant difference

between Academic Software users and Social Networks and ICT users of modern technology, and the Multimedia group of Academic Software users shows no significant difference in effect on teacher efficiency. In group four, the ICT use of modern technology has a significant effect on teacher efficiency in the classroom as $p = .000$ values for varied comparisons. It may be concluded that using ICT affects the teacher's efficiency.

Table 3
Table Demonstrating the Effect of Teachers' Level of Computer Literacy on Teachers' Efficiency

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4352.757	3	1384.656	21.264	.000
Within Groups	8348.791	130	61.485		
Total	12701.548	133			

Table 3 reflects the significant effect of Teacher Computer Literacy on Teacher Efficiency $F(3,130) = 21.264, p = .000, p < 0.05, p$ is lesser than 0.05. Therefore, the level of computer literacy has a significant effect on teachers' efficiency. It can be concluded that teachers' level of computer literacy has caused a difference in teachers' efficiency. The results support the conclusion that the teachers with high levels of computer literacy performed more efficiently than the other teachers.

Table 4
Post Hoc LSD Test Deciphering the Multiple Comparisons among Teachers on Computer Literacy Based on the Teaching Efficiency

Dependent Variable: Teachers' efficiency						
LSD						
(I) Level of Computer Literacy	(J) Level of Computer Literacy	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Average	Above average	-21.45946*	2.64855	.000	-26.6993	-16.2196
	Trained	-15.53333*	2.46794	.000	-20.4159	-10.6508
	Expert	-17.88889*	3.56217	.000	-24.9362	-10.8416
Above average	Average	21.45946*	2.64855	.000	16.2196	26.6993
	Trained	5.92613*	1.65034	.000	2.6611	9.1911
	Expert	3.57057	3.05318	.156	-2.4698	9.6109
Trained	Average	15.53333*	2.46794	.000	10.6508	20.4159
	Above average	-5.92613*	1.65034	.000	-9.1911	-2.6611
	Expert	-2.35556	2.89790	.317	-8.0887	3.3776
Expert	Average	17.88889*	3.56217	.000	10.8416	24.9362
	Above average	-3.57057	3.05318	.156	-9.6109	2.4698
	Trained	2.35556	2.89790	.317	-3.3776	8.0887

*. The mean difference is significant at the 0.05 level.

Table 4 reflects LSD computations, which show the effect of teachers' level of computer literacy as an independent variable on teachers' efficiency as a dependent variable. LSD computation shows that in group one, the average level of computer literacy has a significant effect on teacher efficiency, isolating above-average, trained, and expert teachers.

In group two, there is a significant difference between the above-average level of computer literacy and the average trained teacher efficiency, but there is no significant difference between the above-average level of computer literacy of teachers and experts.

In group three, there is a significant difference between the trained level of computer literacy and the average and above-average level, but there is no significant difference between the level of computer literacy of trained teachers and the expert level of computer literacy regarding teacher efficiency.

In group four, there is a significant difference in teacher efficiency between the expert level of computer literacy and the average level of computer literacy, but there is no significant difference between the expert teachers' level of computer literacy as compared to the above-average and trained level of computer literacy.

Discussion

This research study delves into the impact of modern technologies on teacher efficiency. This investigation, conducted within a Pakistani context, stands out as an innovative effort to address a gap in the predominantly Western-centric body of knowledge on this subject.

While existing empirical studies have primarily focused on the Western world, the current research extends its scope to a developing country, namely Pakistan. The study draws partial support from previous research by De Witte & Rogge (2014) and finds resonance with recent works by Ibragimovich et al. (2021) and Musurmonov et al. (2021) on the global impact of modern technologies on teachers' efficiency. Contrary to the Western-centric origins of theories on the effect of modern technology on teachers' efficiency, the study reveals that Pakistani universities utilizing modern technologies influence teachers' efficiency. Noteworthy is that despite cultural differences, the impact of modern technology transcends geographical boundaries.

The research identifies that Teachers' Computer Literacy significantly influences Their Efficiency, with those with high levels of computer literacy performing more efficiently. The study underscores the substantial impact of modern technology on teachers' efficiency. These results align with previous works by Omenyi et al. (2007), Bower (2011), Lazar & Panisoara (2018), and Gupta & Pathania (2021), confirming that modern technologies significantly enhance teachers' effectiveness.

In conclusion, this study makes a significant contribution to comprehending the impact of modern technologies on the educational context in Pakistan, shedding light on their influence on teachers' efficiency. This study finds that teachers' computer literacy significantly affects their efficiency.

Conclusions

The research concluded that modern technology significantly impacts teachers' efficiency, with teachers who utilize such technology demonstrating higher efficiency compared to those who do not. It also concluded that teachers' computer literacy significantly impacts teachers' efficiency, with computer-literate teachers performing better.

Recommendations

Considering the recent study's evidence of modern technology's strong impact on teachers' efficiency, it is suggested that governmental bodies such as the Higher Education Department and the Ministry of Education ensure that teachers have access to reliable teaching tools, such as video conferencing software, digital whiteboards,

projectors, and virtual labs. This allows teachers to manage classes efficiently without compromising quality.

The study's results underscore the impact of Modern Technology on Teachers' Efficiency. Consequently, university administrators should consider implementing modern technologies across all departments.

Give teachers access to a wide range of digital resources, such as academic databases, e-books, and multimedia content, making it easier for them to enhance their lectures and course materials.

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