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RESEARCH PAPER

Impact of Modern Technologies on Teachers' Efficacy at University Level

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ABSTRACT

This study aims to investigate the impact of modern technologies on teachers' efficacy at the university level. The researchers used ex-post facto (causal-comparative) survey research design in the current quantitative study to collect data from teachers. The sample comprised male and female university teachers selected through a simple random sampling technique. Data collection was facilitated by a five-point Likert scale questionnaire and a dual-option checklist, validated by experts and pilot-tested for reliability using Cronbach's Alpha. The results revealed that university teachers predominantly employ technologies such as Microsoft Office, laptops, mobile phones, projectors, Zoom applications, Google Meet, WhatsApp, YouTube, Facebook, and email in their teaching activities. Furthermore, it was found that modern technologies significantly impact teachers' efficacy. It is recommended that modern technological devices, applications, and software be made available in all public sector universities to enhance teachers' efficacy.

KEYWORDS Modern Technology, Professional Development, Teacher Efficacy, University Teachers, University

Introduction

In this century, people live in a push-button era where updated information is readily available, and they can use knowledge in all areas of life as needed. Technology has made life more enjoyable and comfortable; education is no exception. The education system has dramatically changed, pushing educators into a time when technology is essential for teaching. With schools and universities worldwide switching to online learning, the reliance on modern technology has become more evident than ever. This significant change has altered the traditional classroom environment and led to a critical look at how modern technology affects teacher efficacy (Maheshwari et al., 2021).

Technology profoundly influences society's educational system. Since education is a fundamental aspect of life, integrating modern technology-based methods has enhanced our educational system, enabling knowledge acquisition beyond human understanding (Amjad et al., 2024, a, b, c; Shafqat & Amjad, 2024).

Bandura (1997) stated that self-efficacy refers to an individual's belief in their capability to perform actions required to achieve a specific outcome or complete a task. In a professional context, self-efficacy relates to an individual's assessment of their ability to handle the demands of their job responsibilities effectively (Amjad et al., 2020, 2021, 2022, a, b). Bandura explored how an individual's level of self-efficacy influences their emotional well-being, decision-making processes, effort levels, and perseverance in the face of challenges. According to Bal-Taştan et al. (2018), teacher self-efficacy is a teacher's assessment of their own ability to achieve the desired outcomes in student learning and performance.

Integrating modern technology into classrooms has empowered educators to adopt innovative and customised teaching strategies. Tools like interactive whiteboards, educational applications, and online simulations provide dynamic and engaging content,

allowing teachers to address diverse learning preferences. Modern technology enhances teachers' confidence and efficacy in delivering high-quality instruction (Mishra & Koehler, 2006).

Technology supports educators' ongoing professional development via online courses, webinars, and collaborative platforms. Teachers can access many resources to enhance their skills, keeping them updated on the latest educational trends and teaching methodologies. This accessibility increases teachers' self-efficacy (Ertmer et al., 2015). This study examines the impact of modern technologies on teachers' efficacy at the university level, exploring how technological tools influence educators' confidence, teaching practices, and overall effectiveness.

Literature Review

The integration of technology in university teaching has introduced both opportunities and challenges. Collins and Halverson (2018) state that digital tools such as Learning Management Systems (LMS), virtual classrooms, and interactive whiteboards have transformed traditional pedagogical practices. These technologies facilitate more dynamic and interactive learning environments, enabling educators to engage students in novel ways and provide access to a wealth of digital resources. Almarashdeh (2016) highlights that LMS platforms, for instance, streamline the management and dissemination of course materials, thereby enhancing organisational efficiency and instructional delivery.

While technological tools offer potential benefits, their adoption can impact teachers' confidence and efficacy (Ong et al., 2024). Ertmer and Ottenbreit-Leftwich (2010) argue that the effective use of technology in teaching is contingent upon educators' knowledge, confidence, and beliefs. Teachers needing more proficiency with new technologies may experience improved confidence, adversely affecting their teaching effectiveness (Tabbasam et al., 2023; Tabassum et al., 2024). Furthermore, the transition to technology-enhanced education often requires significant adjustments in teaching strategies and practices, which can be challenging for some educators.

The implementation of modern technologies in higher education also presents several challenges. Selwyn (2016) points out that disparities in technological access and digital literacy among faculty members can lead to uneven teaching quality and student experiences. Teachers in institutions with limited technological resources or insufficient training may need help integrating technology effectively into their pedagogical practices (Qureshi et al., 2023). Additionally, Koehler and Mishra (2009) emphasise the importance of providing adequate professional development to support educators in navigating and utilising new technologies.

Investing in professional development and support for educators is crucial to addressing these challenges. Studies suggest that targeted training programs can enhance teachers' technological skills and confidence, improving their efficacy in technology-enhanced teaching environments (Amjad et al., 2023, a, b, c; Amjad & Malik, 2024; Koehler & Mishra, 2009). Providing ongoing support and resources can help educators adapt to technological changes and integrate digital tools more effectively into their teaching practices.

Theoretical Framework

The theoretical framework for examining the impact of modern technologies on teacher efficacy at the university level is grounded in several established educational theories and models. This framework integrates the Technological Pedagogical Content Knowledge (TPACK) model, the Technology Acceptance Model (TAM), and Bandura's theory of self-efficacy to understand how technology influences teacher efficacy comprehensively.

The TPACK model, developed by Koehler and Mishra (2009), is a critical foundation for understanding technology integration in education. TPACK emphasises the importance of teachers possessing a blend of technological, pedagogical, and content knowledge to effectively integrate technology into their teaching practices. According to this model, effective teaching with technology requires understanding the complex interplay between these three domains. The TPACK framework helps identify the specific knowledge and skills teachers need to develop to enhance their efficacy in using technology in the classroom.

The Technology Acceptance Model, proposed by Davis (1989), provides insights into the factors influencing teachers' acceptance and use of technology. TAM posits that perceived usefulness and perceived ease of use are the primary determinants of technology acceptance. In the context of higher education, this model helps explain how teachers' beliefs about the benefits and usability of technological tools impact their willingness to integrate these tools into their teaching practices. Understanding these perceptions can guide the development of strategies to improve technology adoption and teacher efficacy.

Albert Bandura's theory of self-efficacy (1997) is another crucial element of the theoretical framework. Self-efficacy refers to an individual's belief in their ability to succeed in specific tasks. In the context of teaching, self-efficacy influences how teachers approach challenges and their persistence in overcoming obstacles. Bandura's theory suggests that teachers with higher self-efficacy are more likely to experiment with new technologies and integrate them effectively into their teaching practices. This theory underscores the importance of building teachers' confidence in their technological skills to enhance their overall efficacy.

The theoretical framework combining TPACK, TAM, and Bandura's self-efficacy theory offers a comprehensive approach to understanding and improving the impact of modern technologies on teacher efficacy at the university level. This framework provides a robust foundation for enhancing educational practices and outcomes in higher education by addressing the interrelated aspects of knowledge, acceptance, and confidence.

Material and Methods

Research Design

This research was a quantitative study that used a survey for data collection. The study aimed to accomplish its objectives using an ex-post facto (causal-comparative) design, employing a five-point Likert scale. In this study, the independent variable was Modern Technology, while the dependent variable was Teacher Efficacy.

Population and Sample Selection

Male and female public university teachers of the Punjab province were the population of the study. To obtain a sample from the accessible population, fifteen (15) universities in the Punjab province were chosen. The selection was based on the simple random sampling technique. The Punjab province is divided into three geographical regions: north, central, and south Punjab. Five universities from each region were selected through a random sampling technique. The researchers randomly selected 15 universities offering BS Programs. Male and female University teachers teaching BS Programs were the study's sample. Ten teachers (male and female) were selected randomly from each university based on their informed consent. The total number of teachers as the sample was one hundred and fifty (150). After receiving consent, the researchers distributed surveys to the 150 teachers. Ultimately, the researchers received 134 complete responses from the teachers.

Research Instruments

Two research instruments were developed for data collection: a five-point Likert scale called the "Teachers' Efficacy Questionnaire" and a “Checklist” for the teachers.

Validation of Research Instruments

After developing questionnaires for teachers, they were vetted by five experts from university faculties specialised in research to ensure their validity. Considering all feedback and suggestions provided by the university teachers, modifications were made to the questionnaires as needed. Further refinements, additions, and rephrasing were implemented based on the responses received. Subsequently, two assessment tools, the Teachers’ Efficacy Questionnaire and Checklist, underwent pilot testing with 30 teachers at the University of Education, Lahore. Respondents for this trial were selected from public universities, expanding beyond the initial research sample while remaining within the same population. The pilot testing phase proved instrumental in identifying any weaknesses or shortcomings in the research instruments. Based on the findings obtained from the pilot study's data collection, necessary improvements were made to the instruments before implementation in the actual research.

Reliability of the Research Instruments

The reliability of the research instruments used for data collection was evaluated using Cronbach's Alpha. The computed Cronbach Alpha reliability for the instrument Teachers' Efficacy Questionnaire was determined to be .87. Furthermore, the Cronbach Alpha reliability for the Checklist was determined to be .84, indicating a high level of reliability. This degree of reliability is deemed highly suitable for research.

Data Collection

Following the pilot study, data was collected with the authorisation of the department head and the respective university teachers. The researchers personally visited the 15 universities included in the sample, using email and Google Forms, and administered the Teachers’ Efficacy Questionnaire and Checklist. To effectively reach the dispersed sample population, the researchers used various methods to increase the response rate:

The researchers visited different universities to distribute the questionnaire to public university teachers. They made a concerted effort to collect the data themselves. After a brief introduction by the researchers, participants were informed about the purpose of the research and assured that the research would not affect their employment status or the academic performance of their students. The questionnaires were then distributed to the participants involved in the study.

Soft copies of the questionnaires were created using Google Forms and distributed via WhatsApp to universities where the researchers had professional relationships with faculty members, requesting them to facilitate the completion of the questionnaires by teachers.

Data Analysis

The data collected for this study was quantitative. Descriptive statistics were utilised to summarise the demographic characteristics, expressed in frequency and percentage. Specifically, frequency and percentage calculations were conducted for demographic variables such as gender, academic qualifications, professional qualifications, teaching experience, level of computer literacy, and use of modern technology in the classroom. Additionally, frequency, percentage, and mean scores were computed for the

types of technology-based educational gadgets commonly used in classrooms. ANOVA and Post Hoc LSD tests were applied to determine the effect of modern technology on teachers' efficacy.

Ethical Consideration

In this study, informed consent was obtained from all participants, who were thoroughly informed about the research's purpose, procedures, and rights, including the right to withdraw at any time without penalty. Confidentiality and anonymity were strictly maintained, with personal data being de-identified and securely stored to prevent unauthorised access. The study was designed to minimise potential harm, ensuring that questions and procedures were non-intrusive and respectful of participants' comfort levels. The integrity of the data was preserved through honest and transparent reporting, with a commitment to using the data solely for the purposes outlined in the study.

Results and Discussion

Table 1
Table Revealing Respondent Teacher's Gender

	Gender	Frequency	Percent
	Male	70	52.2%
	Female	64	47.8%
Total		134	100.0

Table 1 illustrates that male teachers were more responsive than females. There were 70 (52.2%) males whereas 64 (47.8%) were female respondents.

Table 2
Table Showing Teachers' Academic Qualification

	Academic Qualification	Frequency	Percent
	M.A/M.Sc.	2	1.4%
	M.Phil	53	39.6%
	Ph.D	79	59.0%
Total		134	100%

Table 2 shows the distribution of respondents regarding the academic qualifications of teachers. This table demonstrates that Ph.D.79 (59.0%) respondents were more than M.Phil and M.A/M.Sc. respondents. Ph.D. respondents were 59.0%, whereas 53 (39.6%) were M.Phil respondents and 2 (1.4%) were M.A/M.Sc. respondents.

Table 3
Table Reflecting Teachers' Professional Qualification

Professional Qualification	Frequency	Percent
B.Ed.	23	17.2%
M.Ed.	51	38.1%
M.A/M.Sc.	15	11.2%
M.Phil	24	17.9%
Ph.D	21	15.7%
Total	134	100.0

Table 3 demonstrates teachers' professional qualifications, which shows a higher percentage of M.Ed. than other academic qualifications. Teachers to the tune have 51 (38.1%) M.Ed. degrees; on the other hand, 23 (17.2%) had B.Ed. qualification, 15 (11.2%) had M.A/M.Sc., 24 (17.9%) had M.Phil, and 21 (15.7%) of the teachers had Ph.D. qualifications to their credit. University teachers in Punjab province are highly qualified in academic and professional qualifications.

Table 4
Table Divulging Teacher's Teaching Experience in Years

Experience of Teaching in years	Frequency	Percent
1-5 Years	40	29.9%
6-10 Years	42	31.3%
11-15 Years	31	23.1%
16-20 Years	17	12.7%
More than 20 Years	4	3.0%
Total	134	100.0

Table 4 reflects that more than one-third of the teachers, 42 (31.3%), had 6 to 10 years of teaching experience. Some of them, 40 (29.9%) had 1 to 5 years of experience, and 31 (23.1%) had 11 to 15 years of teaching experience. Only a few of them, 17 (12.7%), had 16 to 20 years, and just 4 (3%) of teachers had more than 20 years of teaching experience. Most of the teacher respondents are teaching BS program students. Therefore, there are less experienced teachers with more than 20 years of teaching experience to their credit.

Table 5
Table Reflecting Level of Computer Literacy among Teachers

Level of Computer Literacy	Frequency	Percent
Average	13	9.7%
Above average	37	27.6%
Trained	75	56.0%
Expert	9	6.7%
Total	134	100.0

Table 5 depicts the level of computer literacy among university teachers. The results show a considerable number of trained 75 (56.0%) teachers who participated in the study, while 37 (27.6%) above-average computer-literate teachers and 13 (9.7%) average computer-literate teachers participated in the research. Just 9 (6.7%) of teachers were found to be computer experts.

Table 6
Table Showing the Use of Modern Technologies in the Classroom

Modern Technologies	Frequency	Percent
Rarely	11	8.2%
Occasionally	29	21.6%
Frequently	73	54.4%
Very Frequently	21	15.6%
Total	134	100.0

Table 6 elaborates on the usage of modern technologies among university teachers. The results show that 73 (54.4%) of teachers who frequently use modern technologies have been part of the study, 29 (21.6%) of teachers who occasionally use modern technologies, and 21 (15.6%) of teachers who very frequently use modern technologies have been part of the research. Just 11 (8.2%) of teachers were found to use modern technologies in the classroom rarely.

The study highlighted several modern technologies currently used by university teachers. A table was created to analyse the frequency of these technologies. Researchers used a checklist to identify the specific types of modern technologies educational institutions use. The table displays the number of participants who responded yes or no to each technology, with the results shown as percentages and the mean calculated for each statement.

Table 7
Checklist of Types of Technologies Being Used In the Universities

Technologies	Frequencies			Mean
	Yes	No	Total	

	No.	Percent	No.	Percent	No.	
Zoom application	108	80.6%	26	19.4%	134	1.19
Skype	88	65.2%	46	34.8%	134	1.18
Google Meet	103	76.6%	31	23.4%	134	1.05
WhatsApp	115	85.3%	19	14.7%	134	1.33
Instagram	107	79.5%	27	20.5%	134	1.03
Facebook	128	95.4%	6	4.6%	134	1.20
YouTube	111	82.8%	23	17.2%	134	1.17
Microsoft Office	130	96.8%	4	3.2%	134	1.33
Email	116	86.6%	18	13.4%	134	1.13
Projector	129	96.1%	5	3.9%	134	1.31
Computers	104	77.6%	30	22.4%	134	1.30
Laptops	130	96.5%	4	3.5%	134	1.35
Tablet	88	65.5%	46	34.5%	134	1.32
Mobile Phones	130	96.7%	4	3.3%	134	1.35
Google	128	95.5%	6	4.4%	134	1.23

Table 7 shows that the use of modern technology is now very common at universities for teaching and learning. The results demonstrate the high frequency of technology users. Teachers use Zoom applications, WhatsApp, Facebook, YouTube, MS Office, email, projector, laptops, mobile phones, and Google more than 80% more than other technologies.

Table 8
Table Presenting the Effect of Modern Technology on Teachers' Efficacy

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3048.896	4	762.224	12.414	.000
Within Groups	22274.604	129	172.671		
Total	25323.500	133			

Table 8 makes it clear that the significant effect of the difference between the means of elements of teachers' efficacy F (4,129) = 12.414, p = .000, p< 0.05, p is lesser than 0.05. Therefore, modern technology has a significant effect on teachers' efficacy. It can be concluded that modern technologies have caused a difference in teachers' efficacy. The results support the conclusion that the teachers who use modern technology have more efficacy than the other teachers.

Table 9
Post Hoc LSD Test Deciphering the Multiple Comparisons among Teachers on Teachers Efficacy Based on the Use of Modern Technologies

Dependent Variable: Teachers' Efficacy

LSD

(I) Modern Technology	(J) Modern Technology	Mean Difference (I-J)	Std. Error	*Sig.*	95% Confidence Interval	
					Lower Bound	Upper Bound
Messaging apps	Multimedia	7.00000	9.98089	.484	-12.7474	26.7474
	Social Networks	-6.37838	9.53952	.505	-25.2526	12.4958
	Academic Software	3.25333	9.41477	.730	-15.3740	21.8807
	ICT	-4.57143*	10.53580	.000	-25.4168	16.2739
Multimedia	Messaging apps	-7.00000	9.98089	.484	-26.7474	12.7474
	Social Networks	-13.37838*	4.23665	.002	-21.7607	-4.9961

	Academic Software	-3.74667	3.94775	.344	-11.5574	4.0640
	ICT	-11.57143*	6.16034	.000	-23.7598	.6169
Social Networks	Messaging apps	6.37838	9.53952	.505	-12.4958	25.2526
	Multimedia	13.37838*	4.23665	.002	4.9961	21.7607
	Academic Software	9.63171*	2.63990	.000	4.4086	14.8548
	ICT	1.80695	5.41610	.739	-8.9089	12.5228
Academic Software	Messaging apps	-3.25333	9.41477	.730	-21.8807	15.3740
	Multimedia	3.74667	3.94775	.344	-4.0640	11.5574
	Social Networks	-9.63171*	2.63990	.000	-14.8548	-4.4086
	ICT	-7.82476*	5.19323	.000	-18.0997	2.4502
ICT	Messaging apps	4.57143*	10.53580	.000	-16.2739	25.4168
	Multimedia	11.57143*	6.16034	.000	-.6169	23.7598
	Social Networks	-1.80695	5.41610	.739	-12.5228	8.9089
	Academic Software	7.82476*	5.19323	.000	-2.4502	18.0997

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

Table 9 shows *LSD* computations with modern technology as an independent variable and teachers' efficacy as a dependent variable. The LSD computation reveals that in group one, the use of Messaging apps is significantly different from the use of ICT. However, there is no significant difference between the use of messaging apps, multimedia, social networks, and academic software on teachers' efficacy.

In group two, there is a significant difference in the use of Multimedia compared to Social Networks and ICT, but there is no significant difference between the use of Multimedia with Messaging apps and Academic Software.

In group three, there is a significant difference in the use of Social Networks compared to Multimedia and Academic Software, but there is no significant difference between the use of Social Networks with Messaging apps and ICT.

In group four, there is a significant difference between the use of academic software and social networks and ICT. However, no significant difference exists between using academic software with messaging apps and multimedia.

In group five, there is a significant difference in the use of ICT with Messaging apps, Multimedia, and Academic Software, but there is no significant difference in the use of ICT with Social Networks.

Discussion

The present study finds out the impact of modern technologies on teachers' efficacy at the university level. The study reveals that teachers in the surveyed universities heavily rely on technologies such as Microsoft Office, Laptops, Mobile Phones, and Projectors for their teaching. Social media platforms like Facebook and YouTube are also commonly utilised. However, using technologies like Instagram and Google Meet is relatively lower and may not be as integral to the learning experience in these academic settings. The mean scores provide additional context about the frequency of usage for each technology.

Teachers use Zoom applications, WhatsApp, Facebook, YouTube, MS Office, email, projector, laptop, and mobile phones more than 80% of the time compared to other technologies.

Moreover, the research highlights the positive effect of modern technology on teachers' efficacy, consistent with findings from Bandura (1997), Hoy (2000), and Gkolia, Belia, and Koustelios (2014). The study establishes a strong link between the use of modern technology and teachers' overall efficacy. The study concludes that Modern Technology significantly affects Teachers' Efficacy, with teachers using modern technology exhibiting higher efficacy.

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 impact of modern technologies on teachers' efficacy. Contrary to the Western-centric origins of theories on the effect of modern technology on teachers' efficacy, the study reveals that Pakistani universities utilising modern technologies do indeed influence teachers' efficacy. Noteworthy is that despite cultural differences, the impact of modern technology transcends geographical boundaries. It was explored that modern technologies impact teachers' efficacy at the university level.

Conclusion

Based on the data, it is concluded that Modern Technologies significantly affect Teachers' Efficacy, with teachers using modern technology exhibiting higher efficacy. The study indicates that teachers at the surveyed universities predominantly use technologies like Microsoft Office, laptops, mobile phones, and projectors for their teaching activities. Using technologies such as laptops, mobile phones, Microsoft Office, and projectors allows teachers to deliver content more effectively, streamline administrative tasks, and adapt to diverse learning needs. As a result, these technologies contribute to a more efficient and dynamic educational environment, ultimately benefiting both teachers and students.

Recommendations

- To enhance Teachers' Efficacy, it is recommended that Modern Technology devices, applications, and software be made available in all public sector universities.
- The study's results underscore the impact of Modern Technology on Teachers' Efficacy. It is suggested that university administrators consider implementing modern technology across all departments.
- For a comprehensive assessment of the impact of Modern Technology on Teachers' Efficacy, a comparable investigation should be carried out in both rural and urban settings.

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