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A STUDY ON TECHNO-PEDAGOGICAL SKILLS AMONG TEACHERS OF HIGHER EDUCATION

Dr. Ranjita Marak[1], Anushka Dwivedi[2]
[1]*Assistant Professor, Department of Education, Vasanta College for Women*
[2]*M.Ed., Department of Education, Vasanta College for Women,*
Admitted to the privileges of Banaras Hindu University

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ABSTRACT
As higher education rapidly shifts toward technology-driven teaching, the capacity of educators to blend digital tools with pedagogy has become a decisive factor in learning outcomes. This study investigates the techno-pedagogical skills of teachers in affiliated colleges under Banaras Hindu University, with a focus on assessing their current competency levels and examining differences across gender, teaching experience, and subject specialization. A quantitative research design employing a descriptive survey method was adopted. The sample comprised 70 teachers from Language, Social Science, and Arts disciplines, drawn from Vasanta College for Women and Arya Mahila P.G. College, selected through stratified random sampling. Data were collected using a self-constructed questionnaire based on literature review and expert validation, covering areas such as technology integration, digital content creation, use of online platforms, and technology-supported instructional planning. Descriptive statistics (mean, standard deviation, variance, skewness, kurtosis) were used to summarize data trends, while non-parametric tests (Mann-Whitney U Test, Kruskal-Wallis Test) examined group differences. Findings reveal that the overall level of techno-pedagogical skills among teachers is moderate. Additionally, there is no statistically significant difference in these skills based on gender, teaching experience, or subject specialization. Such results highlight the need for inclusive training programs aimed at enhancing these skills across all teacher groups.

KEYWORDS: *Techno-Pedagogical Skills, Teachers, Higher Education, Banaras Hindu University*

INTRODUCTION
In the 21st-century digital era, technology has become an indispensable part of daily life, and education is no exception. For today's educators, especially those entering the teaching profession, possessing a sound understanding of Information and Communication Technology (ICT) is no longer optional it is essential. The National Curriculum Framework (NCF, 2005) and the XIIth Five-Year Plan (Planning Commission, 2013) have both underscored the urgent need to integrate ICT into curriculum transaction processes, urging a shift from conventional teaching methods to more interactive, learner-centric, and digitally empowered approaches.

The rapid integration of digital technologies into education has redefined the nature of teaching and learning, transforming classrooms from static, teacher-centered spaces into dynamic, interactive, and student-centered environments. This transformation reflects the shifting priorities of 21st-century education, where the focus has moved beyond rote memorization toward the cultivation of higher-order skills such as critical thinking, creativity, problem-solving, digital literacy, and the ability to access, evaluate, and synthesize information effectively.

In this evolving educational landscape, educators are required to adapt their instructional practices to meet the demands of technology-rich learning environments. This adaptation calls for the development of techno-pedagogical competence, a comprehensive set of skills that integrates technological proficiency with sound pedagogical principles. Such competence is not limited to operating digital tools; rather, it encompasses the ability to select appropriate technologies, integrate them strategically into teaching, and evaluate their impact on student learning in alignment with curricular goals and diverse learner needs.

Despite these developments, teacher education continues to face both quantitative and qualitative challenges. According to UNESCO (2002), an estimated 15 to 35 million new teachers are needed globally to meet the goals of "Education for All." In the Asia-Pacific region, the need is especially pressing due to the rapid changes brought about by educational and curriculum reforms. To prepare teachers for 21st-century classrooms, there is a growing demand for new pedagogical paradigms and innovative approaches grounded in both conceptual understanding and technological tools (UNESCO, 2002). While the integration of technology into education has sparked extensive debate, its significance in 21st-century pedagogy is undeniable. As *Riel (1998)* noted, the transformative potential of technology in education depends not merely on access but on how effectively teachers interpret and implement digital tools to enrich the learning process.

TECHNO PEDAGOGICAL SKILLS
Pedagogy, often described as the *science and art of teaching*, encompasses both theoretical understanding and practical

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application in educational contexts. The term *techno*, derived from the Latin word *"texere"*, meaning *to weave or construct*, adds a dynamic dimension to pedagogy by emphasizing the integration of technology into teaching and learning environments. Thus, techno-pedagogy refers to the skillful weaving of technological tools into pedagogical practices to enhance the learning experience.

Educational technology supports the design of effective learning environments by aligning teaching strategies with learning objectives. It facilitates the implementation of best practices and instructional methods that have a direct impact on student learning outcomes. At the core of pedagogy lies the TPACK framework: Technology, Pedagogy, and Content Knowledge which illustrates how these domains interact to inform effective teaching. Technology includes both advanced tools like computers, digital video, Learning Management Systems (LMS), and the internet, as well as traditional resources like blackboards, books, and overhead projectors.

Pedagogy itself comprises practices, strategies, methods, and theories that guide teaching and learning. It also includes essential components such as instructional objectives, assessment techniques, and understanding of student learning processes. According to Beaudin and Hadden (2004), when teachers are empowered to create engaging, technology-rich resources, students are more likely to reach their full potential. Therefore, the integration of techno-pedagogical approaches in teacher training is not just beneficial but necessary.

Importantly, the effective use of technology in classrooms is not about simply adding gadgets or digital tools. It requires the development of a dynamic and transactional relationship between technology, pedagogy, and content knowledge. As the popular saying goes, *"Technology will not replace teachers. But teachers who use technology will probably replace those who do not."*

Research by Lee and Tsai (2010) affirms that teachers who successfully incorporate ICT in classrooms do so by aligning digital tools with appropriate pedagogical strategies suited to the subject matter. This indicates the need for pre-service teachers to develop techno-pedagogical competencies, a combination of knowledge, skills, and attitudes that enable the meaningful use of technology in instructional settings.

Techno-pedagogical competency is defined as a teacher's ability to effectively and consistently apply digital tools to support and enhance teaching and learning. It involves not just technical knowledge, but also the willingness to integrate these tools to promote student engagement and learning outcomes. As Yurdakul (2011) highlights, students need regular hands-on experiences with current technologies during their academic journey. To meet this need, teacher education programs must introduce dedicated courses on technological pedagogy and invest in developing technology-integrated teaching and learning centers. Building such competencies is essential for teachers to respond effectively to the demands of the digital generation and navigate the evolving challenges of contemporary classrooms.

RATIONALE OF THE STUDY

Despite the growing emphasis on technology integration in higher education, many faculty members continue to depend on traditional, lecture-based instructional approaches that limit opportunities for active, student-centered learning. While digital tools and platforms are increasingly available, their effective use requires techno-pedagogical competence, the ability to purposefully align technology with pedagogy and content knowledge to enhance learning outcomes.

In many higher education institutions, systematic initiatives to develop these competencies among faculty remain limited, leading to inconsistent adoption of technology enhanced teaching practices. This gap hinders the potential of higher education to fully prepare students for the demands of a digitally driven, knowledge-based global economy. Without targeted strategies to strengthen techno-pedagogical skills, faculty may struggle to create engaging, interactive, and personalized learning experiences that foster critical thinking, creativity, collaboration, and digital literacy core competencies for 21st-century learners. Therefore, there is a pressing need to examine the current state of techno-pedagogical competence among higher education faculty and identify effective approaches to enhance their readiness for technology integrated teaching.

REVIEW OF RELATED LITERATURE

Information and Communication Technology (ICT) has emerged as a powerful tool in education, capable of enhancing instructional quality, expanding access to resources, and supporting personalized learning (UNESCO, 2018). The National Curriculum Framework (NCF, 2005) and the XII Five-Year Plan (Planning Commission, 2013) in India have emphasized integrating technology into teacher education programs to improve pedagogical efficiency and student outcomes. However, the effective integration of ICT depends not only on access to technological tools but also on the educator's competence to use them pedagogically (Koehler & Mishra, 2009).

Rajalakshmi & Prabu (2024) found systematic differences in techno-pedagogical competency across gender, subject group, type and locality of college, and medium of study; urban and government-aided settings often reported higher competency levels.
Nayak & Choudhury (2024) reported similar overall levels of techno-pedagogical competence across arts and science teacher-educators, suggesting that some contexts show parity across streams even when access differs.

Chauhan (2024) and Lyonga et al. (2021) indicate that teachers who use technology more tend to hold more favourable attitudes toward teaching and where measured show higher performance indices or student outcomes. Several studies differ like Rajalakshmi (2022) and Jena (2023) report no significant gender differences in some contexts, while other regional studies (viz. Parkash & Sirsa, 2018; Bala & Tao, 2018) report male or urban teachers sometimes scoring higher, indicating context sensitivity and measurement variance across instruments and samples.

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Beura & Guru (2019) and Habib (2018) found associations between teacher techno-pedagogical competence and students' academic achievement or teacher effectiveness, suggesting that competence matters for learning outcomes though causal attribution is often limited by cross-sectional designs.

Within India and adjacent regions, several studies (e.g., Rajalakshmi & Prabu, 2024; Prakash & Hooda, 2018; Ezhilarasan & Vijayarani, 2020) report moderate overall levels of techno-pedagogical competence and consistent urban - rural divides attributable to access to infrastructure and training. Similarly, studies from Malaysia and Algeria report relatively high basic access but variable pedagogical integration pointing to the global nature of the challenge and the need for context-sensitive solutions (Yusof et al., 2019; Hanane & Djilali, 2015).

While existing studies highlight the benefits of technology integration and the necessity of techno-pedagogical competence, limited research focuses specifically on higher education faculty in the Indian context. There is a need to investigate not only the current competence levels but also the perceptions, challenges, and institutional factors influencing technology adoption in teaching. Hence, this study aims to examine the current level of techno-pedagogical skills among teachers of affiliated colleges under Banaras Hindu University and to investigate whether significant differences exist in these skills based on gender (male/female), teaching experience, and subject specialization (language, social science, arts).

OBJECTIVES OF THE STUDY

- To explore the current level of techno-pedagogical skills among teachers of affiliated colleges under Banaras Hindu University.
- To examine the differences in techno-pedagogical skills of these teachers across gender (male/female), teaching experience, and subject specialization (language, social science, arts).

RESEARCH HYPOTHESIS

H1 – There is significant difference in techno-pedagogical skills of teachers of affiliated colleges under Banaras Hindu University with respect to:

- Gender (Male/Female)
- Experience of teaching [(0-6) (7-12) (13-18) (19-26)].
- SubjectSpecialization(Language/Social Science/Arts).

METHODOLOGY OF THE STUDY

A quantitative research design was adopted, employing a descriptive survey method to gather data and examine patterns in techno-pedagogical competencies. The target population comprised all teachers from the affiliated colleges of Banaras Hindu University. The sample consisted of 70 teachers representing three major academic streams - Language, Social Science, and Arts drawn from Vasanta College for Women and Arya Mahila P.G. College. A stratified random sampling technique was employed to ensure adequate representation across disciplines and gender categories. The final sample included 46 female and 24 male teachers, enabling balanced subgroup comparisons. Data were collected using a self-constructed questionnaire specifically developed to assess the techno-pedagogical competencies of teachers in higher education. It encompassed core dimensions such as: Technology integration in teaching, Digital content creation, Utilization of online learning platforms and Technology-supported instructional planning.

Both descriptive and inferential statistical techniques were applied to analyze the data. Descriptive statistics included mean, standard deviation, variance, skewness, and kurtosis, which provided insights into the central tendency, dispersion, and distribution characteristics of the dataset.

For hypothesis testing and group comparisons, non-parametric inferential statistics specifically the Mann-Whitney U Test and Kruskal-Wallis Test were employed, as the data did not meet the assumptions required for parametric testing. These statistical methods allowed for a robust examination of both the overall competency levels and the significance of differences across gender, teaching experience, and subject specialization.

DATA ANALYSIS AND INTERPRETATION

The collected data were analysed as per the objectives of the study by using non-parametric measures, which are presented in the following paragraphs.

Table 1. Descriptive Statistics

Statistics	Total Teachers
Sample size	70
Mean	189.0
Standard deviation	21.63

This table presents statistical data for a sample of 70 teachers. The mean score is 189.0, indicating the average performance, while the standard deviation is 21.63, showing the variability in the scores among the teachers.

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Table 2. Level of Techno- Pedagogy skills

Raw Score range	Range of z Score	Frequency	Percentage	Level of techno-pedagogical skills
118-165	+1.01 σ and above	8	13%	High
169-206	1 σ to +1 σ	53	76%	Moderate
215-230	-1.01 σ and below	9	11%	Low
Total		70	100%	

The table categorizes techno-pedagogical skill levels among 70 individuals based on their raw scores and corresponding z-scores. A majority (76%) fall within the moderate range (169–206), indicating average skills. High skill levels (+1.01σ and above, raw score 118–165) are shown by only 13% (8 teacher's), while low skills (-1.01σ and below, raw score 215–230) are found in 11% (9 teacher's). This suggests that most participants possess moderate techno-pedagogical competence, with fewer individuals demonstrating either high or low proficiency.

Table 3. Ranks and Mann- Whitney U test for Gender

Gender	Sample	Mean Rank	Mann-Whitney U test	Z- Value	P-Value
Male	24	32.60			
Female	46	37.01	482.50	-0.860	0.390
Total	70				

The table presents the results of the Mann-Whitney U Test conducted to examine the difference in techno-pedagogical skills based on gender. The sample includes 24 male and 46 female participants. The mean rank for males is 32.60, while for females it is 37.01, indicating a slightly higher average rank for females. However, the Mann-Whitney U value is 482.50, with a Z value of -0.860. The associated p-value is 0.390, which is greater than the standard significance level of 0.05. This suggests that the observed difference in mean ranks between male and female participants is not statistically significant. Therefore, it can be concluded that there is no significant difference in techno-pedagogical skills between male and female teachers.

Table 4. Ranks and Krushkal-Wallish test for Experience of Teaching

Experience	Sample	Mean Rank	Kruskal-Wallis H test	Degree of Freedom	P - Value
(0-6) years	28	35.54	3.698	3	.296
(7-12) years	23	40.48			
(13-18)years	13	31.92			
(19-26)years	6	24.00			
Total	70				

The table shows the results of the Kruskal-Wallis H Test conducted to assess differences in techno-pedagogical skills across four teaching experience groups. The mean ranks vary, with the (7–12) years group scoring the highest (40.48) and the (19–26) years group the lowest (24.00). The test statistic is 3.698 with 3 degrees of freedom and a p-value of 0.296, which is greater than 0.05. This indicates that the differences in mean ranks across experience groups are not statistically significant. Therefore, teaching experience does not significantly affect techno-pedagogical skill levels among the participants in this study.

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Table 5. Ranks and Krushkal-Wallish test for Subject specialization

Subject	Sample	Mean Rank	Kruskal-Wallis H test	Degree of Freedom	P – Value
Language	26	31.69	1.636	2	.444
Arts	16	36.00			
Social science	28	38.75			
Total	70				

The table presents the Kruskal-Wallis H Test results for differences in techno-pedagogical skills across subject specializations. Social Science teachers had the highest mean rank (38.75), followed by Arts (36.00) and Language (31.69). The test statistic is 1.636 with 2 degrees of freedom and a p-value of 0.444, which is greater than 0.05. This indicates that there is no statistically significant difference in techno-pedagogical skills among teachers of different subject areas in the given sample.

DISCUSSION AND CONCLUSION

The findings reveal that most teachers from BHU-affiliated colleges possess moderate techno-pedagogical skills, with only 13% demonstrating high proficiency and 11% showing low competence. This suggests that while many teachers are somewhat capable of integrating technology into teaching, few excel, and some still lag behind. The non-normal distribution with slight negative skewness confirms a clustering around moderate skill levels. This aligns with Karmakar, Behera, and Mohalik's (2025) study, which also reported moderate skills among college teachers. The prevalent moderate proficiency indicates partial adoption of technology, but not to its full potential. Hence, structured training programs and professional development initiatives are essential to enhance teachers' techno-pedagogical competencies, especially targeting those at lower skill levels. Strengthening these skills is crucial for fostering effective technology integration, improving teaching quality, and enriching student learning experiences. Institutions must prioritize ongoing capacity building to meet the evolving demands of digital education.

The study revealed no significant differences in techno-pedagogical skills among teachers based on gender, teaching experience, or subject specialization. Although female teachers and those from Social Science backgrounds showed slightly higher mean ranks, these differences were statistically insignificant. This suggests a uniform distribution of techno-pedagogical competence across diverse teacher demographics. Chauhan (2024) similarly found no significant variance in such skills based on gender or teaching experience. These findings highlight that technological proficiency in teaching is not influenced by demographic factors like gender or years of service. Therefore, professional development programs should be inclusive and designed to benefit all teachers equally, regardless of background. Broad-based training initiatives will ensure that every educator is equally equipped to integrate technology effectively into their teaching. Promoting equitable access to techno-pedagogical skill development is essential for enhancing the overall quality of education and meeting the demands of contemporary, technology-driven classrooms.

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