



Assessing the Techno-Pedagogical Competency of Secondary School Teachers

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Abstract

The use of technology in education has changed the way teaching and learning takes place and has set new challenges for teachers, requiring them to have not only pedagogical and content knowledge, but also knowledge of how to use technology effectively in the teaching-learning process. Techno-pedagogical competency is the ability of teachers to use and incorporate appropriate technological tools and resources with pedagogical strategies and content of the subject to enable meaningful, interesting and effective learning. The aim of the present study is to assess the techno-pedagogical competence of secondary school teachers and the ability of teachers to use technology in teaching. Descriptive research is used for the present study and the data was collected randomly from 80 secondary school teachers from Kohima district of Nagaland. For data collection, the Teacher's Techno-Pedagogical Competence Scale developed and standardized by Rajasekar and Sathiyaraj (2013) was used. Appropriate statistical techniques such as percentage, mean, standard deviation, t-test, were employed to analyze the data. The study reveals the majority of the respondents possess an average level of techno-pedagogical competence. Results show that 25% have high techno-pedagogical competence, 66.25% indicate an average level of techno-pedagogical competence and 8.75% have a low level of techno-pedagogical competence. Findings revealed that there is no statistically significant difference in gender nor a significant difference between locality and management, indicating that male and female teachers, urban and rural, and government and private school teachers exhibit similar techno-pedagogical competencies in general.

Keywords: Techno-Pedagogical Competency, Technology Integration, secondary school teachers

Introduction

In the rapidly evolving landscape of 21st-century education, the integration of technology and pedagogy has become paramount to ensuring effective knowledge dissemination and fostering critical thinking skills among students (Pal, 2022). The word 'Techno' is derived from the Latin word 'Texere', which means 'weave or construct', and Pedagogy refers to the 'Science and Art of teaching'. Techno-Pedagogy refers to the weaving of instructional technologies into the learning environment itself. Techno Pedagogical Competency is the hybrid method using information and communication for effective teaching and learning activities (Sathiyaraj and Rajashekar, 2013). Techno Pedagogical Competency refers to the capabilities of teachers for integrating different technologies with their teaching methods to improve the quality of teaching and learning (Sibichen,

2018). Acquiring techno-pedagogical proficiency will make teaching and learning a pleasurable exercise as it would lessen the pressure on the teachers, and enable the students to plunge deeper into the knowledge acquisition process (Kumar, 2018). Techno-Pedagogical Competency is hugely required for teachers in their active learning as it helps their learning and teaching enormously (Dangwal and Srivastava, 2016). Moreover, teaching and learning activities are shifted to student-centred, which means that teachers need to enrich their knowledge and skills in terms of various technologies used in teaching, and need to make it very efficient (Bala and Imlikokla, 2018). Techno-pedagogical skills foster the students' development, attainment of learning outcomes and maintain the context of designing the classroom (Beaudin and Hadden, 2004). To be effective, teachers need to possess techno-pedagogical skills or competencies which enable them to manage time, optimize the integration of technologies and invest in new interactive technologies in congruence with the nature of subject (Habib, 2018).

Specifically, technology integration should build on technological skills and be able to use pedagogical knowledge as the base for integrating technology into teaching and learning. This means that teachers need to come up with ways to encourage pupils to work towards this goal as the lesson goes on and also be mindful of the different learning styles pupils have and that they learn at different speeds (Okojie et al., 2006). True techno-pedagogical competency is not merely the addition of technology to a classroom, but rather a dynamic, transactional relationship where the introduction of technology represents new ways of conceptualizing and teaching content (Koehler & Mishra, 2005). As a class room teacher is competent enough in content area the focus should be on skills to integrate the combination of technology and pedagogy, called techno-pedagogical skill.

Theoretical Framework

Pedagogical Content Knowledge (PCK) by Shulman 1986

Effective teaching does not rely on knowledge of a content area or the use of instructional technologies. It relies on the ability of teachers to convert content into learning experiences that are relevant to specific learners, contexts, and learning objectives. This perspective is rooted in the idea of Pedagogical Content Knowledge (PCK) that Shulman developed, which is teachers' specialized knowledge that can be developed through a process of integrating pedagogical knowledge with knowledge of how the content can be taught effectively (Shulman, 1986). PCK also emphasizes that expert teaching is not just about what to teach, but also understanding how students are likely to interpret specific concepts, what representations and explanations might help students understand, and what instructional strategies might address common misconceptions.

TPACK by Mishra & Koehler 2006

At the core of this field is the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006). This model describes the complex relationships and interactions between three primary domains of knowledge: Content Knowledge (the subject matter), Pedagogical Knowledge (teaching strategies and methods), and Technological Knowledge (modern digital tools). It goes beyond these three independent domains by emphasizing the interaction among them leading to four additional domains: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and Technological Pedagogical Content Knowledge (TPACK) (Koehler &

Mishra 2009). TPACK, the core of the framework represents the integrated set of knowledge that teachers need in order to teach specific content using appropriate technology-based pedagogical approaches and technological tools that can enhance the students' learning and understanding (Mishra and Koehler, 2006).

Review of related literature

Habib (2018) examined how senior secondary school teachers' effectiveness was affected by their techno-pedagogical proficiency. It was revealed that significant portion of senior secondary school teachers demonstrated a high level of techno-pedagogical competence. Specifically, 42.50% were considered as highly techno-pedagogically competent, 24.5 % average techno-pedagogical competent, and 33 % low techno-pedagogical competent.

Parkash & Hooda (2018) revealed that the private higher secondary school teachers were more techno-pedagogically competent than the government school teachers which was correlated with the better facilities of the technological components in private higher secondary schools. The male government and private school teachers showed higher value of techno-pedagogical competency than the female government and private school teachers. On the contrary, both the government and the private school teachers in the urban area demonstrated a greater value of techno-pedagogical competency than the rural teachers in both the government and private school sectors. The study recommended that an effort is needed to enhance more technological facilities and techno-pedagogical competency in government and rural school teachers and to minimize hindering factors for effective technology integration.

Kumar & Parveena (2022) studied on techno-pedagogical skills among teacher trainees and revealed varying levels of proficiency. It revealed that most teacher trainees have moderate techno-pedagogical skills, but a considerable number of them are not very techno-pedagogically proficient. The study emphasizes the need for targeted interventions, including specialized training, expert guidance, and curriculum updates, to enhance these crucial 21st-century skills among future educators.

Quarashi & Jan (2022) conducted a study on "Techno-Pedagogical Competence of Private and Government Secondary School Teachers of Kashmir-A Comparative Study" and the results indicated that the majority of teachers exhibited good competence in terms of techno-pedagogy. The overall level of competence of the teachers in the private schools was higher than that of the teachers in the government schools. However, the competence of teachers was different, ranging from low to high, between the two types of schools. Generally, the study revealed that teachers from private schools had comparatively higher competencies in techno-pedagogical practices as compared to government school teachers. There is a statistically significant difference in techno-pedagogical competence between private and government secondary school teachers.

Mondal (2024) study investigates the impact of techno-pedagogical competence on teacher effectiveness and student outcomes across diverse educational contexts, revealing that urban teachers have higher competency due to better resources and professional development opportunities, and urban teachers also exhibited high levels of pedagogical content knowledge. The findings emphasize the importance of the interaction between the techno-pedagogical competence of teachers and teacher support and the educational outcome, and call for targeted interventions, particularly in rural settings, in order to guarantee access to resources and professional development in an equitable manner.

Prabu, R. Rajalakshmi (2024) concluded that there was a statistically significant difference between the profile of prospective teachers and their techno-pedagogical competencies. They also found out that prospective teacher educators demonstrated a greater level of techno-pedagogical competence among those who are male, from science department, studying in government funded colleges, located in urban areas, using Tamil language for instruction and whose father had an education at a college.

Marak & Dwivedi (2025) found out that, on average, teachers have a moderate proficiency in techno-pedagogical skills, but there were no significant differences found by gender, teaching experience or subject specialization, therefore, there is a need to develop these skills among teachers.

Mittal & Dubey (2025) investigated techno-pedagogical content competency among 300 secondary school teachers in Jaipur and showed that the overall level of secondary school teacher's techno-pedagogical content competency is very high compared with the average level. It was found that there is no significant difference between government and private schools, and concludes that teachers are adequately prepared for technology-integrated teaching.

Ali & Chetia (2026) revealed that most teachers had an average and above-average level of techno-pedagogical competence, indicating the need to develop further, and there were no statistically significant differences in techno-pedagogical competency between arts and science streams, but urban teachers generally had higher techno-pedagogical competency than rural teachers.

The Paradigm Shift in Education

The global education system is currently witnessing a massive paradigm shift from traditional "chalk and board" or "chalk and talk" methodologies to digitized pedagogical approaches (Pal, 2022). This transition is driven by the demands of the Fourth Industrial Revolution (4IR), which requires students to be digitally literate and competitive in an increasingly globalized context. In this era, students, often referred to as digital natives, require interactive, learner-centric environments where technology is used to personalize instruction and encourage higher-order thinking skills.

Significance of the study

The study is important because it offers empirical support for teachers' techno-pedagogical competency and its role in effective incorporation of technology in teaching and learning. The results could enable teachers to identify professional development needs, guide teacher preparation programs in providing focused professional development, and guide policymakers in designing digital technology integration evidence-based strategies. Research consistently demonstrates that high levels of techno-pedagogical competency are associated with increased teacher effectiveness and improved student academic achievement. Acquiring these skills can transform the classroom experience, making teaching a pleasurable exercise by reducing mechanical pressure on educators and allowing students to delve deeper into knowledge acquisition.

Objective of the study

1. To study the level of techno-pedagogical competency of secondary school teachers.
2. To determine whether there is any significant difference in techno-pedagogical competency based on gender, locality, and management.

Hypothesis of the study

H₀₁: There is no significant difference between male and female secondary school teachers in techno-pedagogical competency.

H₀₂: There is no significant difference between urban and rural secondary school teachers in techno-pedagogical competency.

H₀₃: There is no significant difference between government and private secondary school teachers in techno-pedagogical competency.

Methodology

The present study employed a descriptive research method to assess the techno-pedagogical competency of secondary school teachers. The study was conducted on secondary school teachers of Kohima district in Nagaland. The sample was selected using random sampling technique. The sample of 80 secondary school teachers from Kohima district of Nagaland was drawn for the study.

Tools used in the Study

For data collection, the Teacher's Techno-Pedagogical Competence Scale developed and standardized by Rajasekar and Sathiyaraj (2013) was used for the study. The scale consists of 40 items.

Analysis and Interpretation

The level and significant differences of techno-pedagogical competency of the respondents were determined by analyzing the collected data by appropriate descriptive statistical techniques, namely frequency, percentage, mean, standard deviation and t-test. The results were interpreted based on the study objective.

Objective 1: To study the level of techno-pedagogical competency of secondary school teachers.

Table 1: Percentage-wise distribution of secondary school teachers from Kohima district of Nagaland on different levels of Techno-pedagogical Competence.

Variable	Range of raw scores	Frequency	Percentage (%)	Level of Techno-pedagogical Competence
Techno-pedagogical competence	40-72	7	8.75%	Low
	73-128	53	66.25%	Average
	129-200	20	25%	High
Total		N=80	100%	

The above table 1 indicates that the majority of the respondents demonstrated an average level of techno-pedagogical competence. The table shows that 25% have high techno-pedagogical competence, 66.25% indicate an average level of techno-pedagogical competence and 8.75% have a low level of techno-pedagogical competence.

Objective 2: To determine whether there is any significant difference in techno-pedagogical competency based on gender, locality, management, and teaching experience.

H₀₁: There is no significant difference between male and female secondary school teachers in techno-pedagogical competency.

Table 2: Gender wise Mean, SD, t-value and significant difference of techno-pedagogical competency of secondary school teachers.

Gender	N	Mean	SD	t-value	Significance level
Male	31	113.65	27.105	0.50	0.05
Female	49	110.47	28.23		

From the values presented in the above table 2, it reveals that the mean scores of techno-pedagogical competency of male is 113.65 and female is 110.47. The SD of male and female secondary school teachers is 27.105 and 28.23 respectively. The computed t-value is 0.50 which is greater than 0.05 level of significance. It is concluded that there is no significant difference in techno-pedagogical competency of male and female secondary school teachers. Therefore, the null hypothesis, there is no significant difference between male and female secondary school teachers in techno-pedagogical competency is accepted.

H₀₂: There is no significant difference between urban and rural secondary school teachers in techno-pedagogical competency.

Table 3: Locality wise Mean, SD, t-value and significant difference of techno-pedagogical competency of secondary school teachers.

Locality	N	Mean	SD	t-value	Significance level
Urban	38	107.21	30.107	1.37	0.05
Rural	42	115.76	24.93		

From the values presented in the above table 3, it reveals that the mean scores of techno-pedagogical competency of urban is 107.21 and rural is 115.76. The SD of urban and rural secondary school teachers is 30.107 and 24.93 respectively. The computed t-value is 1.37, which is greater than 0.05 level of significance. It is concluded that there is no significant difference between urban and rural secondary school teachers in techno-pedagogical competency. Therefore, the null hypothesis, there is no significant difference between urban and rural secondary school teachers in techno-pedagogical competency is accepted.

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H₀₃: There is no significant difference between government and private secondary school teachers in techno-pedagogical competency.

Table 4: Management wise Mean, SD, t-value and significant difference of techno-pedagogical competency of secondary school teachers.

Management	N	Mean	SD	t-value	Significance level
Government	28	113.04	23.67	0.42	0.05
Private	52	110.48	29.67		

From the values presented in the above table 4, it reveals that the mean scores of techno-pedagogical competency of government is 113.04 and private is 110.48. The SD of male and female secondary school teachers is 23.67 and 29.67 respectively. The computed t-value is 0.42, which is greater than 0.05 level of

significance. It is concluded that there is no significant difference between government and private secondary school teachers in techno-pedagogical competency. Therefore, the null hypothesis, there is no significant difference between government and private secondary school teachers in techno-pedagogical competency, is accepted.

Educational Implications

After conducting the research study on techno-pedagogical competence, here are some of the educational implications:

- 1. Teachers' Professional Development:** Professional learning is the most effective way to close the gap between current pedagogical knowledge and the technical skills that are needed in the 21st-century classroom. Training should not only be geared towards the development of ICT skills, but also be linked to the use of ICTs in the classroom context, lesson design, digital assessment, and innovative teaching methods. Continuous professional development can boost teachers' confidence and competence in using technology in teaching.
- 2. Institutional Support and Infrastructure:** Appropriate institutional support, such as provision of digital devices, high-quality internet connectivity, technical assistance and access to appropriate digital resources, is essential for the effective use of techno-pedagogical skills. It is important that school administrators provide opportunities for teachers to try out technology and share what they do well with other teachers. The shortcomings of the infrastructure and institutional support can be a hindrance for teachers to convert into meaningful classroom practice their techno-pedagogical knowledge.
- 3. Technology integration that integrates with pedagogy and content:** The use of technology should be encouraged by the teachers to be used purposefully, linking it with suitable teaching methods and subject content. The aim for techno-pedagogical competency should thus not only be on how to use digital tools, but also on choosing the tools that support meaningful and learner-centred, interactive learning. This integration can help to enhance classroom practices and student learning experiences.
- 4. Effective teaching that is both learner-centred and inclusive:** Using multimedia, interactive activities, collaborative platforms and differentiated learning resources, techno-pedagogical skills can be used to help teachers implement a more learner-centred approach. These practices can provide for the needs of students of varying abilities, interests and learning needs and foster active engagement. Thus, the integration of technology be a focus of teacher education and teacher professional development that is inclusive and pedagogically meaningful.

Discussion and Conclusion

The current research is descriptive in nature, and the results reveal that most secondary school teachers are of an average level of techno-pedagogical competency, suggesting that teachers have some basic skills for the use of technology in their teaching, but there is room for improving skills of techno-pedagogical competency in secondary schools. This result aligns with those found by other research which reported moderate or average teachers' technological-pedagogical competence. For instance, in the research study done by (Nagarajan & Selvakumar, 2025; Ering & Ering, 2025) teachers' techno-pedagogical competency was moderate, which

means that teachers have a basic technological knowledge but require additional professional development to use technology in pedagogical practices. Therefore, secondary school teachers need to gain exposure and knowledge about different techno-pedagogical methods and techniques to enhance techno-pedagogical competency. Acquiring techno-pedagogical proficiency will make teaching and learning a pleasurable exercise as it would lessen the pressure on the teachers, and enable the students to plunge deeper into the knowledge acquisition process (Kumar, 2018).

The result also reveals that there is no significant gender difference nor significant difference between localities and type of school indicating that male and female teachers, urban and rural, and government and private school teachers exhibit similar techno-pedagogical competencies in general. This could indicate that technology exposure and professional learning opportunities are similar among these groups of teachers. It is important to highlight the importance of continuous professional development, training focused on the use of technology in practice and institutional support, rather than demographic differences, as a priority. Schools and educational authorities should ensure adequate digital resources, technical support and regular training, to increase teachers' confidence and capacity in using digital tools as part of learner-centred teaching and assessment, learning collaboration and to enhance learning outcomes.

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