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## The Role of Techno-Pedagogical Approach in Educational Practices: A Systematic Literature Review

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# The Role of Techno-Pedagogical Approach in Educational Practices: A Systematic Literature Review

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## Abstract

In recent years, researchers have explored the possibility of techno-pedagogical approach in educational practices. Building on this growing interest, this study examines the existing literature to find the role of the techno-pedagogical approach in the educational context. For this purpose, the study follows preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework to review the existing literature related to the study. After analyzing the shortlisted articles, the study reveals that the techno-pedagogical approach is appropriate in creating effective learning environments, improving learners' academic excellence, and enhancing both digital literacy and cultural awareness in education. Therefore, this study advocates for the implication of this approach in the classroom. However, this study relies on existing studies sourced from only four database sources and therefore suggests conducting more comprehensive and experimental studies to better understand the impact of this approach in the diverse educational contexts.

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## Introduction

The introduction of the techno-pedagogical approach has unveiled new avenues in educational practice. It incorporates technology, pedagogy, and content knowledge in teaching practice and promises to enhance learners' learning (Yusof et al., 2019). This integrated approach acknowledges that effective learning is possible through interacting with these three forms of knowledge (Leema & Saleem, 2017). In recent years, researchers have shown their interest in the search for the possibility of this approach in the educational practices (Nica, 2017; Sharma & Saarsar, 2020; Sulastri et al., 2020). However, the existing body of literature provides limited insights into its role and relevance in the varied educational contexts. In this scenario, there is a need for academic exploration to examine its role and relevance to understand how it impacts educational practices in terms of teaching-learning process and outcomes.

This concern is addressed by Mishra and Koehler's (2006) technological pedagogical content knowledge (TPACK) framework that highlights the importance of an integrated approach focusing on the interconnectedness of technological, pedagogical, and content knowledge. According to this framework, the teaching-learning process is enhanced through the interplay between these three forms of knowledge (Alamri & Awjah, 2023). Therefore, teacher-practitioners must be competent in subject matters, teaching procedures, and integrating technology into

teaching practice (Gurukkal, 2021). For this, TPACK provides teacher practitioners a theoretical lens to design and implement curricula that integrate technology as an indispensable part of educational practices, preserving contextual relevance.

Besides, the theory of educational technology equally contributes to address the above concern because this theory focuses on the effective combination of technology with pedagogy to foster educational outcomes (Sahin, 2011; Wegerif & Major, 2023). Further, this theory emphasizes the systematic procedures of designing, developing, implementing and evaluating both technologies and pedagogical strategies to improve teaching-learning practices (Lei, 2017). In this sense, this theory provides a theoretical foundation for understanding the role of the techno-pedagogical approach in creating an interactive and learner-centered learning environment and promoting learners' desired learning behavior (Issroff & Scanlon, 2002).

However, procedures for applying these theoretical frameworks in a specific educational context are yet to be fully established. For example, the educational context, like in Nepal, with distinct socio-cultural and infrastructural challenges, may encounter obstacles in adopting TPACK. These challenges include limited infrastructure, lack of support system, constraints of budget, and teachers' lack of technological competence that hinder the successful integration of technology. In such contexts, there is a need to explore the possibility of this pedagogical approach through the lens of TPACK and the theory of educational technology to offer practical insights to address these challenges. This study contributes to the discourse by reviewing the existing literature to address the following research question:

What is the role of the techno-pedagogical approach in educational practices?

## **Method**

This section outlines the process of identifying, screening, and including papers, including quality assessment, data extraction, and synthesis procedures.

### **Identification, Screening, and Inclusion of Papers**

This study followed the PRISMA framework proposed by Moher et al. (2009) for conducting a systematic review. In this process, we used key phrases 'techno-pedagogy OR techno-pedagogical approach,' 'role of techno-pedagogy OR role of techno-pedagogical approach,' 'impacts of techno-pedagogy OR impacts of techno-pedagogical approach' to search relevant articles on Semantic Scholar, Google Scholar, ERIC, and Open Alex. The search process identified 215 articles initially, including 36 papers from ERIC, 19 papers from Semantic Scholar, 53 papers from Google Scholar, and 107 papers from Open Alex. The identified articles were recorded in the Excel sheet for the screening process.

Then, the recorded articles were screened by title and author. In this process, we removed 16 papers, including 13 papers from Open Alex and three papers from Semantic Scholar due to their similarities sorted out by the system. Similarly, we eliminated 53 papers from Open Alex, 23 from Google Scholar, six from Semantic Scholar, and 26

from ERIC due to their irrelevant topics. Subsequently, we screened the abstracts of the remaining 91 papers for the full-text accessibility and relevance of research objectives. During this process, we removed three papers from Open Alex due to full-text inaccessibility. Further, we excluded 17 papers from Open Alex, eight from Google Scholar, one from Semantic Scholar, and six from ERIC because these papers were irrelevant to the research focus. As a result, the remaining 56 papers were subjected to the eligibility process.

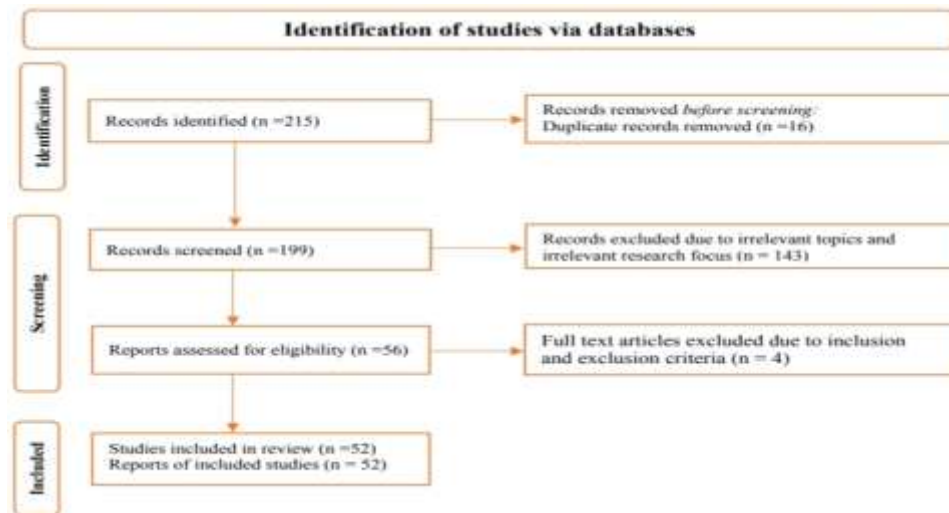


Figure 1. PRISMA Flow-chart

Table 1. Criteria for Exclusion and Inclusion

Criteria	Inclusion	Exclusion
Year	From 2010-2024	Before 2010
Document	Journal/conference paper	Book/book chapter/dissertation
Language	Article in English	Other than English
Focus area	Role/impacts of techno-pedagogy/techno-pedagogical approach	Other than the role/impacts of techno-pedagogy/techno-pedagogical approach

Further, we assessed all 56 full-text papers against the inclusion and exclusion criteria (Table 1) employed by Ardoin and Bowers (2020) and Batdi et al. (2024) to refine the articles. According to these criteria, we included only the journal or conference papers due to their contribution in providing research-based insight. Similarly, we selected the papers published within the last 15 years to capture the recent developments in the field of study. Further, we included the papers written in English so that the content could be accessed. More importantly, we selected papers that focused on the role or impact of techno-pedagogy or techno-pedagogical approach in educational practices. In this process, we found four papers from Open Alex ineligible because these papers did not satisfy the primary focus of the study established in the inclusion and exclusion criteria. Therefore, they were removed from the study. Finally, the study shortlisted 52 research papers, comprising 49 (94.23%) journal papers and three (5.76%) conference proceedings, sourced from four databases. Among the shortlisted studies, 22 papers (42.30%) were extracted from Google Scholar, 17 papers (32.69%) from Open Alex, nine papers (17.30%) from Semantic Scholar, and four papers (7.69%) from ERIC. These papers were relevant to the research objectives and

sound in methodological rigor.

### Quality Appraisal

The quality of each paper was assessed using the mixed method appraisal tool (MMAT) developed by Hong et al. (2018) because it can appraise the paper containing all types of research designs. According to this tool, we followed stepwise procedures to appraise the quality of each paper. For example, first, we examined the explicitness of the research questions and the appropriateness of the research design to address the research question. Second, we evaluated the justifiable sampling procedures and adequate sample size. Third, we reviewed the valid and reliable data collection method. Fourth, we assessed the appropriateness of the data analysis procedure. Fifth, we examined the clarity in the presentation of the results and the accuracy in interpreting the results. Finally, only the paper that satisfied the above criteria was finalized for inclusion with mutual agreement.

### Data Extraction and Synthesis Procedures

For the extraction and synthesis procedures, we underwent three phases. First, we used active and repeated readings to get in-depth information about the sampled papers. We listed necessary information extracted from the papers in the Excel spreadsheet under different headings, such as database sources, publication year, research design used in the papers, and key findings. It provided valuable insights to acquaint with data and establish a foundation for the subsequent actions. Second, we followed inductive coding frameworks, created initial codes based on the data, and organized them into broader categories based on similar patterns and connections. Finally, we generated four main themes and synthesized the data thematically, following the qualitative synthesis approach (Flemming et al., 2019) and stepwise thematic synthesis procedures (Kiger & Varpio, 2020). However, the characteristics of shortlisted papers were analyzed using percentage and counts, which were reported in the results section.

## Results

### Publication Year Count

Figure 2 shows that 15 (28.84%) papers were published in 2022, nine (17.30%) in 2023, and six papers (11.53%) in 2020. Similarly, 2019 and 2021 had an equal number of papers, with four (7.69%) each, followed by 2017, 2018, and 2024 which had three (5.76%) papers each. Further, 2015 had two (3.84%) papers, while 2011, 2014, and 2016 each had a single (1.92%) paper.

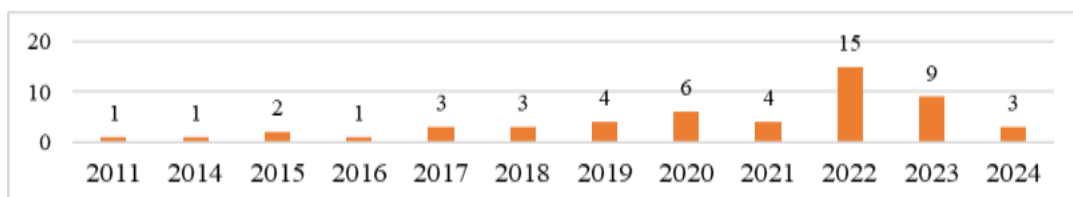


Figure 2. Publication Year Count

### Authorship Countries Count

Among the selected studies, Figure 3 shows that India contributed the highest number of papers with 24 (46.15%), followed by Indonesia with five (9.61%), and Turkey with three (5.76%). Similarly, Spain, the USA, Malaysia, Pakistan, and Canada each contributed an equal number of papers with two (3.84%). Additionally, Peru, Nigeria, Mauritania, Cameroon, Philippines, Romania, China, Saudi Arabia, Israel, and Colombia each contributed a single (1.92%) paper.

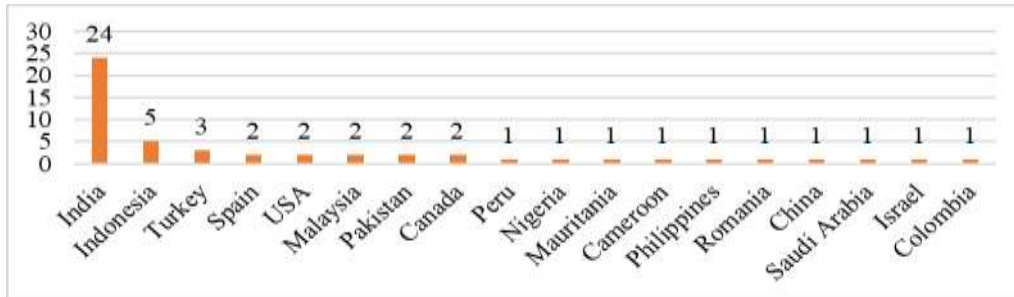


Figure 3. Authorship Countries Count

### Authorship Continent Count

Among the shortlisted papers, Figure 4 demonstrates that Asia contributed the highest number of papers, with 37 (71.15%). Europe followed with six (11.53%) while North America accounted for four (7.69%) papers. Africa contributed three (5.76%) papers, and South America had the lowest representation with two (3.84%) papers among the selected studies.

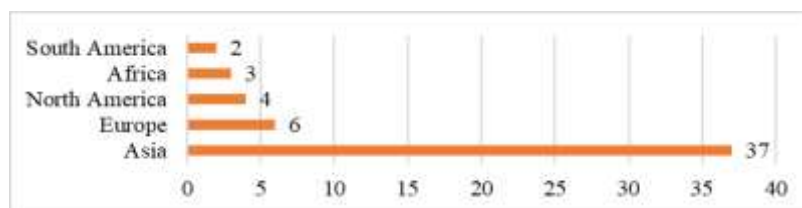


Figure 4. Authorship Continent Count

### Paper Count about Approach

Figure 5 demonstrates that 26 (50%) papers employed the qualitative approach, 18 (34.61%) papers deployed the quantitative approach, and eight (15.38%) papers followed the mixed-method approach.

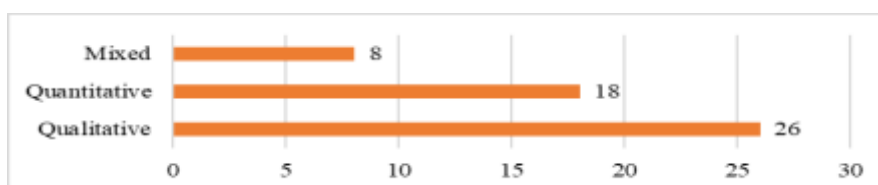


Figure 5. Paper Count about Approach

**Authors and Thematic Concentration**

Table 2 presents the papers contributed by authors and their allocation in generating themes. For example, 19 (36.53%) papers explored strategies for creating inclusive and effective learning environments with techno-pedagogy. Additionally, 16 (30.76%) papers focused on advancing learners’ academic excellence. Meanwhile, 10 (19.23%) papers concentrated on the challenges and transitions of techno-pedagogical approach. Similarly, seven (13.46%) papers highlighted enhancing digital literacy and cultural awareness in education.

Table 2. Authors and Thematic Discussion

Authors	Themes	n	%
Bansal (2022), Deb and Pradhan (2023), Deb and Sardar (2023), Gloria and Benjamin (2014), Hererra (2022), Jain (2019), Karılı et al. (2024), Lyonga and Nkeng (2022), Maqood et al. (2022), Nica (2017), Oladej et al. (2023), Palanisamy et al. (2020), Pozo-Sánchez et al. (2021), Roy (2022), Samson and Yango (2023), Seyed (2022), Terzi (2020), Vijaya (2017), Yusof et al. (2019)	Creating inclusive and effective learning environments with techno-pedagogy	19	36.53
Baby and Sareef (2017), Chauhan (2024), Churaquispe and Castro (2024), Deori and Begum (2023), Grenoon et al. (2022), Guru and Beura (2019), Hamed (2017), Kadioglu and Çetin (2021), Kumari and Rani (2022), Laxmi and Gure (2016), López Núñez et al. (2020), Malakar and Gope (2022), Rajalakshmi (2022), Rao and Jalajakshi (2021), Salman et al. (2022), Thenmozhi and Sugirtha (2023)	Advancing learners’ academic excellences	16	30.76
Alamri and Awjah (2023), Duan et al. (2022), Jose and Raja (2011), Neufeld and Delcore (2018), Nurjanah et al. (2020), Setiasih et al. (2023), Sulastri et al. (2020)	Enhancing digital literacy and cultural awareness in education	7	13.46
Asad et al. (2021), Ginting et al. (2022), Islam (2020), Javed and Singh (2023), Kumar (2018), Par (2022), Rabah (2015), Setua (2022), Singh and Gupta (2022), Thakur (2015)	Navigating the challenges and transitions of techno-pedagogy	10	19.23
Total	4 Themes	52	99.98

**Discussion**

Among the selected studies, the review shows the predominant use of a qualitative approach. It also reveals that Asia, as a continent, and India, as a country, contributed the most research papers on the techno-pedagogical

approach. The distribution of research papers in different contexts indicates that the research practice on the techno-pedagogical approach is in the increasing trend. Surprisingly, this trend has decreased over the last two years. However, it does not necessarily indicate a declining interest in this approach because it may be attributed to a research shift in integrating it into teacher education. This study primarily focused on examining the role of this approach in educational practices. Therefore, findings are discussed regarding the following themes to address the aforementioned research question.

### **Creating Inclusive and Effective Learning Environments with Techno-Pedagogy**

Application of the techno-pedagogical approach in the classroom requires a systematic and structured process because it comprises developing ICT skills and using effective pedagogical procedures to deliver the contents (Deb & Pradhan, 2023). In this regard, Gloria and Benjamin (2014) highlighted the importance of developing creative strategies for integrating technology that enhances learners' learning. These strategies may include defining learning outcomes to achieve and choosing appropriate technological tools that facilitate achieving the predefined objectives (Hererra, 2022). Digital tools and platforms such as multimedia, Google Classroom, Google Meets, Zoom, Microsoft Teams, Google Workspace, learning management system (LMS), Padlet, Kahoot, Quizziz, Edmodo, Edpuzzle, and Khan Academy offer interactive and collaborative learning promoting inclusive and effective learning environment (Karlı et al., 2024). For example, Google Docs allows learners to have group discussions promoting peer interaction and knowledge exchange through collaborative project work (Palanisamy et al., 2020). Similarly, using digital platforms such as Edpuzzle helps learners learn at their own pace by watching videos and answering questions previously posted by teachers, fostering their personalized learning (Pozo-Sánchez et al., 2021). In the face-to-face mode, teachers can use multimedia tools to present the content based on the curriculum framework (Oladejo et al., 2023). They can engage learners in problem-solving, comprehension, and reflection in collaboration and cooperation with peers, followed by assessment through Quiziz, Quizlet, e-portfolio, and LMS (Karlı et al., 2024). This strategic process offers richer learning experiences, creates interest, and optimizes learners' engagement in their learning with technological tools effectively (Samson & Yango, 2023).

In other contexts, researchers such as Bansal (2022) and Terzi (2020) highlighted the usefulness of this approach for creating a sound atmosphere and smart learning environment. For example, project-based learning through LMS and collaborative activities through flipped learning help create a smart classroom learning environment (Nica, 2017). This process is also useful for enhancing learners' learning because Maqood et al. (2022) reported a positive correlation between its practice and a sound learning environment that promotes learning through teacher interaction. Other researchers such as Jain (2019) and Oladej et al. (2023) also acknowledged the role of techno-pedagogical practice in converting the teaching-learning process into a more accessible and enjoyable, simultaneously reducing learners' anxiety. They suggested incorporating digital platforms such as Kahoot, Padlet, and Cirrus and multimedia tools to engage learners in gamification and collaborative activities. These activities are reported to be useful for enhancing the quality of both the teaching and learning process leading to learners' success in their learning (Deb & Sardar, 2023; Lyonga & Nkeng, 2022; Roy, 2022; Seyed, 2022; Vijaya, 2017; Yusof et al., 2019). In this sense, the techno-pedagogical approach is appropriate for facilitating the teaching-



learning process and making it more inclusive and generating a supportive and anxiety-free learning environment.

### **Advancing Learners' Academic Excellences with Techno-Pedagogy**

The techno-pedagogical approach offers different classroom activities. These activities include collaborative learning with digital tools, interactive and gamified learning, personalized learning, flipped learning, project-based learning with technology, and blended learning (Chura-Quispe & Castro, 2024). These activities, along with different digital tools and platforms, are useful for advancing learners' academic excellence because the use of these techno-pedagogical activities positively impacts the performance and achievement of learners from different educational levels (Kadioglu & Çetin, 2021; López Núñez et al., 2020). However, teacher-practitioners must possess techno-pedagogical competence to effectively implement these activities (Gurukkal, 2021). For this purpose, studies have stressed the essence of integrating techno-pedagogical skills in teacher education to prepare digitally competent teachers to navigate the changing educational scenario to enhance learners' performance (Gloria & Benjamin, 2014; Grenon et al., 2022; Kumari & Rani, 2022; Laxmi & Gure, 2016; Malakar & Gope, 2022; Rajalakshmi, 2022; Rao & Jalajakshi, 2021).

Most importantly, recent studies have highlighted the positive relationship between teachers' techno-pedagogical competence and academic achievement. For instance, Farrell and Hamed (2017) reported that teachers possessing sound knowledge of the techno-pedagogical approach could reinforce learners to achieve better academic outcomes because their study disclosed a positive correlation between teachers' techno-pedagogical competency and learners' academic achievement. Similarly, Guru and Beura (2019) established a relationship between these two variables, arguing that techno-pedagogically competent teachers provide effective delivery of instructional activities and foster learners' learning achievement by creating a smart learning environment. Aligning with these studies, Salman et al. (2022) argued in favor of teachers' techno-pedagogical competence for ensuring effective teaching and enhancing learners' learning achievement. Therefore, it is crucial to enhance teachers' techno-pedagogical competence through training to improve learners' academic achievement.

Besides teachers' digital competency, their attitudes also influence the integration of this pedagogical practice. For example, Gloria and Benjamin (2014) highlighted that teacher with positive attitudes toward this approach are likely to feel comfortable incorporating it into their teaching practice. Similarly, Baby and Sareef (2017) reported that teachers' attitudes towards this pedagogical approach positively enhance their digital literacy, leading to the successful integration of this approach.

Further, Thenmozhi and Sugirtha (2023) highlighted a significant positive correlation between teachers' techno-pedagogical knowledge and this approach, indicating that teachers equipped with it will likely integrate it into their pedagogical practice. Chauhan (2024) also aligns with this study. However, Deori and Begum (2023) reported that teachers' techno-pedagogical attitudes correlate positively with their techno-stress despite low correlation. Therefore, it is necessary to foster their attitudes and provide training to equip them with techno-pedagogical knowledge to lower the techno-stress and enable them to integrate this approach in the classroom to bring positive results.

### **Enhancing Digital Literacy, Fostering Language and Cultural Awareness**

The techno-pedagogical approach has been a transformative tool for enhancing writing and digital literacy. For example, Sulastri et al. (2020) demonstrated that techno-pedagogical practice is useful for improving learners' writing skills because integrating this approach allows learners to engage with deep writing tasks. According to them, learners' writing skills can be enhanced by engaging them in collaborative writing using Google Docs or blogging sites, where they can be encouraged to draft, edit, and share their writing. They further stated that teachers can engage them in expressing their ideas or narrating stories by integrating text with images, audio, or video. While doing these activities, they learn to handle digital platforms and formatting tools, which leads to digital literacy. Therefore, Neufeld and Delcore (2018) advocated for practicing this pedagogical approach to cultivate students' digital literacy, which leads them to foster their agency in navigating the complexities of a digital society. Furthermore, Setiasih et al. (2023) highlighted its importance in enhancing students' digital literacy and ultimately enabling them to become competent users of digital tools.

Similarly, studies show the importance of integrating techno-pedagogical approaches in fostering linguistic and cultural understanding. For example, Nurjanah et al. (2020) highlighted its significance in language acquisition, internalizing cultural values, and building students' self-identity. They reported that integrating this approach enables teachers to expose learners to diverse communication skills and cultural practices through multimedia tools such as video and podcasts, while also encouraging them to practice language in real-life situations. They further stated that teachers can engage learners from different cultural backgrounds in online discussion, promoting linguistic exchange and intercultural communication skills. This procedure helps learners learn language successfully because studies by Asjah (2023), Duan et al. (2022), and Jose and Raja (2011) underscored the crucial role of this pedagogical process in removing barriers to language acquisition and enhancing learners' cognitive ability related to language learning.

### **Navigating Challenges and Transitions of Techno-pedagogical Approach**

Although integrating a techno-pedagogical approach offers opportunities for positive change in the classroom, several studies have highlighted significant challenges for its practice. For example, Asad et al. (2021) presented key obstacles such as inadequate ICT infrastructure and teacher training and preparation. They reported that a deficiency of coordination, specialized support, and network and power issues further impair these issues. Supporting these findings, Rabah (2015) extended other barriers, such as a lack of support from school leaders and insufficient technology integration into a curriculum that hinder the integration of this approach. Similarly, Singh and Gupta (2022) and Thakur (2015) outlined the complications in applying this approach in higher education due to teachers' linguistic incompetency in accessing online content, insufficient resources, and lack of departmental coordination. These studies disclosed the key issues in integrating the techno-pedagogical approach, which requires solutions to improve ICT infrastructure, provide teaching training, and provide institutional support.

However, these issues can be addressed through governmental and institutional investment in ICT infrastructure,

teacher training programs for target teacher groups, and the formation of support system networks (Javed & Singh, 2023). If these challenges are addressed, the role of this approach cannot be ignored because its practice has extended a horizon in the pedagogical practice. For example, teacher-practitioners were unprepared for the unforeseen situation created by COVID-19. However, its deployment in the educational context helped them overcome the issues (Kumar, 2018). It extended the pedagogical dimension and redefined the teaching-learning process beyond the four-walled classroom by enabling virtual teaching-learning and providing flexible and accessible online educational resources (Ginting et al., 2022). Studies have also realized its importance and reported its transformative role in re-conceptualizing teaching and learning, creating interactive teaching-learning through the combination of digital technologies and pedagogical strategies to cater to the diverse need of learners (Islam, 2020; Par, 2022; Setua, 2022). Therefore, it is essential to navigate the aforementioned challenges to integrate this approach successfully in the classroom.

## **Conclusions**

This study investigated the role of the techno-pedagogical approach in educational practices. The findings indicate that the techno-pedagogical approach is a useful approach in creating an inclusive and sound learning environment, improving learners' academic excellence, enhancing digital literacy, and fostering language and cultural awareness. These findings are crucial for teacher practitioners to bring positive outcomes in the multiple dimensions of education. More importantly, these findings provide insights into how this pedagogical approach can improve teaching-learning practices, provided that challenges related to resources constraints and digital disparities are addressed, thereby enhancing educational accessibility in diverse socio-economic context like in Nepal. Therefore, this pedagogical approach can be integrated into educational practices to ensure quality education. However, this study was limited to research papers sourced from only four academic databases. Therefore, future studies can broaden its scope by incorporating a wider range of database sources. Further, as this study relied on existing studies, future studies can employ experimental designs to rigorously assess the efficacy of this approach across diverse educational contexts to better understand the impact of techno-pedagogical approach.

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