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Embracing Change and Navigating Challenges*

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## **Adapting Techno-Pedagogy: A Comparative Study of Localized Teacher Support Systems in Rural Sri Lanka and Tamil Nadu, India**

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### **Abstract**

The recent global drive for digital education has unveiled stark discrepancies between urban and rural education, especially in developing countries. This paper compares the challenges and responses to the process of adapting techno-pedagogy through local teacher support networks in rural Sri Lanka and Tamil Nadu, India. The paper, which draws on existing literature and reports, applies the Technological Pedagogical Content Knowledge (TPACK) framework to show that the problem is not one of hardware distribution, but of contextually relevant professional development. The study finds that both regions face important common obstacles, such as a lack of infrastructure, unreliable internet connectivity, and teacher training that is not contextualized. But the nature of their localization efforts varies: while Sri Lanka's localization often takes the form of piecemeal, multi-stakeholder initiatives with an emphasis on basic digital literacy, Tamil Nadu's localization is more likely to be achieved through large-scale, state-led initiatives like the DIKSHA platform. Among the successful strategies in both contexts are the importance of differentiated and individualized teacher support, the influence of Professional Learning Communities (PLCs) as a collaborative support system, and the success of blended learning. The article concludes by suggesting a multi-tiered model of localized support that highlights the importance of diagnostic needs assessment, school-based mentorship, and the development of teacher agency. Among the lessons learned from this comparison is the need for support systems for sustainable techno-pedagogical integration in rural areas to not be only transplanted but grounded in local realities.

**Keywords:** TPACK, rural education, digital divide, localization

### **Introduction**

The digital shift in education has been a global trend that has been sped up by the pandemic, requiring teachers to develop techno-pedagogical capabilities, that is, the knowledge of technology, pedagogy, and content (Koehler & Mishra, 2006). Such integration is fundamental to broader educational aims, such as the Sustainable Development Goal (SDG) 4: Quality Education (UN, 2015). The actualization of techno-pedagogy is, however, highly uneven, and rural areas in developing countries encounter specific infrastructural, socio-economic, and pedagogical obstacles (Tondeur et al., 2017; Zou et al., 2021).

In Sri Lanka, even though the government has been promoting computer education since 1983 and Computer Resource Centres since 1994, the use of Information and Communication Technology (ICT) has not been effectively integrated (UNESCO, 2009). The lack of infrastructure, the presence of only one computer for every 100 students in 2009, and teacher training are significant challenges for advancement (Hudah, 2009; Karunathilake & Vidanagama, 2021). Rural Tamil Nadu faces similar challenges of internet connectivity and disconnect between the provision of resources and the integration of pedagogy, despite the presence of extensive state-led initiatives (Kumar & Kumari, 2023; Sindakis & Showkat, 2024).

One important lesson to be learned from both is that traditional, standardized Professional Development (PD) programs often do not work because they do not take into consideration local constraints and resources (Schulze-Vorberg et al., 2021). There is no "one-size-fits-all" solution to building teacher capacity. This paper aims to fill this gap by posing the following question: What

are the features of successful, locally situated teacher support systems for techno-pedagogy in rural Sri Lanka and Tamil Nadu, and what comparative lessons can be learned?

The goal of this review is to draw on the existing literature to build a framework for the provision of contextually relevant techno-pedagogical support. This paper seeks to contribute to the discussion around more equitable and sustainable educational technology integration by examining two South Asian contexts that are culturally similar but have different policy environments.

### **Theoretical Framework: Contextualizing TPACK**

This review is guided by the Technological Pedagogical Content Knowledge (TPACK) framework, which suggests that successful technology integration is dependent on the interplay between knowledge of technology (TK), pedagogy (PK), and content (CK) (Koehler & Mishra, 2006). The value of the framework lies in highlighting the combined knowledge generated when the three areas interact, forming the integrated TPACK necessary to create authentic learning experiences.

However, in the rural context, the TPACK framework needs to be explicitly expanded to incorporate contextual knowledge (XK). TPACK is not a set of knowledge but a form of expertise that is situated and contextualized (Pareto & Willermark, 2019). Li and Li (2024) also found that “XK is significant in determining the overall TPACK along with PK, PCK, and TCK” (p. 23687). This means that any teacher support system must be designed to understand and incorporate the unique contextual realities of rural classrooms, including but not limited to multi-grade teaching, linguistic diversity, intermittent electricity, and socio-economic challenges.

Thus, the present review takes a Contextualized TPACK perspective, which suggests that teacher support systems should assist teachers in contextualizing the core techno-pedagogical knowledge to their local context (Tondeur et al., 2017). In addition, teachers' attitudes, beliefs, and self-efficacy also affect the development of TPACK. Scherer, Tondeur, Siddiq, and Baran (2018) also concluded that “attitudes toward technology and TPACK self-beliefs were positively related” (p. 67), indicating that teachers need support not only in building their confidence but also in enhancing their competence.

### **Methodology**

The methodology used in this paper is a literature review. It draws from a review of secondary sources, including snippets of peer-reviewed articles, government reports, and institutional studies on Technology integration and teacher professional development in Sri Lanka and Tamil Nadu. Thematic synthesis was used to extract key themes and data points. Data collected was then analyzed, coded, and sorted into categories and themes that emerged from the data that could inform the development of localized support systems for rural teachers. Historical context and policy initiatives, infrastructure challenges, teacher preparedness and attitudes, support systems currently in place, and strategies are key themes that have proven effective. The data were coded and placed in a comparative matrix to compare and contrast rural Sri Lanka and rural Tamil Nadu, ensuring equal weight is given to both contexts in the analysis.

### **Comparative Analysis of Localized Support Systems**

#### **The Context of Rural Sri Lanka**

Sri Lanka has a long history of introducing ICT in education. National policies, such as the “Digital Bridge through Education”, sought to create a knowledge-based society (Ministry of Education, 2005). In 2009, there were nearly 9,700 schools with computer laboratories in 3,415 of them, but the computer-to-student ratio was 1:100 (Hudah, 2009). E-learning programs such as E-Thaksalawa (a Learning Management System) and the Nenas Telecentre Network have been

introduced to address the digital divide. However, they are hampered by the absence of internet connectivity in rural schools (Kailasapathy et al., 2017).

One of the significant challenges is the inequality of resources. National Schools are also better equipped, with 78.3% having IT labs in 2012, compared to only 31.3% of Provincial Schools (Ranasinghe et al., 2016). This 'internal digital divide' is further exacerbated by a lack of qualified ICT teachers, especially in rural and estate schools where students often do not have the basic English and Mathematics skills that are essential for ICT (Marsook, 2019; Sethunga et al., 2016).

A lack of preparedness among teachers is also an obstacle. Kailasapathy et al. (2017) reported a mean score of 2.8 among teachers' readiness for e-learning, where a score >2.6 indicates lack of readiness, and attribute this to lack of technical competency, high workload, and resistance to pedagogical change (p. 105-106). This emphasis on teaching over technology is demonstrated in the way teachers themselves articulate the issue. In the same line, Technological Factors were rated the fourth most relevant to student's readiness to learn when it comes to Sri Lanka, after Student factors, Teacher factors, and Contextual factors (Piratheeban & Bandara, 2024) which is an important validation for effective support systems that emphasize on coaching to teachers, to see technology as a valuable instrument to restructure their pedagogical approach in order to achieve certain learning goals, instead of just building skills of technology for its own sake. But it is also something that might get better. For instance, the Commonwealth Digital Education Leadership Training in Action (C-DELTA) program showed that teachers, when provided with encouragement and specific support, could develop digital skills and move toward more student-centered practices (Karunanayaka et al., 2021).

### **The Context of Rural Tamil Nadu, India**

The techno-pedagogy that Tamil Nadu has pursued is a more state-centric techno-pedagogy. The DIKSHA platform is an example of a national platform within an ecosystem of availability of digital technologies for curriculum resources and teacher training to make these resources accessible to all (Kumar & Kumari, 2023). The government has also promised to provide tablets in large numbers and establish SMART classrooms with interactive technologies (Kailasapathy et al., 2017).

Despite these enormous investments, rural Tamil Nadu has many challenges. The use of online platforms such as DIKSHA is also affected by infrastructural problems, including poor internet connectivity (Kumar & Kumari, 2023). In addition, there is evidence to suggest that, without localized pedagogical support, the learning benefits of hardware distribution are minimal. Often, the concern has more to do with the technology itself rather than how to teach with it (Koh et al., 2017). Thus, a clear disconnect appears between the integration of technology and its practical application in classroom teaching, as evidenced by a study on teachers' knowledge and perceptions in rural Tamil Nadu. Only 65% of teachers knew the term techno-pedagogy, and only 28% could say what that means. In addition, teachers' attitudes were heavily biased in favor of technology, depending on their self-efficacy. Teachers with low technical confidence identified it as another burden in addition to their teaching load, rather than a teaching tool (Jayanthi & Tholappan, 2016). This highlights the need for a system of support to not only offer infrastructure but also actively engage in restructuring long-held beliefs and stereotypes about teaching.

This kind of effective support has been articulated as Techno-pedagogy, married to a content area and community-based support. For example, teachers' buy-in and content curation in Tamil have been reported as crucial for integrating digital tools in science education or language learning (Tondeur et al., 2018). The Digital India Program (DIP), although assisting in the development of digital literacy, access, adoption, and students' socio-economic status, is also a barrier to learning outcomes (Sindakis & Showkat, 2024; Rani, 2016).

## **Cross-Cutting Themes and Divergences**

### **Similarities**

In both Sri Lanka and Tamil Nadu, the most important commonality is that while the provision of technological infrastructure is necessary, it is not sufficient for educational reform; sustainable integration requires continuous in-person pedagogical and technical support on the ground (Zou et al., 2021). Plus, the success of these support systems depends on promoting teacher agency, where teachers are seen as co-creators and “reflective practitioners” of techno-pedagogical solutions rather than mere receivers. This approach has been proven to be more successful and sustainable (Pareto & Willermark, 2019). In addition, teachers’ internal psychological variables, such as self-efficacy and fundamental attitudes towards technology, are also very relevant factors in the successful adoption and effective use of technology in both regions (Scherer et al., 2018).

### **Differences**

A key distinction between the two contexts lies in their policy drivers and implementation frameworks, where Tamil Nadu’s approach is characterized by large-scale, state-driven programs such as DIKSHA. In contrast, initiatives in Sri Lanka are often more fragmented, involving a complex mix of government, NGO, and donor projects, which present different challenges for scalability and sustainability. The focus of what is being localized is also quite distinct in that in Tamil Nadu it largely involves translating language and State curriculum specific content into Tamil whereas in Sri Lanka, the localization must deal with the more complicated linguistic situation of being supportive to both Sinhala and Tamil medium schools, which adds a much more complicated level to the resource development and teacher support (Phiri et al., 2024).

## **Synthesis of Effective Localized Support Strategies**

### **Personalized Support**

ICT and TPACK skills levels also differ among teachers as they arrive at professional development. The necessity of tailored support rather than a one-size-fits-all training is a recurrent element in the literature (Schulze-Vorberg et al., 2021; Tondeur et al., 2017). This can include diagnostic testing to determine personalized learning paths for teachers, intensive foundational support for those new to teaching, and more advanced design-based practice for the more experienced (Koh, 2020).

### **Collaborative and Practice-Based Models**

Top-down professional development has little impact. Instead, design-based, collaborative models in which teachers are engaged in the creation and critique of technology-integrated lessons hold promise. Professional Learning Communities (PLCs) or “Techno-Pedagogy Circles” formed within and between rural schools can provide peer support, resource sharing, and collective problem solving (Koh & Chai, 2014; Liu et al., 2015). The “TPACK in situ” model, which views teaching as a design activity situated in particular classroom contexts, is especially relevant to rural contexts (Pareto & Willermark, 2019).

### **Blended and Mobile**

The online versus face-to-face training debate is solved by blended learning models, which are best for rural areas where travel is difficult. Blended learning as a concept combines traditional classroom learning with the latest e-learning technologies in a more effective way (Piratheeban & Bandara, 2025). They further emphasized that it is a more straightforward, flexible, and time-efficient approach that does not exclude any potential benefits from either method of teaching, thereby significantly enhancing the learning outcome. In this model, technology is not a complete takeover. However, it is used strategically "for projects, assessments, and for providing enriching learning experience," while the teacher's role shifts to that of a facilitator who guides "students

with essential, reliable resources and activities" (Tholappan & Begam, 2024). Zagouras et al. (2022) concluded that a hybrid model exceeded traditional training because it provided flexibility while still offering some human contact. Face-to-face initial workshops for basic skills development can be followed by ongoing online collaboration and mentorship on mobile phone accessible platforms, which have higher penetration in rural areas (Chen & Tsai, 2021).

### **Focus on Pedagogical Realignment over Technical Skill**

The common pitfall of focusing on Pedagogical Realignment over Technical Skill is emphasizing technical skills (TK) too much and not enough on pedagogical integration (TPK and TPACK). Valtonen et al. (2023) concluded that even after training, teachers were still focusing more on content and pedagogy than on technology. Support should then not only be about "how to use a tool" but also "why and when to use this tool to teach this specific content to these specific students" and should use design scaffolds and lesson study approaches (Koh, 2019; Joubert, 2020).

### **A Proposed Model for Localized Teacher Support**

From the above discussion, this paper presents a multi-tiered model of rural teacher support systems in Sri Lanka and Tamil Nadu. At the core of this model is a Diagnostic Layer, which begins with a thorough needs assessment to identify the current infrastructure, teacher TPACK levels, attitudes, and contextual challenges such as multi-grade classrooms, using diagnostic tools that have been adapted (Yang & Wei, 2025). Based on this diagnosis, the Programmatic Layer would consist of the creation of contextually relevant, subject-specific professional development using methods such as "learning by design" and lesson study cycles (Agyei & Voogt, 2015; Joubert et al., 2020), as well as training "Techno-Pedagogy Champions" or master teachers to support teachers continuously and locally in a non-threatening and flexible way (Baser et al., 2021). At the same time, the Technological Layer should work on developing low-cost, low-bandwidth, mobile-first technologies and build an Open Educational Resource (OER) digital repository that can function well in low connectivity and in the local languages where it is needed. Lastly, a Community and Policy Layer is needed to involve school leaders in developing a school culture that supports experimentation and time for collaboration (Chiu et al., 2024) and to create formal and informal Professional Learning Communities (PLCs) at the cluster or district level to reduce professional isolation.

### **Conclusion and Recommendations**

This comparative analysis confirms that the challenge of adapting techno-pedagogy for rural communities in Sri Lanka and Tamil Nadu is not technological, but rather pedagogical and systemic. The teacher support system that surrounds this initiative is the key to its success, and must be strong, culturally responsive, and localized. Despite the commonalities in infrastructure and resource imbalances in both areas, the policy contexts require different approaches to implementation.

#### **Recommendations**

- Policymakers should cease funding centralized training and begin to invest in more continuous, school-based models of professional development that incorporate blended learning and peer mentorship.
- School Management needs to give teachers time and credit to engage in PLCs and lesson design so that a culture of collaboration and innovation can be fostered.
- Include contextualized TPACK and problem-based learning in teacher training programs for both pre-service and in-service teachers in order to prepare teachers for the rural classroom.

- The proposed support framework should be piloted and refined in selected rural districts in both regions using longitudinal and participatory action research methodologies. Future research is also required on the impact of new technologies, such as local language AI tools and offline adaptive learning systems, in these resource-poor environments.

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