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The Teacher as Global Connector: How Online Communities Change STEM Teaching in Karachi and Hyderabad's Schools

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Abstract

Today, science and math teachers in Karachi and Hyderabad are connecting with colleagues worldwide through online Professional Learning Communities. These digital spaces offer teaching ideas from other countries, but these foreign methods must be carefully changed to work in our local classrooms.This study examined: (1) How our local teachers use these global online groups, (2) What challenges they face when trying foreign teaching methods, and (3) How they successfully adapt international ideas for Pakistani students. A mixed methods used over one year. Surveyed 215 teachers from 47 private schools, conducted deep interviews with 35 teachers, analyzed 80 adapted lesson plans, and observed 25 classrooms in action.Nearly all teachers (89%) use online communities, mainly through Facebook groups (82%) and YouTube (76%). However, success varies greatly: in well-equipped schools, 68% of foreign ideas work well; in schools with fewer resources, only 31% succeed. Teachers use three adaptation approaches: Direct Use, Modified Use, and Complete Redesign.Global teacher communities are valuable resources, but their ideas require careful translation to our context. The real skill lies not in finding foreign ideas, but in knowing how to make them work effectively in our own educational environment.

Keywords: STEM Education, Teacher Communities, Karachi Schools, Hyderabad Schools, Teaching Adaptation, Online Learning

Introduction

Consider today's science and math teacher in our major cities of Sindh. No longer working in isolation, they now join global networks of educators through online Professional Learning Communities. These digital platforms connect teachers across continents, allowing them to share new teaching methods and approaches. Like travelers returning from distant lands with new treasures, these teachers bring back ideas from around the world. Yet herein lies a challenge. These teaching methods often come from educational systems that differ greatly from ours with better equipped laboratories, smaller classes, and different assessment systems. Our schools in Karachi and Hyderabad operate under different conditions: teachers face resource limitations, exam pressures, large classes, and the need to make foreign concepts understandable to local students. The bright idea from abroad must therefore be carefully adjusted to fit our reality. Existing research tells us some things about this phenomenon. Studies by Trust and colleagues

(2020) show how online communities support teacher development. Prestridge (2019) documents how teachers build knowledge through digital networks. Pakistani researchers like Jamil and Malik (2021) describe the challenges of science education here. But a key question remains unanswered: How do teachers take foreign teaching ideas and successfully implement them in Pakistani classrooms?

This study addresses three important questions:

1. How do teachers in different types of private schools use global online communities?
2. What school factors help or hinder implementation of foreign ideas?
3. What adaptation strategies work best, and how can schools better support this adaptation process?

Literature Review

The rise of online Professional Learning Communities (PLCs) has fundamentally reshaped how teachers engage in continuous professional development, particularly in STEM education. International scholarship emphasizes that digital networks enable rapid sharing of pedagogical strategies, peer feedback, and collaborative problem-solving, which can accelerate teacher learning beyond traditional, localized forms of professional development (Trust, 2020). Such networks are not neutral transfer pipelines; rather, they function as social learning ecosystems where practices are negotiated, contextualized, and reinterpreted. This theoretical framing helps explain why Karachi and Hyderabad teachers in the present study treat global ideas as starting points rather than turnkey solutions. Research into teacher participation in online communities highlights two complementary mechanisms that underpin learning: resource access and identity/relationship work. Prestridge (2019) argues that access to diverse resources (videos, lesson plans, classroom clips) increases teachers' repertoire, while the social dimension of communities comments, mentorship, and reputational signaling shapes how teachers adopt and adapt resources. This dual mechanism is visible in the study's finding that teachers both consume content (YouTube) and interact in social spaces (Facebook groups), suggesting that successful adaptation requires both high-quality materials and sustained social engagement to make sense of foreign practices. Contextual constraints are a recurring theme in literature on transfer and adaptation. Comparative education studies underscore that pedagogical approaches developed in resource-rich settings frequently assume small class sizes, advanced laboratory equipment, and assessment cultures dissimilar to those in many Pakistani schools (Jamil & Malik, 2021; Sultana et al. 2025). Consequently, literature recommends a process-oriented approach to adaptation where teachers critically evaluate the affordances and limitations of imported practices and intentionally redesign them to local constraints. The typology identified in the present study (Direct Use, Modified Use, Complete Redesign) resonates with established models of instructional adaptation that move from fidelity to adaptation to reinvention depending on contextual fit. A growing body of empirical work also shows that institutional support mediates the success of adaptation. Schools that provide time for collaborative planning, modest material innovation, and leadership endorsement see higher implementation fidelity and student uptake. This aligns with organizational learning theories that position schools as enabling or constraining environments for teacher-led innovation. Finally, the literature calls attention to equity implications: unequal access to technology and varying school resources can reproduce or widen disparities unless targeted supports are introduced. Taken together, existing research frames the current study's contribution as both confirmatory and context-expanding: it confirms global findings about online teacher learning (Trust, 2020; Prestridge, 2019) while illuminating how

Pakistani school types shape the adaptation pathways described by Jamil and Malik (2021). The literature recommends strengthening localized adaptation skills, institutional supports, and resource-creative strategies so that global pedagogical ideas translate into meaningful classroom change.

Materials and Methods

Research Design

Used a mixed-methods approach over twelve months. Deliberately studied three categories of schools to allow comparison:

- Type A: Well-resourced schools following international curricula (like Cambridge)
- Type B: Mid-level schools following Pakistani curriculum with adequate resources
- Type C: Schools with limited resources serving less affluent communities

Participants

For this study, chosen 215 STEM teachers from 47 schools across both cities. From this group, we selected 35 teachers for in-depth interviews. Also analyzed 80 adapted lesson plans and conducted classroom observations in 25 schools.

Research Instruments

Survey, interview guide, and lesson plan analysis frameworks were used to collect data.

Data Collection

Surveys, interviews, classroom observations, and lesson plan analysis were completed with approval from the Sindh Education Institute.

Data Analysis

Survey data were statistically analyzed; interviews were thematically examined; lesson plans were scored using a Localization Quality Score.

Ensuring Quality

Multiple validation strategies strengthened reliability and accuracy.

Results

Online Community Engagement

The findings reveal that engagement with online Professional Learning Communities (PLCs) has become a routine part of teachers' professional lives in Karachi and Hyderabad. A striking 89% of surveyed teachers reported using digital platforms weekly to explore teaching resources, observe global classroom practices, and seek peer advice. Facebook groups often hosting thousands of international members emerged as the most active platforms, with 82% participation. Teachers described these groups as vibrant spaces where they could pose questions, share their challenges, and receive instant feedback from educators across different countries. Similarly, YouTube was heavily used (76%), primarily for demonstration-based learning, where teachers watched STEM experiments, interactive simulations, or model lessons to refine their own instructional skills. WhatsApp communities, though less documented globally, played a notable role in localized peer support. Many teachers relied on closed WhatsApp groups managed by school networks or district educators to discuss implementation difficulties, share simplified lesson ideas, or circulate low-cost adaptations of foreign practices.

Type-A schools displayed the highest level of structured engagement, often encouraging teachers to subscribe to premium educational channels. In contrast, Type-C schools depended more on freely available content and informal networks, showing how platform choices vary with socioeconomic conditions.

Implementation Challenges

Despite widespread access to global ideas, the extent to which teachers could implement them successfully differed sharply across school types. Resource constraints were the most significant barrier, particularly in Type-C schools, where 91% of teachers cited insufficient laboratory materials, outdated technology, and large classroom sizes as obstacles. Teachers reported that many foreign instructional videos assume the availability of digital screens, science kits, or individual student workstations resources rarely found in under-resourced schools. Time pressure, exam-driven teaching culture, and rigid curriculum guidelines also hindered innovation. Teachers in Type-B and Type-C schools highlighted that even when they understood international teaching methods, limited preparation time and heavy teaching loads prevented them from experimenting with new strategies. Moreover, language barriers arose when foreign resources used technical English terms unfamiliar to many students, requiring teachers to translate and simplify content before classroom use.

Adaptation Strategies

Through analysis of 80 adapted lesson plans and interviews with teachers, three clear adaptation strategies emerged. Direct Use involved applying a foreign idea without modification. This was more common in Type-A schools where resource environments matched those assumed in international materials. Examples included replicating inquiry-based science labs or digital simulations exactly as shown in foreign videos. Modified Use was the most widespread approach. Teachers made partial changes such as replacing expensive materials with locally available ones, converting digital tasks into manual ones, or simplifying activity steps to fit class sizes of 40–50 students. For instance, teachers replaced imported science kits with household items or replaced group-based inquiry activities with teacher-led demonstrations. Complete Redesign involved taking only the conceptual core of a foreign idea and rebuilding the activity entirely around local realities. This was observed most frequently in Type-C schools, where teachers had to restructure experiments, integrate Urdu explanations, or create low-cost teaching aids. Lesson plan scoring showed that redesigned lessons often achieved the highest Localization Quality Scores because they demonstrated deep pedagogical reflection and creativity.

Outcomes and Effectiveness

Schools with supportive leadership, access to professional development, and collaborative planning time demonstrated significantly better adaptation outcomes. Teachers in Type-A schools achieved a 68% success rate in implementing foreign teaching ideas, largely due to stronger administrative backing, peer mentoring systems, and adequate classroom resources. Type-B schools showed moderate success, often limited by inconsistent resource availability and mixed leadership support. In contrast, Type-C schools reported only a 31% success rate, with teachers expressing that successful adaptation was largely dependent on individual effort rather than structural support. Classroom observations reinforced survey findings: in supportive environments, students displayed higher engagement, clearer conceptual understanding, and greater enthusiasm during hands-on activities adapted from global ideas. In less supportive

contexts, teachers often reverted to lecture-based methods because of time pressure or lack of materials.

Discussion

The results of this study underscore the growing role of teachers as global navigators who bridge international pedagogical ideas with local educational realities. Teachers in Karachi and Hyderabad do not merely consume foreign content; they interpret it through the lens of their cultural norms, institutional constraints, and student needs. This aligns with Wenger's (1998) theory of Communities of Practice, which positions learning as a social process in which meaning is continually reconstructed through community interaction. Teachers in this study participated in such global communities but engaged with them selectively, demonstrating agency in adapting what they found. The variation in implementation across school types highlights the persistent structural inequalities within Pakistan's private education sector. Type-A schools, equipped with better infrastructure, could adopt international methods with minimal adjustments, demonstrating what literature calls "fidelity-based adaptation." This mirrors research by Trust (2020), who notes that teachers in well-resourced environments tend to use online content as intended. In contrast, Type-C teachers were forced into "reinvention-based adaptation," where creative redesign was not optional but essential. Their adaptations often reflected an advanced understanding of pedagogy because they required rethinking learning objectives, materials, and delivery strategies altogether. The findings also deepen our understanding of how contextual factors influence instructional transfer. Jamil and Malik (2021) highlighted the structural limitations of science education in Pakistan, and our study empirically confirms how these constraints shape teachers' engagement with global networks. The high reliance on modified or redesigned strategies in Type-B and Type-C schools illustrates the tension between global pedagogical aspirations and local practicalities. Teachers' ingenuity in resource substitution, language translation, and procedural simplification showcases the sophisticated cognitive work involved in adaptation. Another key insight relates to institutional support. Schools that offered collaborative planning sessions, technology access, and leadership encouragement amplified teachers' capacity to adapt ideas meaningfully. This aligns with Fullan's (2016) framework, which emphasizes that system-level support is critical for sustained instructional change. Conversely, in settings where teachers worked in isolation, the burden of adaptation fell solely on individuals, lowering success rates. Ultimately, this study positions adaptation not as a deficit but as a professional skill. Teachers acted as designers, problem-solvers, and cultural mediator's roles rarely highlighted in conventional teacher training. Their adaptive behaviors illustrate how global ideas acquire new life when situated in the sociocultural and resource-specific realities of Karachi and Hyderabad's schools.

Conclusion

This study provides a comprehensive understanding of how STEM teachers in Karachi and Hyderabad engage with global online teaching communities and how they navigate the complex process of adapting international pedagogical practices. The findings reveal that digital platforms have expanded teachers' access to diverse instructional ideas, transforming them into global participants in the evolving landscape of STEM education. However, access to ideas alone is insufficient. The true challenge lies in translation interpreting foreign methods and reshaping them to fit local students, local classrooms, and local constraints. The study concludes that

adaptation is a multifaceted professional competency shaped by school resources, teacher experience, and institutional culture. Teachers in well-resourced schools can adopt foreign ideas with relative ease, but those in resource-constrained contexts must rely heavily on creativity and improvisation. This reality underscores the importance of strengthening teacher training programs focused specifically on adaptation techniques, resource innovation, and culturally responsive pedagogy. The findings also call on school leaders and policymakers to address systemic inequities. Providing modest laboratory upgrades, scheduling collaborative planning time, and promoting sustained professional development can dramatically increase teachers' adaptation success. Strengthening these enabling conditions is essential for meaningful and equitable STEM education reform. In summary, global ideas hold immense potential, but their effectiveness depends on thoughtful localization. Teachers in Karachi and Hyderabad demonstrate remarkable resilience and innovation, turning international pedagogical concepts into practical, culturally relevant, and resource-sensitive classroom experiences. Supporting their adaptive expertise is key to improving STEM learning outcomes across diverse school environments.

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