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Linking teacher training to learning outcomes: A review of empirical studies

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Abstract
Teacher training is an important determinant of learning and the overall quality of education. In order to evaluate the empirical evidence from 2010 to 2025 regarding how teacher education and professional development impact classroom practice and student achievement in settings similar to India, this literature study synthesized research on pre-service and in-service teacher education, pedagogical content knowledge (PCK), mentoring systems, and competency-based reforms. The results indicate that effective, continuous training leads to an increase in teacher competency, pedagogical integration, and reflective curriculum behaviour, which in turn leads to improved student learning. However, relatively weak institutional conditions, a lack of follow-up, and disequilibrium in policy implementation often reduce these measures to half-realized efforts. A primary conclusion of this paper is that credential-centric systems of preparation must be replaced by continuous, contextualized, and focused professional development directly related to classroom performance. Initial teacher training curricula should be outcome-driven, with mechanisms embedded into the wider cultural contexts of schools. For India's National Education Policy (NEP) 2020 initiatives, such as the Integrated Teacher Education Programme (ITEP) and Samagra Shiksha, to succeed, professional development cannot rely on isolated, one-off awareness initiatives.

Keywords: Pedagogy, NEP 2020, teacher education, pedagogies inside the classroom, technology, teacher training, professional development, learning outcomes

Introduction

Teachers have long been perceived to be the single largest school-based factor influencing student teaching (Darling-Hammond *et al*., 2017) [6]. Consequently, improving teacher training remains high on the agenda of the international community as a primary mechanism for elevating educational quality. "Teacher training" in this context refers to both pre-service education (degree or certificate courses a person takes before becoming a professional teacher) and in-service professional development (continuing professional learning).

In theory, high-quality training enhances teachers' knowledge, pedagogical skills, and confidence, resulting in superior teaching that ultimately leads to better student performance. Conversely, poor or fragmented training fails to make a difference in classroom learning. In the context of this review, "learning outcomes" refers to student achievement. While Bloom's taxonomy categorizes learning into cognitive, affective, and psychomotor domains, the empirical evidence evaluated in this review primarily focuses on cognitive achievement and standard competencies (such as standardized test scores) due to the nature of the available data. Professional development must be inextricably linked to these outcomes; if it does not result in measurable increases in student learning, it represents a misallocation of educational resources. This article offers a comprehensive summary of the existing empirical evidence regarding this connection.

Objectives of the Study

The objectives of this paper are to:

1. Synthesize empirical studies that investigate the connections between teacher training and the achievement of learning results.
2. Identify the mediating factors that affect program effectiveness, including program design and institutional context.
3. Highlight existing gaps in the research and outline specific implications for educational policy and practice.

By considering both international and Indian experiences, the literature is organized thematically around pre-service and in-service teacher education, pedagogical content knowledge, technology-enabled learning, and contextual mediators. Against this background, the NEP 2020 reforms in India emphasize a substantially improved linkage between teacher preparation and learning outcomes, making this review highly topical.

Significance of the Study

In contributing to the broader literature on teacher education, this review examines the empirical relationship between teacher training and learner outcomes—a relationship that is widely assumed but seldom empirically scrutinized within the Indian context. This study bridges three significant needs:

- **Policy alignment:** Providing an evidence base for the implementation of NEP 2020 and the National Council for Teacher Education (NCTE) standards.
- **Quality assurance:** Supporting teacher competency models and the research evidence underlying NCTE quality standards.
- **Evidence-based reform:** Identifying highly effective practices (such as sustained mentoring, school-based practicums, and reflective teaching) that improve a teacher's impact inside the classroom.

Simultaneously, this paper advocates for a systemic transition from credential-centric professional development approaches to performance- and outcome-oriented frameworks.

Conceptual and Theoretical Implications

While this review centres on empirical data, foundational theories regarding teacher learning are utilized to interpret the evidence. Professor Shulman's (2004) [23] theory of Pedagogical Content Knowledge (PCK) postulates that effective teaching is a function of interweaving subject matter knowledge with pedagogy. In essence, effective teachers understand both *what* to teach and *how* to teach it, enabling them to make complex subject content accessible to learners (Lee, Saat, & Loke, 2015) [13].

Furthermore, Vygotsky's social constructivist theory posits that learning occurs through social interaction, positioning teachers as mediators of student knowledge construction. Accordingly, effective teacher training must reflect this social dimension by focusing on cooperative learning, teacher communities, coaching, and peer observation. Additionally, Malcolm Knowles' Adult Learning Theory (Andragogy) reveals that successful professional development must be problem-based, highly relevant to the classroom context, and respectful of teachers' prior experiences. These theoretical frameworks collectively indicate that training programs must be consistent, active, and practice-based to genuinely alter teaching behaviour.

From a systems perspective, this review operates on the following Theory of Change: Teacher training (Input) → Teacher competence → Classroom practice → Student learning outcomes (Output).

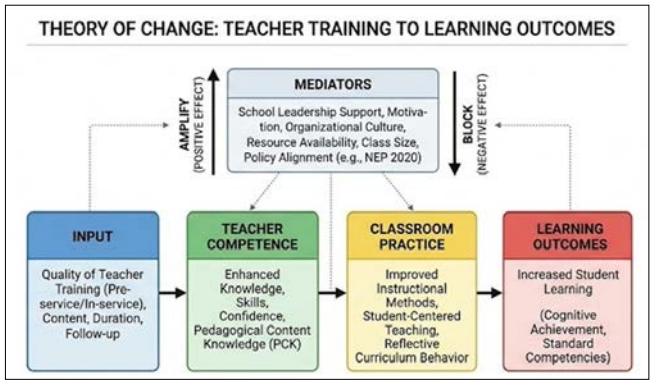

Fig 1: The causal chain of teacher development and the role of contextual mediators.

Training programs serve as the input; the quality of these programs (determined by content, duration, and follow-up) directly influences a teacher's core knowledge and skills. This enhanced competence leads to improved instructional practices in the classroom (e.g., student-centered teaching), which ultimately yields improvements in students' cognitive skills. Crucially, specific "mediators"—such as teacher motivation, school support, leadership, and resources—act upon each step of this chain, amplifying or diminishing the ultimate impact of the training.

Methodology of the Review

This study is a narrative integrative literature review of empirical research. Academic databases (ERIC, Scopus, Google Scholar) and grey literature from credible organizations (UNESCO, World Bank, Azim Premji University, Indian government agencies) were searched using keywords such as "teacher training," "professional development," "learning outcomes," "teacher effectiveness," and "PCK".

Inclusion and Exclusion Criteria

Studies were included if they were empirical evaluations (quantitative, qualitative, or mixed-methods) of pre-service or in-service training programs that reported measurable changes in student learning outcomes or classroom practices. The primary review period covers literature published between 2010 and 2025 to align with current policy relevance. Opinion and commentary papers lacking original data were excluded from the empirical synthesis. However, foundational theoretical frameworks (e.g., Knowles, 1980; Shulman, 2004) [12, 23] and seminal regional studies prior to 2010 (e.g., Kingdon, 2006) [10] were deliberately retained to establish historical context and theoretical grounding.

The screening process utilized a structured approach to identify duplicates and review abstracts for relevance. Approximately 71 initial articles and reports were identified, which were subsequently refined to 43 directly relevant texts for synthesis, extracting data on the training context, program type, and outcome measures.

Review of Related Literature

1. Pre-Service Teacher Training

Pre-service training (e.g., B.Ed., teaching colleges) is designed to educate novice teachers before they enter the classroom. However, there is conflicting empirical evidence regarding whether traditional pre-service education significantly improves student learning at scale. Using large administrative data sources in India, Kingdon (2006) [10] found a small but statistically significant positive impact (about 0.09 standard deviations) of formal teaching training on student test scores. Similarly, Kingdon and Teal (2007) [11] noted slight improvements in retention and outcomes with better-certified teachers.

In contrast, extensive broader studies frequently find the effect of traditional pre-service education to be remarkably weak. Pritchett *et al*. (2013) noted that teacher education in many developing countries is overly academic, lacking the practical monitoring required to positively affect classroom teaching quality. Evans and Yuan (2019) [8] found no significant improvement in student achievement in a regression discontinuity study of teachers promoted to four-year teaching degrees in China. Internationally, a DFID rapid review (Latham & Addey, 2010) [7] stated that measurable teacher variables, such as professional qualifications, often appear to have no effect on student achievement, though specific subject-area qualifications yield minor positive effects. Furthermore, a field experiment in India by Muralidharan and Sundararaman (2013) [20] revealed that certified, regular teachers were no more effective at raising student learning than uncertified contract teachers, suggesting that formal certification alone is a poor guarantor of teaching efficiency.

In conclusion, the historical contribution of traditional pre-service teacher training to learning outcomes is structurally limited, with quantifiable comparisons showing only marginal benefits. These limitations underscore the urgent necessity of structural reforms like India's NEP 2020[9] Integrated Teacher Education Programme (ITEP). For the new ITEP framework to succeed where past pre-service

programs struggled, it must move away from rote, academic pedagogy and actively integrate the continuous mentoring, school-based practicums, and content-focused methodologies that have proven highly effective in modern in-service models.

2. In-Service Training and Learning Outcomes

In-service professional development (PD) provides much stronger evidence for improved educational outcomes, provided it is properly designed. PD programs vary vastly, encompassing single-day workshops, continuous coaching, and communities of practice. A recent systematic review by Lindvall *et al*. (2025) [14] demonstrated that training programs featuring cooperative design, where teachers and coaches engage in continuous, ongoing collaboration throughout the year, produced vastly superior student results. Similarly, Ambon *et al*. (2024) [1] concluded that continuous PD significantly improves the quality of teaching through the enhancement of pedagogical skills and in-class problem-solving.

In high-performing global education systems, such as Singapore and Finland, teachers are consistently involved in scheduled, ongoing professional learning and reflective practice. In India, institutionalized in-service training is provided by District Institutes of Education and Training (DIETs) and State Institutes (SCERTs) under frameworks like Samagra Shiksha. A qualitative study in Odisha (Biswal *et al*., 2023) [4] observed that after attending specific in-service workshops, teachers significantly increased their use of teaching aids and classroom interactivity.

However, as highlighted by Roy and Swargiary (2024) [22], many large-scale, generic training programs in India remain inconsistent and lack local contextualization. While government-led trainings reach a massive volume of educators, they are frequently brief, formulaic, or conducted irregularly. Lindvall *et al*. (2025) [14] confirm the strict relationship between well-designed PD (featuring coaching, collaboration, and sustained engagement) and student gains, explicitly noting that low-intensity, individualized workshops generally yield an impact close to zero.

3. Pedagogical Content Knowledge (PCK) and Student Achievement

Professional development activities frequently attempt to develop teachers' PCK in core subjects, acting as the bridge between theoretical subject knowledge and classroom practice. However, empirical studies linking PCK directly to student achievement show inconsistent findings.

In a study in Peru, Cueto *et al*. (2017) [5] found a positive correlation between teachers' PCK and mathematics performance; however, this correlation only existed above a specific knowledge threshold. Teachers with a highly thorough understanding of how students conceptualize mathematics were effective at raising achievement, while there was no measurable impact for teachers below the threshold. Conversely, Usak and Kuzu (2022) [24] found no significant link between teacher PCK and student achievement in Indonesian science lessons, highlighting the persistent difficulty of tracing a direct route from theoretical PCK to standardized test scores.

These differences are partially explained by measurement challenges, as PCK is a highly complex construct. Current evidence suggests that basic PCK functions as a necessary but insufficient mediator; deep theoretical subject knowledge must be actively mobilized by effective communication skills and institutional support to result in measurable student learning gains.

4. Significance of Technology-Mediated Training

Increasingly, teacher education is delivered via digital technology, including MOOCs and national portals like India's SWAYAM and DIKSHA. These platforms are widely regarded as highly scalable solutions for continuous training, particularly in underdeveloped or geographically isolated regions. Misra (2018) [19] notes promising evidence that MOOCs can successfully promote teacher learning, citing high completion rates and self-reported shifts in instructional approaches.

However, widespread digital adoption does not automatically ensure an impact on students. For example, the DIKSHA platform recorded billions of learning sessions and achieved massive scale. Yet, researchers identified a distinct paradox: this high volume of digital adoption did not necessarily translate into measurable learning gains, particularly in underserved communities struggling with low internet connectivity (Martin *et al*., 2022) [16]. Quantitative metrics, such as usage frequency or login rates, are insufficient indicators of success. The evidence base linking isolated EdTech usage to downstream student achievement remains weak. Purely online platforms must be viewed as complementary tools that require "human" support structures—such as continuous mentoring, follow-up discussions, and localized contextual adaptation—to genuinely alter classroom practice.

5. Mediating and Contextual Factors

As illustrated in the Theory of Change (**Figure 1**), high-quality training alone cannot guarantee better outcomes; contextual mediators are critical. The available literature explicitly indicates that high-quality training alone cannot guarantee better outcomes; contextual mediators are critical. Ambon et al. (2024) [1] strongly emphasize the role of school leadership: when professional development is actively supported by school principals through the allocation of dedicated time, resources, and follow-up, the impact on classroom practice is far more significant.

Organizational culture is equally vital. Highly effective PD programs encourage teachers to learn collaboratively through practices like lesson studies or professional learning communities. Furthermore, external systemic factors—such as class size, student backgrounds, and the availability of physical resources—heavily mediate success. In under-resourced rural schools, even highly trained teachers cannot effectively deploy their pedagogical skills if fundamental resources like textbooks are entirely absent. Consequently, Lindvall *et al.* (2025) [14] caution against extrapolating the findings of "ideal pilot" programs to normal, under-resourced classroom environments without accounting for these critical mediators.

6. Studies in the Regional and Indian Context

While much empirical rigor exists in high-income settings, emerging evidence from India paints a complex picture. Seminal studies by Kingdon (2006) and Kingdon and Teal (2007) [10, 11] demonstrate moderate returns to traditional qualifications. However, NGO monitoring bodies like the ASER Centre consistently highlight that rural India suffers from severe learning deficits despite high enrollment, pointing to chronic gaps in teaching quality.

A study in West Bengal by Banerjee *et al*. (2017) [3] suggested that targeted coaching and mentoring for government school teachers was moderately effective in boosting student learning, confirming that well-implemented, continuous support is viable in India. Conversely, Pritchett and Beatty (2012) [21] noted that much traditional Indian training relies on rote lecture repetition, rendering it largely irrelevant to active classroom dynamics. Regional disparities further complicate this; in Meghalaya, teacher qualification levels remain significantly below the national average, heavily hampered by systemic issues such as a lack of trained personnel at block resource centres (Mehta, 2023) [17]. Reviews of national schemes (Roy & Swargiary, 2024) [22] emphasize the need to better align centralized training curricula with highly localized, rural contexts.

Synthesis of Findings

Overall, the literature demonstrates a moderate, positive relationship between teacher training and student learning, strictly conditional upon the delivery context. Darling-Hammond *et al*. (2017) [6] show that quality professional development generally improves instruction and has a small to moderate effect on student achievement. This is supported by Lynch *et al*. (2025) [15], whose meta-analysis for the Annenberg Institute found that high-level, content-focused professional development leads to significant teacher learning (with an effect size of $SD = 0.52$), which in turn correlates strongly with gains in student achievement.

However, methodological limitations in the broader literature must be acknowledged. Lindvall *et al*. (2025) [14] explicitly note that many legacy PD studies suffer from poor controls and inherent bias; when this bias is statistically removed, the apparent impact on student scores dilutes significantly, dropping from an effect size of +0.09 to essentially zero in some re-analyses. Intensive, targeted coaching interventions frequently show strong causal effects (0.3–0.5 SD), while isolated, single-event workshops consistently show effects close to zero.

The most effective training modalities are active, sustainable, and content-centered. Darling-Hammond *et al*. (2017) [6] identify attributes of effective PD, including adult learning principles, collaboration, active coaching, and extended duration. Ventista and Brown (2023) [25] confirm that coaching combined with a reflective approach immediately following training produces the highest skill retention. Conversely, the lack of a standardized definition for "learning outcomes" across studies—ranging from standardized test scores to behavioral metrics—complicates direct comparisons and contributes to conflicting findings.

Discussion and Implications for Practice and Policy

The present review reaches an optimistic but highly conditional conclusion: quality teacher training positively affects pupil learning outcomes exclusively under supportive, enabling conditions. While short-term, generic workshops fail to achieve measurable impacts, sustained programs rooted in social-constructivist theory and andragogy effectively help teachers translate theoretical knowledge into practical classroom capability.

The mediating effects of institutional quality, school leadership, and resource availability are paramount. Even the most highly trained teachers underperform when poorly resourced or unsupported by school leadership. Therefore, teacher development must be viewed as an ecosystem-strengthening endeavour rather than an isolated administrative task.

For policymakers implementing NEP 2020[9] reforms (such as ITEP and Samagra Shiksha), teacher education curricula must be strictly aligned with measurable learning outcomes. The prevailing culture of one-off, credential-centric workshops must be replaced with long-term, practice-based professional development. Furthermore, while technology-supported learning (DIKSHA, SWAYAM) offers immense scale, pure digital delivery is insufficient; these platforms must be integrated with robust, human-led mentoring and localized peer support systems to affect true pedagogical change.

Future research must move beyond qualitative reliance and small-sample studies. There is a critical need for large-scale natural experiments, randomized controlled trials, and longitudinal studies to definitively isolate causal effects across diverse demographics. Standardized national measures, such as the National Achievement Survey (NAS), should be systematically utilized to provide objective, continuous reviews of training program efficacy.

Limitations of the Study

This review is inherently limited by the availability of rigorous empirical studies that utilize objective metrics of learning outcomes within the Indian context. The heavy reliance on qualitative data in regional studies complicates direct quantitative comparisons. Furthermore, vast institutional variations and diverse regional profiles make universal generalization challenging. Nonetheless, this synthesis provides a robust and valuable overview of current evidence and necessary policy trajectories.

Conclusion

There is clear evidence of a positive correlation between high-quality teacher education and student learning outcomes; however, this impact is neither automatic nor guaranteed by mere formal certification. Continuous, case-based, and collaborative professional learning yields the highest positive impact on students. Unfortunately, many current training programs fail to incorporate these criteria, explaining the highly mixed results seen globally. Ultimately, while teacher training is a vital educational input, it must be embedded within a holistic ecosystem serving as the 'mediators' identified in **Figure 1** of school leadership, adequate resourcing, and accountability to fully realize its potential impact on student learning.

References

1. Ambon J, Alias BS, Komariah A, Mansor AN. The impact of continuous professional development on teaching quality: A systematic review. International Journal of Evaluation and Research in Education (IJERE), 2024, 13(6). https://doi.org/10.11591/ijere.v13i6.30427.
2. Azim Premji University. Teacher learning and classroom practice in India. Bengaluru: APU, 2022.
3. Banerjee A, Banerji R, Berry J, Duflo E, Kannan H, Mukerji S, et al. From proof of concept to scalable policies: Challenges and solutions, with an application. Journal of Economic Perspectives,2017:31(4):73–102. https://doi.org/10.1257/jep.31.4.73.
4. Biswal P, Nayak S, Swain AK. Impact of in-service teacher training programme on classroom transaction at

elementary level. Journal of Emerging Technologies and Innovative Research, 2023, 10(3).
5. Cueto S, León J, Sorto MA, Miranda A. Teachers' pedagogical content knowledge and mathematics achievement of students in Peru. Educational Studies in Mathematics,2017:94(3):329–345. https://doi.org/10.1007/s10649-016-9735-2.
6. Darling-Hammond L, Hyler ME, Gardner M. Effective teacher professional development. Learning Policy Institute, 2017.
7. Department for International Development. Impact of teacher training on students' learning outcomes: Rapid review of the literature. UK Aid, 2010.
8. Evans DK, Yuan F. Equivalent years of schooling: A metric to communicate learning gains in concrete terms. World Bank Policy Research Working Paper No. 8752, 2019.
9. Government of India, Ministry of Education. National Education Policy 2020. New Delhi, 2020.
10. Kingdon G. The progress of school education in India. Oxford Review of Economic Policy, 2006. https://doi.org/10.1093/oxrep/grm015.
11. Kingdon GG, Teal F. Does performance related pay for teachers improve student performance? Some evidence from India. Economics of Education Review,2007:26(4):473-486.
12. Knowles MS. The modern practice of adult education: From pedagogy to andragogy. Englewood Cliffs: Prentice Hall/Cambridge, 1980.
13. Lee CL, Saat RM, Loke SH. The knowledge of teaching – Pedagogical Content Knowledge (PCK). Malaysian Online Journal of Educational Sciences,2015:3(3):39–47.
14. Lindvall J, Kirsten N, Ryve A, Gustafsson JE. A critical review and meta-analysis of studies investigating the effects of the professional development teachers typically receive. Studies in Educational Evaluation,2025:86:101482. https://doi.org/10.1016/j.stueduc.2025.101482.
15. Lynch K, Gonzalez KE, Hill HC, Merritt R. A meta-analysis of the experimental evidence linking mathematics and science professional development interventions to teacher knowledge, classroom instruction, and student achievement (EdWorkingPaper No. 24-1023). Annenberg Institute at Brown University, 2025. https://doi.org/10.26300/r79z-tf23.
16. Martin C, Ramanna K, Muthuram V. DIKSHA: A transformational bet on educational outcomes in India. Blavatnik School of Government, 2022.
17. Mehta AC. Status of education in the north-eastern part of India 2023. Education for All in India, 2023.
18. Ministry of Education (MoE). Samagra Shiksha: An Integrated Scheme for School Education. New Delhi, 2021.
19. Misra PK. MOOCs for teacher professional development: Reflections and suggested actions. Open Praxis,2018:10(1):67–77. https://doi.org/10.5944/openpraxis.10.1.780.
20. Muralidharan K, Sundararaman V. Contract teachers: Experimental evidence from India (NBER Working Paper No. 19440). National Bureau of Economic Research, 2013.
21. Pritchett L, Beatty A. The negative consequences of overambitious curricula in developing countries (HKS Working Paper No. RWP12-035). Harvard Kennedy School, 2012.
22. Roy K, Swargiary K. A systematic review of the Samagra Shiksha Abhiyan: Evaluating access, quality, inclusivity, digital education, and implementation challenges. ResearchGate, 2024. https://doi.org/10.13140/RG.2.2.28829.73449.
23. Shulman LS, Wilson SM. The wisdom of practice: Essays on teaching, learning, and learning to teach. Jossey-Bass, 2004.
24. Usak M, Uygun H, Duran M. The effects of science teachers' pedagogical content knowledge on students' attitudes toward science and their achievement. Journal of Baltic Science Education,2022:21(5):694–705. https://doi.org/10.33225/jbse/22.21.694.
25. Ventista O, Brown C. Teachers' professional learning and its impact on students' learning outcomes: Findings from a systematic review. Social Sciences & Humanities Open,2023:8:100565. https://doi.org/10.1016/j.ssaho.2023.100565.