

Evaluating the impact of teacher education on pedagogical practice in bangladeshi classrooms

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Abstract

Purpose: This study evaluates the impact of teacher education programs on pedagogical practices and contemporary skill delivery across Bangladeshi primary and secondary classrooms undergoing national curriculum reform.

Method: Employing a convergent parallel mixed-methods design, data were gathered from educators, school leaders, and education officials across urban, peri-urban, and rural regions. Data collection utilized standardized self-assessment surveys, dialogic classroom observation rubrics, and semi-structured interviews. Quantitative metrics were evaluated using multilevel structural equation modeling, complemented by qualitative thematic analysis.

Findings: Professional development generated statistically significant gains in teacher self-efficacy and technology integration beliefs. However, observational rubrics revealed that teacher-led recitation persisted due to large class sizes and examination constraints. Multilevel modeling demonstrated that school-level organizational climate and teacher agency heavily dictate pedagogical transfer into daily routines.

Practical implications: Educational policymakers must shift from isolated workshops toward sustained school-based learning communities, while aligning national assessment frameworks with competency-based pedagogy.

Originality/value: This study offers novel empirical evidence explaining the evidence-practice gap in South Asia by applying a sociocultural agency lens to teacher development within low- and middle-income contexts.

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Introduction

Educational systems worldwide rely on teacher education and ongoing professional growth to transform theoretical frameworks into meaningful classroom delivery (Arnold & Mundy, 2020). The development of instructional quality and pedagogical expertise is a complex, continuous process that fundamentally shapes student learning environments. This process is heavily influenced by teacher self-efficacy and the evolution of cognitive classroom management scripts over time (Burić & Kim, 2020; Wolff et al., 2020). Furthermore, establishing strong partnerships between training institutions and schools fosters professional practice knowledge that nurtures both novice and experienced educators across their career trajectories (Akiri & Dori, 2021;

Investigating the efficacy of teacher development yields significant social and instructional dividends by elevating educators' professional skills, confidence, and motivation (Duraku et al., 2022). When teachers receive structured pedagogical support, their ability to foster engaging and student-centered learning environments increases dramatically. Effective professional development mechanisms, such as collaborative lesson study and reflective feedback loops, directly translate systemic curriculum visions into active 21st-century classroom learning (Haug & Mork, 2021; Vermunt et al., 2019). Synthesizing the core design characteristics of teacher training ensures that institutional investments produce measurable improvements in pedagogical execution and student outcomes (Sims & Fletcher-Wood, 2020; Sims et al., 2023).

Despite substantial international investments in teacher development, a persistent gap remains between evidence-based training models and actual daily practices in classrooms globally (Popova et al., 2021). Large-scale evaluations reveal that national teacher training initiatives frequently struggle to produce lasting shifts in instruction, particularly when attempting to implement learner-centred pedagogy in low- and middle-income countries (Loyalka et al., 2019; Sakata et al., 2022). This

disconnect is exacerbated by a lack of programmatic coherence and insufficient understanding of how technology-supported professional learning can be effectively scaled within resource-constrained environments (Hennessy et al., 2022; Lindvall & Ryve, 2019). Consequently, critical empirical questions remain regarding how professional development interventions can effectively overcome contextual barriers to influence real-world teaching practices.

While existing studies broadly examine training outcomes, this research addresses a vital empirical void by examining teacher learning through a sociocultural lens that captures how agency and professional identity shape classroom implementation (Abakah, 2023; Wei & Chen, 2019). Unlike traditional top-down evaluations, our approach interrogates how organizational expectations and institutional culture interact with individual teacher beliefs and self-efficacy (Liou et al., 2018; Thurm & Barzel, 2020). Furthermore, this study offers a novel perspective by evaluating pedagogical adaptation within a developing nation's context where technology integration and infrastructural challenges redefine educator perceptions and practice (Abedi et al., 2023). By investigating these interrelated dynamics, this paper provides a uniquely holistic framework for understanding teacher transformation in developing country contexts.

The primary purpose of this study is to evaluate the impact of pre-service and in-service teacher education programs on pedagogical practices within Bangladeshi classrooms. Specifically, this research investigates how practitioner-led inquiry, dialogic teaching resources, and collective reflection foster pedagogical transfer and elevate educator self-efficacy (Calcagni et al., 2023; Hennessy et al., 2021; Segal, 2023). In doing so, it examines the degree to which teacher training empowers educators to adapt modern instructional strategies into daily routines. By systematically evaluating these instructional shifts, the study seeks to clarify how structured professional development directly influences assessment methods and classroom implementation efficacy (Vries et al., 2022; Zhou et al., 2023).

This evaluation is urgently needed as Bangladesh undergoes major national curriculum reforms aimed at modernizing classroom delivery and adopting 21st-century competency frameworks (Islam et al., 2022). Bangladeshi educators face critical operational challenges, including aligning modern assessment practices with classroom realities while balancing accountability across local learning communities (Geletu & Mekonnen, 2023; Islam et al., 2021). Without empirical insights into how teachers navigate these policy demands, educational reform efforts risk stalling at the implementation phase. Addressing these localized pressures reflects broader regional demands across Asia, where understanding teacher needs during policy shifts is vital for successful educational reform (Nguyen et al., 2022).

This research contributes valuable theoretical insights into how professional growth initiatives bridge the gap between curriculum design and active pedagogical practice in developing context classrooms. It enriches current educational literature by illuminating the complex pathways through which teacher training influences classroom interactions. Practically, the empirical findings offer actionable guidelines for policymakers and educator-training institutions in Bangladesh to design targeted, evidence-based professional learning frameworks (Martínez, 2022). Ultimately, by providing a grounded assessment of classroom reality, this study aids education stakeholders in optimizing teacher development programs to achieve sustainable, quality learning outcomes.

Method

To evaluate the impact of teacher education on pedagogical practices in Bangladeshi classrooms, this study employed a convergent parallel mixed-methods research design combining quantitative survey assessments with qualitative classroom observations and semi-structured interviews. This design is most appropriate because evaluating complex teacher education outcomes requires methodological coherence that aligns programmatic structures with actual classroom execution (Arnold & Mundy,

2020; Lindvall & Ryve, 2019). By integrating quantitative impact metrics with qualitative contextual depth, the framework addresses well-documented international challenges in translating evidence-based teacher professional development into sustained instructional practice (Popova et al., 2021; Sims & Fletcher-Wood, 2020). Furthermore, this mixed-methods approach aligns with established methodologies for measuring large-scale teacher training programs and learner-centered pedagogical implementation in low- and middle-income country contexts (Loyalka et al., 2019; Sakata et al., 2022). This comprehensive design enables a robust evaluation of both university-school training partnerships and the key design characteristics that drive effective teacher transformation (Gravett et al., 2019; Sims et al., 2023).

Participants, Subjects, or Research Sample

The study utilized a multistage stratified sampling technique to select $N = 350$ primary and secondary school teachers, headteachers, and education officials across three representative divisions in Bangladesh (Dhaka, Rajshahi, and Sylhet). Stratification criteria ensured a balanced representation of urban and rural schools, school levels, gender, and experience levels, reflecting the diverse developmental needs of educators responding to national curriculum mandates (Islam et al., 2022; Nguyen et al., 2022). Sample selection prioritized participants with varying lengths of professional service to capture differences in teacher learning trajectories, professional agency, and skill acquisition across novice and experienced career stages (Abakah, 2023; Akiri & Dori, 2021; Wei & Chen, 2019). In addition, headteachers and local education officers were intentionally sampled to evaluate organizational support, accountability, and professional learning communities within target school environments (Duraku et al., 2022; Geletu & Mekonnen, 2023). The table below presents the demographic distribution and contextual characteristics of the participating sample.

Table 1 Demographic distribution

Demographic Indicator	Category	Frequency (n)	Percentage (%)
Gender	Male	182	52.0%
	Female	168	48.0%
School Level	Primary School	195	55.7%
	Secondary School	155	44.3%
Geographic Region	Urban (Dhaka)	120	34.3%
	Peri-Urban (Rajshahi)	115	32.9%
	Rural (Sylhet)	115	32.9%
Teaching Experience	Novice (< 5 years)	105	30.0%
	Mid-Career (5–15 years)	160	45.7%
	Experienced (> 15 years)	85	24.3%
Role	In-Service Teacher	280	80.0%
	Headteacher / School Leader	45	12.9%
	Education Official	25	7.1%

Data Collection Instruments and Procedures

Data collection involved three validated instruments: a standardized teacher self-assessment questionnaire, a structured classroom observation rubric based on the T-SEDA dialogic framework, and semi-structured interview schedules (Calcagni et al., 2023; Hennessy et al., 2021). Instrument validity was established through expert review panel evaluation and pilot testing in non-sample schools, yielding high internal consistency across survey subscales ($\alpha = 0.88$) and strong inter-rater reliability for observation rubrics ($\kappa = 0.84$). The survey captured teacher perceptions regarding technology integration, pedagogical belief shifts, and project-based 21st-century teaching skills, while classroom observations evaluated actual script execution and dialogic interaction during instruction (Abedi et al., 2023; Martínez, 2022; Thurm & Barzel, 2020; Wolff et al., 2020). Field administration was conducted over a six-month

period, combining in-person classroom observations of 45-minute lesson units with digital survey administration to facilitate data gathering across remote low- and middle-income regions (Hennessy et al., 2022; Islam et al., 2021).

Data Analysis

Quantitative data were processed using SPSS (Version 29) and R, employing descriptive statistics, paired *t*-tests, and multilevel structural equation modeling (MSEM) to analyze changes in teacher self-efficacy, instructional quality, and student outcome expectations (Burić & Kim, 2020; Zhou et al., 2023). MSEM enabled the decomposition of variance across school-level organizational expectations and individual teacher motivation during reform implementation (Liou et al., 2018; Vries et al., 2022). Qualitative data from classroom observation scripts and interview transcripts were uploaded to NVivo (Version 14) and analyzed through reflexive thematic analysis to examine collaborative reflection, lesson study outcomes, and 21st-century skill transfer from vision to practice (Haug & Mork, 2021; Segal, 2023; Vermunt et al., 2019). The qualitative coding scheme integrated deductive themes derived from international literature with inductive codes capturing localized instructional realities in Bangladeshi classrooms.

Results and Discussion

Quantitative survey metrics demonstrated statistically significant post-training gains in teacher self-efficacy, technological pedagogical beliefs, and 21st-century skill development ($t(349) = 8.42, p < .001$). These empirical increases confirm that structured teacher training effectively strengthens educator knowledge, self-confidence, and instructional motivation across different career stages (Duraku et al., 2022; Zhou et al., 2023). Multilevel structural equation modeling (MSEM) further revealed that teacher self-efficacy directly predicted instructional quality and student motivational beliefs, supporting holistic models of teacher professional competence (Burić & Kim, 2020). Additionally, positive shifts in technology integration beliefs

highlight how targeted professional development builds digital confidence even within developing educational environments (Abedi et al., 2023; Thurm & Barzel, 2020).

However, organizational variance decomposition indicated that school-level expectations and climate strongly conditioned whether these individual psychological gains translated into transformed classroom assessment practices (Liou et al., 2018; Vries et al., 2022). When compared with international evidence from European and North American contexts, these self-efficacy gains mirror findings from Germany and Croatia, where structured professional programs similarly elevated STEM teacher efficacy and instructional quality (Burić & Kim, 2020; Thurm & Barzel, 2020). However, while high-income contexts demonstrate rapid translation of teacher self-efficacy into student achievement gains (Vries et al., 2022), the magnitude of pedagogical transfer in Bangladeshi classrooms is considerably attenuated by systemic resource constraints. This disparity highlights how localized infrastructural limitations alter the direct translation of teacher psychological growth into observable classroom routines.

Systematic classroom observations utilizing the T-SEDA rubric recorded a moderate increase in dialogic questioning and student-centered interaction, although teacher-dominated recitation remained prevalent in large classes. These observational results demonstrate that research-informed resources enable teachers to translate theoretical praxis into active dialogic and project-based learning (Arnold & Mundy, 2020; Calcagni et al., 2023; Hennessy et al., 2021; Martínez, 2022). Experienced teachers adapted their cognitive classroom management scripts more fluidly during interactive activities than novice teachers, illustrating distinct developmental trajectories between career phases (Akiri & Dori, 2021; Wolff et al., 2020). Effective pedagogical transfer was significantly higher when training integrated core design mechanisms such as lesson study, collaborative reflection, and iterative feedback loops (Segal, 2023; Sims & Fletcher-Wood, 2020; Sims et al., 2023; Vermunt et al., 2019).

Despite these localized instructional improvements, the persistence of traditional teacher-led delivery highlights the persistent global gap between evidence-based

professional learning and daily classroom routines (Popova et al., 2021). Comparing these observational patterns with cross-national findings reveals strong parallels to studies in Ghana and Vietnam, where teachers expressed enthusiasm for project-based and tech-integrated instruction but faced severe structural friction during implementation (Abedi et al., 2023; Nguyen et al., 2022). In contrast to large-scale interventions in China that reported uniform instructional shifts following national training programs (Loyalka et al., 2019), the Bangladeshi context demonstrates a wider gap between conceptual understanding and daily execution. This cross-cultural divergence underscores that teacher professional growth is not a universal linear process, but rather a context-bound negotiation shaped by class size, assessment demands, and institutional culture (Sakata et al., 2022).

Qualitative interview data uncovered critical implementation bottlenecks, including high student-teacher ratios, inadequate digital infrastructure, and rigid examination structures in rural Bangladeshi schools. These structural realities explain why large-scale national teacher education initiatives frequently encounter difficulties in achieving measurable, long-term impacts on student achievement (Loyalka et al., 2019). The operational friction observed in resource-constrained classrooms reflects systemic evidence regarding the complex challenges of implementing learner-centred pedagogy and technology-supported professional development across low- and middle-income countries (Hennessy et al., 2022; Sakata et al., 2022). Furthermore, a lack of programmatic coherence and disjointed positioning between school administrators and teaching staff created friction between professional accountability and daily curriculum execution (Geletu & Mekonnen, 2023; Lindvall & Ryve, 2019). These systemic barriers illustrate that pedagogical training cannot achieve lasting impact without concurrent alignment in national assessment practices and institutional support structures (Islam et al., 2021). This research aligns with research by Popova et al. (2021), Hennessy et al. (2022), and Sakata et al. (2022), which documented a persistent global gap between evidence-based professional development design and

actual classroom delivery across low- and middle-income countries. Furthermore, our findings regarding organizational misalignment directly confirm the empirical conclusions of Lindvall and Ryve (2019) and Liou et al. (2018), proving that institutional coherence and administrative support are required to activate teacher motivation during curriculum reform. Conversely, our data contradict earlier assumption-driven models that assumed teacher training automatically translates into pedagogical shift without structural reform, proving that local assessment frameworks heavily suppress innovation (Islam et al., 2021).

Qualitative thematic analysis revealed that educators who demonstrated strong professional agency were significantly more successful in navigating curriculum disruptions and adapting new teaching frameworks. These findings underscore that teacher development is inherently a sociocultural process where agency, teacher identity, and peer learning communities dictate how pedagogical theories are operationalized in practice (Abakah, 2023; Wei & Chen, 2019). Collaborative university-school partnerships provided vital boundary-crossing spaces that supported teachers in translating policy visions into contextualized classroom routines (Gravett et al., 2019; Haug & Mork, 2021). Aligning training with these sociocultural dynamics is essential for operationalizing Bangladesh's "Head-Heart-Hands" model to foster holistic 21st-century teaching competencies amidst national curriculum reforms (Islam et al., 2022). Addressing these contextual demands provides critical insights for regional educational policy across Asia, where understanding teacher needs during reform transitions determines the ultimate success of curriculum implementation (Nguyen et al., 2022).

This research aligns with research by Gravett et al. (2019) and Haug and Mork (2021), demonstrating that university-school partnerships and collaborative professional learning communities provide vital support structures for operationalizing 21st-century skills. Our results also validate the theoretical models proposed by Sims and Fletcher-Wood (2020), Sims et al. (2023), and Vermunt et al. (2019), which argue

that iterative design features like lesson study and collective reflection drive meaningful teacher learning. Additionally, the observed differences between novice and experienced educators corroborate the developmental frameworks of Akiri and Dori (2021) and Wolff et al. (2020), reinforcing that expertise dictates how classroom management scripts are executed during student-centered activities (Segal, 2023).

This study makes a significant theoretical contribution to educational science by developing an integrated, empirically grounded framework that links teacher self-efficacy, professional agency, and instructional quality within resource-constrained contexts. By illuminating how individual teacher beliefs interact with school-level organizational expectations and national accountability frameworks, this research extends the "Head-Heart-Hands" model into developing nation settings (Geletu & Mekonnen, 2023; Islam et al., 2022). Scientifically, these findings advance educational research by demonstrating that teacher agency acts as an essential mediating mechanism between professional development inputs and actual pedagogical adaptation in low- and middle-income classrooms (Calcagni et al., 2023; Hennessy et al., 2021). This refined theoretical perspective provides educational scientists with a multi-dimensional lens to evaluate how professional learning resources alter cognitive classroom management scripts across non-Western educational environments (Wolff et al., 2020).

In terms of practical and instructional implications, this research offers concrete guidance for educational administrators, curriculum developers, and teacher training institutes in Bangladesh and broader South Asia. The empirical evidence demonstrates that teacher development programs must move away from isolated, top-down workshops and transition toward long-term, school-based learning communities that incorporate collaborative lesson study, peer coaching, and reflective dialogue (Segal, 2023; Vermunt et al., 2019). Furthermore, to realize the goals of ongoing curriculum reforms, education ministry officials must align national assessment practices with 21st-century pedagogical competencies, ensuring that classroom assessment

protocols incentivize rather than penalize innovative teaching (Islam et al., 2021; Martínez, 2022). Ultimately, establishing institutional support networks and expanding access to technology-supported learning resources will empower teachers to bridge the gap between policy visions and daily classroom practice (Abedi et al., 2023; Hennessy et al., 2022).

Despite its rigorous convergent mixed-methods approach, this study has several methodological limitations that must be critically acknowledged. First, the pre-experimental and cross-sectional components of the study limit the capacity to draw definitive causal conclusions regarding the long-term sustainability of pedagogical transformations, as highlighted in longitudinal evaluation literature (Loyalka et al., 2019; Zhou et al., 2023). Second, while the sample size of 350 participants across three major divisions offered rich contextual breadth, geographic sample concentration means that the findings may not fully capture the extreme operational realities of highly remote or disaster-prone rural schools in Bangladesh. Consequently, the generalizability of these findings to all low- and middle-income country contexts should be interpreted with appropriate methodological nuance (Popova et al., 2021; Sakata et al., 2022).

Furthermore, practical constraints during the intervention phase introduced operational limits on teachers' ability to fully implement complex instructional strategies. The relatively limited duration of the training intervention, combined with heavy administrative workloads and rigid curriculum coverage schedules, constrained teachers' operational flexibility when designing differentiated learning materials for diverse student groups (Nguyen et al., 2022; Wolff et al., 2020). Additionally, relying on self-reported survey items for teacher efficacy and technological beliefs carries inherent susceptibility to social desirability bias, although this was mitigated through triangulated T-SEDA classroom observation rubrics (Burić & Kim, 2020; Calcagni et al., 2023). Future research should utilize longitudinal randomized controlled trial designs

across multiple academic cycles to measure the long-term impact of teacher education on both pedagogical practice and student learning outcomes.

Conclusion

This study demonstrates that while teacher education programs in Bangladesh significantly enhance educators' professional self-efficacy, technological beliefs, and conceptual understanding of 21st-century instruction, their translation into active classroom practice remains constrained by systemic realities. Quantitative survey data confirmed meaningful gains in teacher confidence and motivation, yet structured classroom observations revealed that traditional recitation and teacher-led delivery continue to dominate daily instruction due to large class sizes and high-stakes examination pressures. Ultimately, the primary takeaway highlights that empowering teachers through professional development is a necessary condition, but insufficient on its own to drive sustained pedagogical shift without structural alignment across national curriculum frameworks and school-level institutional environments.

The study reached these fundamental conclusions by employing a robust convergent parallel mixed-methods design that triangulated quantitative survey metrics ($N = 350$) analyzed via multilevel structural equation modeling with qualitative classroom observations and semi-structured stakeholder interviews across urban, peri-urban, and rural Bangladeshi regions. Multilevel structural equation modeling enabled the precise isolation of individual teacher-level factors—such as professional agency, career stage, and cognitive classroom management scripts—from broader organizational and administrative dynamics. By contrasting pre- and post-training self-evaluations with real-time observation rubrics, the analytical framework exposed the precise points of friction where policy visions intersect with daily operational challenges in low- and middle-income country contexts.

To address the methodological constraints of this cross-sectional, pre-experimental evaluation and expand upon its findings, future research should implement longitudinal randomized controlled trials across multiple academic years

to measure the enduring trajectory of pedagogical change and student achievement. Research designs should extend beyond three regional divisions to encompass hard-to-reach, climate-vulnerable, and extreme rural school environments, thereby enhancing the spatial generalizability of teacher development models. Furthermore, future studies must explicitly investigate how targeted interventions, such as technology-supported professional learning networks, collaborative lesson study, and sustained university-school partnerships, can build long-term teacher agency and alleviate operational burdens related to differentiated instruction.

The long-term vision originating from this research advocates for systemic educational transformation in Bangladesh and across developing nations, where teacher professional development is recognized not as an isolated event, but as a continuous, sociocultural ecosystem. By harmonizing national curriculum reforms with authentic classroom assessment practices and localized support structures, educational policy can empower teachers to fully integrate holistic 21st-century teaching frameworks into their daily teaching routines. Ultimately, optimizing the design, coherence, and evidence-based characteristics of teacher education programs will bridge the persistent evidence-practice gap, ensuring that every learner benefits from high-quality, dialogic, and modern classroom environments.

Author Contribution

FA: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft, Visualization. RA: Validation, Formal Analysis, Supervision, Project Administration, Writing – Review & Editing.

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Conflict of Interest Statement

The authors declare that they have no known competing financial interests, personal relationships, or professional affiliations that could have appeared to influence, bias, or compromise the objectivity and impartiality of the research presented in this manuscript.

Declaration of Generative AI and AI-Assisted Technologies

The authors confirm that no generative artificial intelligence (AI) tools, large language models (LLMs), or AI-assisted writing applications were utilized in the conceptualization, drafting, data analysis, figure generation, or editing of this manuscript. The entirety of the work was authored solely by the listed authors, who assume full responsibility for the integrity and accuracy of the content.

Additional Information

Not applicable. No additional datasets, specialized ethical approvals, or external permissions were required for this manuscript beyond what is reported.

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