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Teacher Competency and Professional Development in the Era of Educational Innovation: A Critical Study

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ABSTRACT

Among the various concerns as Indian school education moves to imbibe the changes of the National Education Policy 2020, fast-paced digitalization and competency-based pedagogy, teacher competency and continuous professional development (CPD) are prominent. This paper is a critical analysis of the present scenario of teacher competency and professional-development provision in Uttar Pradesh in terms of the present innovation. The investigation takes the form of the critical secondary-data design involving synthesising authoritative national data and peer-reviewed evidence and then analysing them in a documentary and descriptive-statistical manner. Firstly, that competency and qualification levels still have a way to catch up with policy goals and secondly that there is a positive relationship between sustained participation in CPD and competency and learning outcomes. Results show that there remain significant gaps in professional qualifications, that there is an overall sizeable and uneven utilisation of CPD, and that research evidence is consistent with the content-focused, sustained, collaborative development of teaching and learning having a positive impact. There is evidence of measurable recent progress in the foundations of learning indicators. The conversation puts these findings into perspective with the goals of that study and reveals the challenges of deployment and quality-assurance that exist under the "coverage" numbers. The study's authors conclude that there is a need to now combine scale with depth, contextual relevance, and outcome tracking for innovation-era competency.

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1. INTRODUCTION:

The teacher is a critical factor within any education system and the current era has definitely changed the definition of "competent teacher". The National Education Policy 2020 recognises the teacher as the pivot of the reforms, which includes the use of competency-based pedagogy, the emphasis on foundational literacy and numeracy and 50 hours of CPD in a year (Government of India, 2020). This policy shift was happening at a time when a multitude of innovative educational models are accelerating the move to digital classrooms, blended learning, artificial-intelligence tutoring, and formative assessment, which require skills beyond content mastery. Competency in this age is multi-faceted, encompassing not only content knowledge and pedagogical skill, but also technological fluency, as embodied in the influential Technological Pedagogical Content Knowledge framework (Mishra & Koehler, 2006). According to validated measurement tools (Schmidt et al., 2009), the enduring value of the framework is its recognition that effective technology use is not an add-on but an interaction between content, pedagogy, and tools, which takes place in a particular context.

However, having a framework does not mean to create a qualified workforce nationwide. Professional development is the most critical way that education systems try to move policy aspirations into practice. Decades of rigorous research have established that not all development is created equal; only sustained, content-focused, collaborative, and coherent programmes have a consistently proven impact on learning and instruction (Darling-Hammond, et al. 2017). The conceptual framework for the study of these effects, which ties programme features to teacher knowledge to instruction to learning, was made clear by Desimone (2009) and forms the basis for most compelling impact studies. What India, and what a large populous resource-constrained state like Uttar Pradesh, has to check is how much these quality attributes represent its gargantuan machine for training or how much it is maximizing the reach.

The definition of what teachers need to know has also been changed with the advent of educational innovation. International documents like the UNESCO ICT competency framework for teachers (UNESCO, 2018) or the European DigCompEdu framework (Redecker, 2017) outline increasingly complex digital-pedagogical competency, and OECD (2023) describe how systems are formally integrating these into teacher standards. In the Indian context, large-scale digital initiatives have aspired to scale up such standards, but evidence of whether or not participation leads to greater competency has been mixed and context-dependent (Charania, Cross, et al. 2024). It is this tension: between breadth of provision and depth of competency it produces that this paper interrogates.

Uttar Pradesh provides a major location for such an investigation. It is the most populous state in the country and has one of the biggest sub-national school systems in the world and by extension, achievement and deficit are heightened. However, there are issues of underlying quality and deployment that can be masked by headline indicators of teacher supply and there is often a semantic confusion between 'trained' and 'professionally qualified'. So, a critical study is needed which would go beyond the celebratory statistics of competency, qualification and the provision of development and consider whether they are really up to the challenge of the innovation era in Uttar Pradesh. This paper, therefore, attempts to present a critical synthesis of state-of-the-art data and research evidence to understand the current state of teacher competency and CPD, to analyse how participation in development is related to teacher competency outcomes, to examine the implications of these findings in the light of the trends observed in the nation and to explore current research and literature on this field.

2. Literature Review

Teacher competency and professional development scholarship has evolved from advocacy to an evidence base on what works. The seminal empirical study was by Garet, Porter, Desimone, Birman, and Yoon (2001), who, drawing on a national probability sample of 1,027 teachers and ordinary-least-squares regression, identified three key characteristics

that were associated with enhanced teachers' knowledge, skills, and practice: focus on content, opportunities for active learning, and coherence with other learning activities. They also demonstrated that structural attributes involve characteristics such as duration, collective engagement, and the form of the activities, work largely through these fundamental characteristics. That this was the case was reinforced by the three-year longitudinal study conducted by Desimone, Porter, Garet, Yoon and Birman (2002) which found that teacher development around specific instructional practices positively and measurably impacted teacher use of those practices, and even more so when opportunities for active learning were included.

Desimone (2009) summarised the empirical evidence into a widely accepted conceptual model that posited a causal pathway from programme aspects to teacher knowledge, to instruction, to student learning and included common measurement strategies to support cumulative building of scientific knowledge. The practical application of the framework came from Darling-Hammond, Hyler, and Gardner (2017) who conducted a review of thirty-five methodologically rigorous studies and found that seven characteristics of effective development were focus on content, active learning, interaction and collaboration, sustained time, ongoing feedback, co-conceptualisation, and problem solving. There is a growing consensus in this body of work that brief generic, decontextualized development is unlikely to be successful and long-term, content-rich, collaborative development is likely to be successful.

The technological competence has been overlaid on this foundation during the innovation era. The reconceptualization of teacher knowledge as the dynamic interplay of technology, pedagogy, and content in Mishra and Koehler's (2006) TPACK framework, and the provision of a validated self-report instrument by Schmidt et al. (2009) made TPACK empirically tractable across subjects and stages. Follow-up intervention studies have investigated whether development is possible Çam and Koç (2024) designed and tested a teacher preparation intervention program to measurably improve teacher educators' TPACK and a review of ICT-competency definitions by Xuanyun, Noh@Seth, and Pairan (2024) identified ongoing definitional disagreements about the nature of teacher digital competency and how to develop it. Since then, internationally standardised points of reference have influenced the definition of systems of digital-pedagogical competencies, as have the ways in which these competencies are increasingly being formally integrated in teacher policy on a national level (OECD, 2023).

There is growing and relevant evidence to be used for the Indian and South Asian context. Charania et al. (2024) analysed pre-and post-course surveys from 209 and 109 teachers respectively, who took a TPACK-based online development course, and found that female teachers actually out-performed male teachers in completion rates, and that the values, previous experience, and social position of the teachers were strong predictors of participation outcomes. This highlights the need to understand competency development as a socially located problem rather than just a problem of delivery of technical aspects of competency. Stutchbury, Ebubedike, Amos, and Chamberlain (2023) explored the broader role of scalable, digital delivery in teacher education and discussed the potential for MOOCs in teacher education, challenges to completion, and issues with contextualisation.

There are two additional strands that are pertinent. First, interest in the measurement of professional-development needs and competencies is ongoing Kırkıç, Töre, Çetin, and Uysal (2025) created and validated a Teacher's Professional Development Competencies Scale, indicating that scholarly work in operationalising the construct continues. Secondly, literature related to policy implementation in Indian education analysing the works of the National Council of Educational Research and Training (2023) consistently highlights an inherent contradiction between covering vast ground and covering the ground in-depth, and between the completion of certificates and the evidence of competence. The literature together suggests three propositions that justify the framing of this study: that a competency is

multidimensional and technologically inflected; that only some development features lead to genuine improvement; and that Indian provision has achieved remarkable in-depth and breadth of reach despite contestation in terms of depth and context. These propositions think about the following objectives and hypotheses.

3. Objectives

1. To critically examine the present status of teacher competency, professional qualification, and continuous professional-development provision in Uttar Pradesh within the context of contemporary educational innovation and NEP 2020.
2. To analyse the relationship between participation in professional-development initiatives and the development of teacher competencies and learning outcomes, as evidenced by current authoritative data and research.

4. Hypotheses

H_1: Teacher professional-qualification and competency indicators in Uttar Pradesh lag behind the benchmarks and targets set under contemporary education-innovation policy.

H_2: Sustained, structured professional-development participation is positively associated with improvement in teacher competencies and student learning outcomes.

5. Methodology

The research design used in the present study is critical and analytical in nature, considered suitable for the present research goal of evaluating the status of teacher competency and teacher professional development in Uttar Pradesh as per the benchmark of innovation era, as it is a secondary data synthesis study. Being a critical study and not a primary survey, the sample is a documentary collection that has been purposively assembled in three categories of sources: (a) official statistical data, mainly the Unified District Information System for Education Plus (UDISE+) and official press and policy statements issued by the government; (b) national programme records for continuous professional development; and (c) peer reviewed empirical and conceptual research papers on teacher competency, TPACK and CPD effectiveness. Comparatively Uttar Pradesh is the focal context with reference to national aggregates.

The method of data analysis was a standardised documentary-analysis protocol, using a standardised data extraction schedule: source, period of reference, definition of indicator, and reported value to ensure consistency among datasets and to differentiate between indicators such as trained and professionally qualified teachers. This method was a descriptive-statistical synthesis of quantitative indicators, as well as a thematic synthesis of study findings in relation to the two objectives of the study. Data was tabulated, triangulated if possible and related to policy targets in the form of indicators. Reliability was enhanced by prioritizing data from primary official statistics, and using only the most recent years for which data was available (2024–2025), and by citing the source of each table. The obvious weakness, openly admitted, is that conclusions are based on secondary and convergent evidence and not on an original sample of state-level evidence and the original estimate of cause.

6. Results

Table 1: School Education Profile: Uttar Pradesh and India

Indicator	Uttar Pradesh	India (national)
Total schools	2,62,358	14.71 lakh
Total enrolment	4,27,89,347	24.69 crore
Total teachers	~15.07 lakh	1,01,22,420
Pupil–Teacher Ratio (higher secondary)	35	23–24

Higher-secondary schools (share)	9.3%	—

Source: Ministry of Education, UDISE+ 2023-24 and 2024-25 (Government of India).

The state of Uttar Pradesh has the largest absolute numbers of pupils in higher secondary education in the country, but the higher pupil–teacher ratio of 35 is more than the NEP ceiling of 30, compared to the national average of around 24. Scale is accompanied by structural strain: just 9.3% of schools in UP are higher-secondary, indicating a declining offering at the senior level with greater competency demand and PTRs as shown in Table 1. Table 1 shows a descriptive contrast, which reveals that the problem in UP is not teacher numbers but the distribution and deployment of teachers at the various stages, the first quantitative support to look at H1.

Table 2: Professionally Qualified Teachers by Level (National, 2024-25)

Level	Professionally qualified (%)
Pre-primary	48.2
Primary (1–5)	87.7
Upper primary (6–8)	88.5
Approx. "trained" (all levels)	~92

Source: Ministry of Education, UDISE+ 2024-25, Table 4.19 (Government of India).

The professional qualification required at a particular level of teaching is not obtained by about 10-12 lakh teachers who are listed as "trained", this is the size of a large state's teachers. The difference is not just rhetorical, but statistical, as pre-primary professional qualification is at only 48,2%, compared with almost 88% in the primary and upper-primary levels. The high gradient in Table 2 indicates that the foundational stage, where NEP focuses its reform, has the lowest competency level, thus supporting H1 that competency credentials fall short of the needs of the innovation era.

Table 3: Teacher Workforce Composition and Deployment (2024-25)

Indicator	Value
Female teachers (share)	54.2%
Average teachers per school	7
Single-teacher schools (national)	1,04,125
Teachers in zero-enrolment schools	20,817
Highest absolute vacancy (state: UP)	1,93,862

Source: Ministry of Education, UDISE+ 2024-25; IndiaSpend/IDR analysis (Government of India).

More than one lakh single teacher schools are still there across the country, while Uttar Pradesh reports the highest absolute number of teacher vacancies in the country at 1,93,862 and more than two decades of teachers are still deployment in zero enrolment schools. As shown in Table 3, it is deployment and equity, not staff level, that is the binding constraint. The average number of staff increased to seven staff per school. The deployment distortions in Table 3 suggest that competency, even if it exists, is not uniformly distributed across UP's schools, an interpretation that is directly relevant to objective one and to H1.

Table 4: Continuous Professional Development Reach (NISHTHA / DIKSHA)

Programme metric	Value
Face-to-face teachers/heads trained (33 States/UTs)	17,74,728
State Resource Groups trained (face-to-face)	23,137
Elementary teachers completing online (by June 2021)	~24 lakh
Teachers trained under NISHTHA-FLN	12.97 lakh

Annual CPD norm per teacher (NEP 2020)	50 hours

Source: NCERT (2023); Press Information Bureau, 2021 and 2025 (Government of India).

In face-to-face NISHTHA training, 23,137 resource-group members and more than 17.7 lakh teachers and head teachers in 33 States and UTs were covered and by mid-2021, approximately 24 lakh elementary teachers had completed the online course and 12.97 lakh teachers were trained under the foundational-literacy programme. Table 4 quantifies huge delivery achievement with regard to the NEP fifty-hour norm. The measures in Table 4, however, are participation and completion, not competency gain, as described in the discussion and important for H2.

Table 5: Foundational Learning Outcomes (ASER 2024 / PARAKH 2024)

Indicator (Class III)	2018	2022	2024
Can read Grade II-level text (%)	20.9	16.3	23.4
Can do basic subtraction (%)	20.9	20.2	27.6
PARAKH 2024 coverage	—	—	21.15 lakh students; 2.7 lakh teachers

Source: ASER Centre, ASER 2024; Press Information Bureau, 2025 (PARAKH Rashtriya Sarvekshan 2024).

Children in Class III have shown their highest-ever achievement in foundational reading in government schools, with 23.4% reading Grade II text in 2024 as compared to 16.3% in 2022, and basic arithmetics has improved from 20.2% to 27.6%. Table 5 reveals quantifiable recovery from the pandemic in the very skills the CPD push served as a vehicle for learning. The rise in Table 5, which corresponds to greater efforts in foundational training, provides some indicative, although not causal, evidence for H2, which is reflected in the discussion.

Table 6: Empirical Evidence on Competency–Development Relationships

Study	Sample / method	Reported finding
Garet et al. (2001)	n = 1,027; OLS regression	Content focus, active learning, coherence: significant positive effects
Desimone et al. (2002)	3-year longitudinal	PD on specific practices increases classroom use of those practices
Charania et al. (2024)	209 pre / 109 post; 23 districts	Female teachers significantly higher completion; outcomes socially mediated
Çam & Koç (2024)	PD-program evaluation	Measurable development of educators' TPACK

Source: Compiled from cited peer-reviewed studies (author-reported results).

However, evidence from these studies is converging and confirms a link between regression-based and longitudinal evidence: development of content and learning through active and coherent practice leads to significant knowledge gains and practice changes, while targeted programmes can be measured in terms of increasing technological-pedagogical competency. Table 6 summarizes the author-reported effects, but does not re-estimate them. A common direction of the effects across independent samples in Table 6 expands the evidence for H2 and tends to point to a suppressive effect for teacher characteristics and context, as highlighted by Charania et al. (2024).

Table 7: Hypothesis-Testing Summary (Evidence-Based Evaluation)

Hypothesis	Evidentiary basis	Direction	Verdict
H1: UP competency/qualification lags benchmarks	Tables 1–3 (UDISE+ 2024-25)	Confirmed gaps in qualification, PTR, deployment	**Supported**

H2: Sustained PD positively associated with competency/outcomes	Tables 4–6; Garet et al. (2001); Desimone et al. (2002); Charania et al. (2024)	Positive, but conditional on quality features	**Partially supported**

Source: Synthesised from Tables 1–6 and cited studies (evidence-based evaluation, not primary inferential testing).

When referring to the assembled evidence, the qualification, ratio and deployment shortfalls are consistent with H1, but only partially with H2, as the positive association is only with development as research-validated core features and not just with participation. In keeping with the study design of secondary data, there is no attempt to fabricate significance values in Table 7, but rather a verdict based on the evidence. In Table 7, the differentiated verdicts match up with the two objectives and organize the subsequent discussion.

7. Discussion

When one reads the findings in the light of the study objectives, the story is coherent and somewhat sobering with regards to the competency of teachers in the age of educational innovation. The first objective wanted to identify the current situation of competency and provision in Uttar Pradesh and the evidence in the tables 1 to 3 confirms the hypothesis one. The state's deficits are not the result of a lack of teachers; there has been an increase in average staffing levels and the number of pupils enrolled is the highest in the country. Instead, they are qualitative and distributional constraints. A higher secondary pupil–teacher ratio of 35 (compared with a policy ceiling of 30), the largest absolute number of vacancies in the country and a continuing pattern of single-teacher schools and of zero enrolment schools all characterize a system of competency that is not being used in the same way and a system where the senior secondary stages that are most sensitive to innovations are the least well served. To put this in perspective, the national qualification gradient in Table 2 shows that the foundational stage that NEP 2020 (Government of India, 2020) focuses on has the lowest level of credentialization. It is important to note, however, that the term “trained” is also equated with “professionally qualified” and thereby masks a significant competency gap, thus justifying the critical stance taken by this study.

The second objective related to the relationship between development participation and competency, and the findings here are not as clear-cut hypothesis two is accepted to a degree, but not necessarily. On the other hand, the delivery achievement detailed in Table 4 is remarkable in any international standard, and the National Council of Educational Research and Training (2023) programmes of intensive training have coincided encouragingly with the improvements in the fundamental learning detailed in Table 5. The research evidence, however, is clear that participation is not enough. Research by Garet et al. (2001) and Desimone et al. (2002) (summarised by Desimone (2009) and Darling-Hammond, Hyler, and Gardner (2017)) reveals that sustained, content-focused, collaborative, and coherent development are the only sure ways of changing practice and outcomes. However, coverage metrics only measure completions, and do not indicate competency growth, which in turn does not prove impact. This is the true essence of the critical reading: India has solved the reach problem more convincingly than depth problem.

Innovation adds to this with demands for competency, talking about a complex and integrated digital-pedagogical competency as defined by the TPACK framework (Mishra & Koehler, 2006) and its measurement tool (Schmidt et al., 2009) as well as the international standards UNESCO (2018), Redecker (2017) and OECD (2023), which cannot be easily achieved by brief generic modules. The Indian evidence presented by Charania et al. (2024) is particularly revealing; it shows that completion is influenced by teachers' values, prior experiences and positioning, and that aspects of the delivery language and learner characteristics also impact outcomes. Scalable digital delivery, as Stutchbury, Ebubedike, Amos, and Chamberlain (2023) warn, is not enough to ensure contextualisation and competency can be

raised and measured if a programme is deliberately designed and assessed, as is seen in the case of Çam and Koç (2024) and instrument-development studies of Kırkıç, Töre, Çetin, and Uysal (2025). The message for Uttar Pradesh is straightforward: the next round of reforms must go from quantity to quality, building in the core features that have been proven through research, adapting development based on teacher traits, acknowledging deployment disparities, and most importantly, monitoring competency outcomes, not certificate downloads. Only then will the headline scale of provision be reflected in the competency in the classroom that the innovation era demands, which you can see is the difference in the Tables 1-7 put together.

8. Conclusion

Teacher competency and professional development is at the center of success or failure of educational innovation. This critical study reveals that Uttar Pradesh, as in the rest of the country, has established an impressive apparatus for teacher supply and a huge apparatus for development but is still beset with problems of teacher professional qualifications, deployment at various stages and extent and depth of competencies required for contemporary pedagogy. The evidence suggests the proposition that competency indicators are behind innovation-era benchmarks, and partially supports the proposition that development participation enhances competency given programmes that are sustained, content-focused, collaborative and coherent in design. There are clear signs of progress for students in recent learning gains in the areas of foundations learning, but from aggregate data alone, it is not possible to say how much of this improvement is due to training. The main recommendation is to transform scale to depth: development should be based on evidence of effectiveness attributes, deployment disparities need to be tackled, digital-competency development needs to be contextualized and outcome measurement should be institutionalized. Future research should build on this important synthesis by conducting high-quality state-level primary research to directly measure competency change and provide policy guidance by evidence of impact, not evidence of reach.

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