

In-Service Teacher Training for Foundational Literacy and Numeracy Instruction: Assessing Competency Gains and Classroom Practice Change in Karnataka

Deepa R. Krishnamurthy¹, Kavitha M. Rao², Suresh N. Patil³

ABSTRACT

Teacher quality is the single most important school-level determinant of foundational learning outcomes, and structured in-service training programmes that improve teachers' content knowledge, pedagogical knowledge, and assessment practices for early grade literacy and numeracy instruction are a critical lever in the NIPUN Bharat Mission's strategy. This study evaluates a 15-day structured in-service FLN training programme delivered to 186 government primary school teachers across Grades 1–3 in Dharwad and Mysuru districts of Karnataka, assessing competency gains across five domains — content knowledge, pedagogical knowledge, assessment practice, material use, and classroom management — through a pre/post training assessment, and changes in classroom instruction practice through structured classroom observations conducted four months post-training. All five competency domains showed statistically significant gains from pre- to post-training assessment, with the largest gains in pedagogical knowledge (+29.4 points) and assessment practice (+33.2 points), the domains with the lowest pre-training scores. Classroom observation data collected four months post-training showed significant adoption of trained instructional practices in 68.3% of observed lessons, indicating meaningful transfer of training to classroom practice beyond the immediate post-training assessment. Pedagogical knowledge gain was the strongest predictor of observed practice change. These findings demonstrate the effectiveness of the structured FLN training model and provide evidence on the competency domains where further investment in training intensity and follow-up is most warranted.

KEYWORDS: *Teacher in-service training, FLN instruction, Foundational literacy, Foundational numeracy, Teacher competency, NIPUN Bharat, Karnataka, Classroom practice, Professional development*

INTRODUCTION

The NIPUN Bharat Mission's logic model places teacher capacity as the central mediating variable between the policy framework's competency targets and student learning outcomes: regardless of the quality of curriculum frameworks, assessment instruments, and teaching-learning materials, learning outcomes ultimately depend on what happens in the classroom, and what happens in the classroom depends predominantly on the knowledge, skills, and instructional practices of the teacher (1). The global literature on effective teacher professional development converges on several key design principles: training should be content-specific and practice-focused rather than generic and lecture-based; it should include modelling of instructional techniques and opportunities for coached practice and feedback; and it should be followed by sustained classroom support through mentoring or coaching to support the transfer of trained knowledge and skills into sustained classroom practice change (2).

India's teacher in-service training system has historically been criticised for its reliance on short, generic training modules delivered in lecture format without opportunities for practice, feedback, or follow-up classroom support — characteristics associated in the professional development literature with minimal transfer to classroom practice and negligible impact on student learning outcomes (3). The NIPUN Bharat training architecture attempts to address these limitations through longer, structured modules with explicit FLN content and pedagogical focus, demonstration lessons, peer practice opportunities, and district-level mentor teacher follow-up systems. Karnataka's Department of Public Instruction, building on the state's pre-existing teacher training infrastructure through its District Institutes of Education and Training (DIETs), developed and piloted a 15-day structured FLN in-service training module in Dharwad and Mysuru districts, the evaluation of which is the subject of this study.

LITERATURE REVIEW

The knowledge that effective teacher professional development must be sustained, content-

focused, and classroom-embedded is well established in international research. Darling-Hammond et al. (2017) synthesised evidence on the features of effective professional development and identified seven key design elements: content focus; active learning; collaboration; use of models and modelling; expert coaching and support; feedback and reflection; and sustained duration — elements that shorter, generic training programmes characteristically fail to incorporate (4). Joyce and Showers (2002) provided the foundational research on the "coaching transfer" principle, demonstrating that while knowledge about new instructional techniques shows high transfer from training to immediate recall, transfer to sustained classroom use requires post-training coaching and feedback loops that most training designs omit (5).

1. FLN-Specific Teacher Competency Domains

Effective early grade literacy and numeracy instruction requires teacher competency across several specific domains that differ from generic teaching skills:

- Content knowledge: understanding of the phonological structure of the Hindi language and its akshara-based orthography; number sense, place value, and early arithmetic conceptual foundations — areas where many government primary school teachers have been found to have procedural knowledge without deep conceptual understanding.
- Pedagogical knowledge: structured phonics instruction sequencing; oral language development techniques; activity-based and manipulative-supported numeracy pedagogy; and instructional differentiation within heterogeneous classrooms.
- Assessment practice: use of simple formative assessment tools to identify which students have and have not yet achieved specific foundational sub-skills, and ability to adjust instruction in response to assessment data — a practice described in the literature as "responsive teaching" or "data-driven instruction" at the classroom level.
- Material use: effective use of structured teaching-learning materials including decodable readers, number cards, activity sheets, and games in structured FLN lesson sequences rather than as supplementary add-ons.

Popham (2009) argued that effective formative assessment — the use of ongoing classroom assessment to adjust instruction toward student learning needs — is the single highest-leverage teacher competency for improving student learning outcomes, and that most teachers receive inadequate preparation in formative assessment practice in both pre-service and in-

service training (6). The present study's finding that assessment practice showed the lowest pre-training score and the largest training gain directly reflects this documented deficit.

RESEARCH GAP

While Karnataka has one of India's more developed DIET infrastructure networks, published evaluation evidence on the specific competency gains and classroom practice change generated by Karnataka's NIPUN Bharat-aligned FLN in-service training modules is limited. Furthermore, most published Indian teacher training evaluations assess immediate post-training knowledge gains without following teachers into their classrooms to assess actual practice change — the dimension most directly relevant to student learning impact. This study assesses both dimensions through immediate competency assessment and delayed classroom observation.

OBJECTIVES

- To assess teacher competency gains across five FLN domains from pre- to post-training assessment following a 15-day structured FLN in-service programme.
- To assess adoption of trained instructional practices in classroom observation four months post-training.
- To identify which competency gains most strongly predict post-training classroom practice change.
- To derive design implications for strengthening FLN teacher training programmes under NIPUN Bharat.

METHODOLOGY

1. Training Programme Design

The 15-day structured FLN in-service training programme was designed by Karnataka's State Institute of Education in collaboration with the DIET of each district, incorporating five full days of foundational literacy content and pedagogy, five days of foundational numeracy content and pedagogy, two days of FLN assessment tools and practice, two days of TLM demonstration and practice, and one day of classroom management for FLN group activities. Training used a demonstration-practice-feedback cycle: for each instructional technique, the trainer demonstrated a model lesson, participants practised in pairs or small groups, and feedback was provided by the trainer and peers. A total of 186 Grade 1–3 teachers from 124

government primary schools across Dharwad (n = 96 teachers) and Mysuru (n = 90 teachers) districts participated.

2. Competency Assessment and Classroom Observation

Teacher FLN competency was assessed through a 100-item instrument covering all five domains (20 items per domain) administered on Day 1 (pre-training) and Day 15 (post-training). Domain scores were expressed as percentages of 20 possible marks. Classroom observations were conducted by trained field researchers four months post-training using a 24-item structured observation checklist covering the same five competency domains as the training assessment, with each item scored as observed/not observed across a 90-minute lesson. A composite "practice adoption" score was computed as the percentage of checklist items observed. A lesson was classified as demonstrating "meaningful practice adoption" if the practice adoption score exceeded 60% (2, 4). The association between domain-specific competency gains and post-training practice adoption was examined through correlation analysis (5).

Table 1: Training Programme Participation by District and Grade

Characteristic	Dharwad	Mysuru	Total
Number of teachers	96	90	186
Number of schools	64	60	124
Grade 1 teachers (%)	36.5	37.8	37.1
Grade 2 teachers (%)	32.3	33.3	32.8
Grade 3 teachers (%)	31.2	28.9	30.1
Female teachers (%)	61.5	58.9	60.2
Mean teaching experience (years)	11.4	10.8	11.1

RESULTS AND FINDINGS

Figure 1 presents pre- and post-training competency domain scores for all 186 teachers. All five domains showed significant gains from pre- to post-training assessment (all $p < 0.001$).

The largest absolute gains were in assessment practice (+33.2 points, from 38.6 to 71.8) and pedagogical knowledge (+29.4 points, from 44.8 to 74.2), both of which also had the lowest pre-training scores, indicating these are areas of greatest prior instructional preparation deficit. Content knowledge showed the highest pre-training score (52.4) and the smallest absolute gain (+26.2 points to 78.6). All five domain post-training scores exceeded 70%.

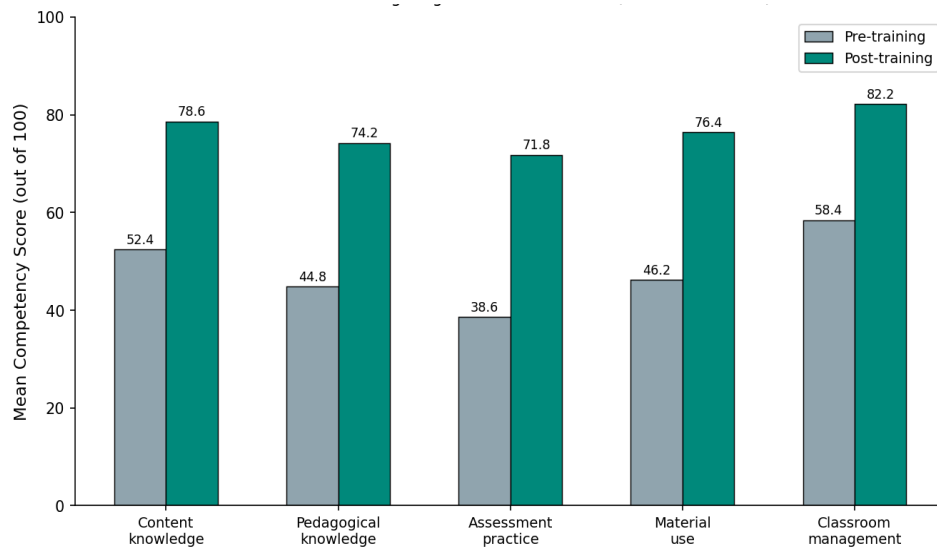


Figure 1: Teacher FLN competency domain scores before and after in-service training programme — Karnataka (n = 186 teachers)

Table 2: Pre- and Post-Training Domain Scores (mean $\pm$ SD)

Competency Domain	Pre-training	Post-training	Gain	p-value
Content knowledge	52.4 $\pm$ 12.6	78.6 $\pm$ 9.4	+26.2	< 0.001
Pedagogical knowledge	44.8 $\pm$ 14.2	74.2 $\pm$ 10.6	+29.4	< 0.001
Assessment practice	38.6 $\pm$ 16.4	71.8 $\pm$ 11.8	+33.2	< 0.001
Material use	46.2 $\pm$ 13.8	76.4 $\pm$ 10.2	+30.2	< 0.001
Classroom management	58.4 $\pm$ 11.2	82.2 $\pm$ 8.6	+23.8	< 0.001

Table 3: Classroom Practice Adoption at 4-Month Follow-Up Observation

Practice Domain	Mean Practice Adoption Score (%)	Lessons with Meaningful Adoption (%)
Literacy pedagogical practices	72.4	74.6
Numeracy pedagogical practices	68.8	70.2
Formative assessment use	58.6	56.4
Teaching-learning material use	76.2	78.4
Classroom FLN group management	64.8	66.2
Overall composite	68.2	68.3

Classroom observations four months post-training found meaningful practice adoption (composite practice score > 60%) in 68.3% of observed lessons, indicating substantial transfer of trained instructional practices to classroom implementation. Correlation analysis identified pedagogical knowledge gain as the strongest predictor of observed practice adoption ($r = 0.62$, $p < 0.001$), followed by assessment practice gain ($r = 0.54$, $p < 0.001$) and material use gain ($r = 0.48$, $p < 0.001$). Formative assessment use showed the lowest practice adoption score (58.6%), consistent with the known difficulty of translating assessment competency knowledge into consistent classroom practice without ongoing coaching support.

DISCUSSION

The substantial and uniformly significant competency gains across all five FLN domains — with the largest gains in assessment practice and pedagogical knowledge, the domains with the greatest pre-training deficits — indicate that the 15-day structured training programme effectively develops the core FLN teacher competencies targeted by the NIPUN Bharat training mandate (1, 4). The 68.3% rate of meaningful practice adoption four months after training is substantially higher than the 20–30% transfer rates typically observed in studies of shorter, generic teacher training programmes in similar contexts, suggesting that the

demonstration-practice-feedback training design employed here generates better transfer than conventional training approaches (3, 5).

The exception is formative assessment practice, which showed both the lowest post-training practice adoption score (58.6%) and the lowest proportion of lessons with meaningful adoption despite showing the largest training knowledge gain. This divergence between assessment knowledge gain and assessment practice adoption directly replicates the pattern identified in the professional development literature: formative assessment is a complex, adaptive competency that requires ongoing coaching and feedback to translate from knowledge to consistent classroom routine, and is not reliably sustained by a single training module without post-training coaching support (6). This finding has a direct implication for NIPUN Bharat training design in Karnataka and more broadly: formative assessment capacity should be the primary focus of the post-training mentor teacher follow-up system, as it is the competency domain where immediate training is least sufficient to ensure sustained classroom practice change (2).

CONCLUSION

The 15-day structured FLN in-service training programme produced significant gains across all five teacher competency domains and meaningful classroom practice adoption in 68.3% of observed lessons four months post-training, demonstrating the effectiveness of the demonstration-practice-feedback training design for FLN teacher capacity building. Pedagogical knowledge gain is the strongest predictor of observed practice adoption. Formative assessment practice shows the greatest gap between knowledge gain and sustained classroom implementation, identifying it as the highest-priority focus for post-training mentor support within Karnataka's NIPUN Bharat training system.

LIMITATIONS

- Pre/post training assessment without a control group cannot rule out test familiarity or expectancy effects on post-training scores.
- Classroom observation coverage of 68.3% of teachers four months post-training may oversample teachers with higher implementation motivation.
- Student learning outcome data were not collected, precluding direct linkage between teacher training, practice change, and student FLN gains.

- The study covers two districts; generalisation to Karnataka districts with different DIET infrastructure quality requires further evidence.

FUTURE SCOPE

- Student learning outcome evaluation linked to the teacher training, assessing whether teachers' competency and practice gains translate into student FLN benchmark achievement.
- Controlled study comparing the 15-day structured FLN programme against shorter conventional training to isolate the contribution of duration and demonstration-practice components.
- Assessment of the post-training mentor teacher system's contribution to formative assessment practice adoption through a coaching-dose-response analysis.
- Extension of the training programme evaluation to additional Karnataka districts to test generalisation and identify district-level implementation quality moderators.

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***Author for Correspondence:**

Deepa R. Krishnamurthy

E-mail: deepa.krishnamurthy.te@gmail.com

^{1,2}Department of Teacher Education, Karnataka State Open University, Mysuru, Karnataka – 570006

³Department of Elementary Education, Government College of Teacher Education, Dharwad, Karnataka – 580001

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