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THE PANCHADI LEARNING STEPS IN THE MODERN TEACHING CLASSROOM: A REVIEW OF NCF-SE 2023, TRADITIONAL INDIAN PEDAGOGY AND CONTEMPORARY EVIDENCE

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ABSTRACT

Modern classrooms are increasingly expected to move beyond traditional lecture-centred approaches towards more learner-centred and outcome-based forms of teaching, as highlighted in India's National Education Policy (NEP) 2020 and the National Curriculum Framework for School Education (NCF-SE) 2023. In this changing educational landscape, traditional Indian pedagogical practices offer valuable insights into structured and sequential learning, although their potential application in contemporary instructional design has received relatively limited attention. Against this background, the present study examines the Panchadi learning steps, the five-step learning process recommended in the National Curriculum Framework (NCF-FS 2022, integrated within NCF-SE 2023) as a way for teachers to plan the sequence of classroom activities, and explores its conceptual foundations and its relevance to contemporary educational research. The study adopts a narrative review approach, drawing upon NCF policy documents, classical Indian pedagogical texts, foundational theories of learning, and major meta-analyses and research syntheses related to instructional effectiveness. Relevant literature was identified and examined on the basis of its conceptual contribution and methodological significance, followed by thematic organisation and analysis. Although the review does not adopt a PRISMA-based systematic review methodology, selected reporting principles from PRISMA 2020 were considered to improve transparency in the review process. The Panchadi framework, as set out in the NCF, consists of five interconnected steps: Aditi (introduction and connection with prior knowledge), Bodha (conceptual understanding), Abhyāsa (practice), Prayoga (application), and Prasāra (expansion through sharing and communicating learning). The review suggests that these steps share meaningful conceptual connections with several established evidence-based instructional practices, particularly active learning (Freeman et al., 2014; Hake, 1998), retrieval practice (Roediger & Karpicke, 2006), learning by explaining and teaching others (Fiorella & Mayer, 2013), formative assessment and feedback (Black & Wiliam, 1998; Hattie & Timperley, 2007), as well as the 5E and Herbartian instructional models and the classical Indian sequence of śravaṇa, manana and nididhyāsana. Overall, the Panchadi sequence emerges as a culturally rooted and theoretically coherent pedagogical framework with potential applications in contemporary classrooms, including blended and technology-supported learning environments. Nevertheless, the NCF describes Panchadi within its Foundational Stage framework and as a non-binding recommendation, and its actual contribution to teaching and learning outcomes, including at later school stages, needs to be established through further empirical investigation, particularly controlled classroom studies examining its influence on students' academic achievement, learning engagement, and long-term knowledge retention.

KEYWORDS: *Panchadi learning steps; NCF-SE 2023; Indian knowledge systems; Śravaṇa–Manana–Nididhyāsana; active learning; instructional design; formative assessment; retrieval practice; National Education Policy 2020; blended learning*

1. INTRODUCTION

Educational systems worldwide are shifting from content transmission to competency development. India's National Education Policy 2020 explicitly encourages experiential, inquiry-based and learner-centred pedagogy, together with integration of Indian knowledge traditions into curricula (Government of India, 2020). The National Curriculum Framework for School Education (NCF-SE) 2023 carries this vision into curricular and pedagogical guidance for learners aged 3 to 18 (NCERT, 2023). Within it, the framework for the Foundational Stage (NCF-FS 2022), which is integrated into the NCF-SE, recommends a five-step learning process called Panchaadi (spelt Panchadi in this paper) as a good way for teachers to plan the sequence of activities used to teach a topic (NCERT, 2022). Yet teachers often lack concrete, step-wise models that join the heritage of Indian learning with contemporary evidence. This paper therefore takes the NCF's Panchadi as its organising framework and asks how far its five steps are supported by classical Indian thought and by contemporary research on teaching and learning.

Classical Indian education treated learning as a progression rather than an event. A well-known formulation from

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the Upaniṣadic tradition describes knowing the self through hearing (*śravaṇa*), reflection (*manana*) and deep contemplation (*nididhyāsana*) (Radhakrishnan, 1953). Traditional accounts also describe learning as shared among teacher, the learner's own effort, peers and time (Mookerji, 1947). Modern instructional science has independently arrived at comparable sequences: Herbart's five formal steps (Herbart, 1901), the BSCS 5E model (Bybee et al., 2006), Kolb's experiential cycle (Kolb, 1984) and Gagné-style events of instruction.

2. REVIEW METHODOLOGY

This study adopts a narrative review approach supported by conceptual mapping to explore the theoretical and empirical foundations of the Panchadi learning framework recommended in the NCF. The review draws upon four major categories of sources: (a) classical and historical texts on Indian education, (b) foundational theories of learning, (c) major meta-analyses and research syntheses examining instructional effectiveness, and (d) relevant educational policy documents, with the National Curriculum Framework for the Foundational Stage (NCF-FS) 2022 and the National Curriculum Framework for School Education (NCF-SE) 2023 serving as the primary sources for the definition of the five Panchadi steps. Sources were selected based on their relevance to either explaining a sequential or stage-based approach to learning or providing credible research evidence for practices associated with the five steps. Priority was given to scholarly publications and well-established sources, while anecdotal observations and claims lacking proper references were excluded. For the analysis, each of the five NCF steps was examined individually, its connections with classical Indian educational concepts and contemporary learning theories were explored, and relevant empirical findings and effect estimates were incorporated wherever available. The NCF describes each step briefly; elaborations beyond those descriptions (learner and teacher roles, example activities, digital tools and assessment methods) are the author's interpretation drawn from the literature reviewed, not NCF prescriptions.

3. CONCEPTUAL BACKGROUND

3.1 Classical Indian learning stages

The śravaṇa–manana-nididhyāsana framework represents a gradual process of learning in which knowledge is first acquired through listening, then examined through critical reflection and reasoning, and finally internalised through continuous contemplation and practice (Radhakrishnan, 1953). Similarly, traditional Indian educational thought emphasises the guru-śiṣya relationship, where learning develops through questioning (praśna), meaningful dialogue, discussion and repeated engagement with knowledge (Mookerji, 1947). These classical stages are echoed in the NCF's Panchadi, in which receiving input and reasoned reflection are brought together in a single step of conceptual understanding (*Bodha*), followed by practice, application and sharing (see Section 5).

3.2 Modern theoretical anchors

- **Constructivism and the Zone of Proximal Development** (Vygotsky, 1978): learning is socially mediated and scaffolded.
- **Advance organisers** (Ausubel, 1968): prior knowledge determines what can be learned.
- **Cognitive load theory** (Sweller, 1988): instruction must manage working-memory limits.
- **Experiential learning** (Kolb, 1984; Dewey, 1938): concrete experience, reflection, conceptualisation and experimentation.
- **Curiosity** (Loewenstein, 1994): an information gap motivates exploration.
- **Self-efficacy and modelling** (Bandura, 1977).
- **Constructive–interactive engagement** (Chi & Wylie, 2014): deeper engagement yields better learning than passive or merely active behaviours.

4. THE PANCHADI FRAMEWORK

The five steps of Panchadi, as recommended in the NCF, are defined below. Table 1 summarises how the NCF describes each step, and Table 2 elaborates the steps in terms of learner and teacher roles and core cognitive goals. The NCF presents the steps as a sequence; in this paper they are also drawn as a cycle (Figure 1), on the interpretation that what children share and ask at Step 5 can seed the introduction of the next topic. In the NCF, Panchadi is offered as a recommended way of planning lessons rather than a fixed prescription, and the NCF-SE states that its illustrations are not binding on teachers (NCERT, 2023).

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Table 1. The Panchadi steps as described in the NCF

Step	NCF term	English gloss	What the NCF describes (paraphrased)
1	Aditi	Introduction	The teacher introduces a new concept or topic by linking it with the child's prior knowledge; children gather relevant information by asking questions and by exploring and experimenting with ideas and materials.
2	Bodh	Conceptual understanding	Children work towards the core concepts through play, enquiry, experiments, discussion or reading, while the teacher observes and guides; the teaching plan lists the concepts to be learnt.
3	Abhyas	Practice	Children strengthen understanding and skills through a range of interesting activities, which may include group work or small projects.
4	Prayog	Application	Children apply their understanding in everyday life through activities and small projects.
5	Prasar	Expansion	Children spread their understanding through conversations with friends, new stories, songs, books and games; teaching others makes learning clearer and longer-lasting.

Note. NCF spellings are shown; this paper uses the transliterated forms Bodha, Abhyāsa, Prayoga and Prasāra. Descriptions are paraphrased from the NCF-FS 2022 account of Panchaadi, which is integrated within the NCF-SE 2023 (NCERT, 2022, 2023).



Figure 1. The five Panchadi steps recommended in the NCF, shown as a cycle (schematic)

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Table 2. Definition of the five Panchadi steps

Step	Sanskrit Term	Meaning	Learner's Role	Teacher's Role	Core Cognitive Goal
1	Aditi	Introduction; linking with prior knowledge	Recalls prior knowledge, asks questions, predicts, explores	Poses a puzzle, discrepant event or driving question	Activate prior knowledge; create an information gap
2	Bodha	Conceptual understanding through guided input, enquiry and discussion	Takes in structured input; discusses, explains, argues, concept-maps	Gives concise, scaffolded explanation or demonstration; facilitates questioning and peer discussion; observes and guides	Encode new information with managed load; elaborate, connect and test understanding
3	Abhyāsa	Practice	Solves problems, self-tests, revisits material at spaced intervals	Provides graded tasks and worked examples	Consolidate and automate; strengthen retrieval
4	Prayoga	Application	Applies knowledge to authentic tasks, projects and everyday situations	Designs authentic tasks; gives formative feedback and rubric-based assessment	Transfer; metacognition
5	Prasāra	Expansion: sharing and communicating learning	Explains, teaches or shares what was learnt with peers, family or community; self-assesses	Creates occasions for sharing; listens and gives feedback on explanations	Consolidate through explaining; communicate; closure

4.1 Step 1: Aditi (Introduce and connect with prior knowledge)

In the NCF, the teacher introduces a new topic by connecting it with what children already know, and children gather relevant information by asking questions and exploring ideas and materials (NCERT, 2022). Learning often begins with a question that stimulates curiosity and encourages learners to explore what they already know. Activities such as short diagnostic quizzes, unexpected demonstrations, real-life problem situations, and reflective questions like "What do you already know?" help teachers identify learners' existing knowledge, uncover misconceptions, and create meaningful connections with new concepts. Since prior knowledge plays a vital role in shaping new learning experiences (Ausubel, 1968), stimulating curiosity by highlighting gaps in learners' understanding can further motivate them to seek answers and engage actively in the learning process (Loewenstein, 1994). The NCF-SE likewise names curiosity and wonder as dispositions at the core of learning (NCERT, 2023), and classical Indian thought gives questioning (*praśna*) a central place in the teacher–learner relationship (Mookerji, 1947).

4.2 Step 2: Bodha (Build conceptual understanding)

In the NCF, children work towards the core concepts of a topic through play, enquiry, experiments, discussion or reading, while the teacher observes and guides (NCERT, 2022). Where guided input is needed, content is presented in short, well-organised segments to make learning easier and more manageable. Drawing on Cognitive Load Theory, this step emphasises the importance of breaking complex information into smaller units, using worked examples, and avoiding unnecessary details that may distract learners (Sweller, 1988). In contemporary classrooms, this approach can be implemented through brief classroom lectures, pre-recorded videos in a flipped learning environment (Bergmann & Sams, 2012), or structured guided-reading activities. Bodha thus joins two classical stages, receiving knowledge (*śravaṇa*) and reflecting on it (*manana*).

Reflection and discussion enable learners to move beyond simply receiving information towards developing a deeper and more meaningful understanding. Activities such as think–pair–share, peer instruction, Socratic questioning and concept mapping encourage students to examine ideas, exchange perspectives and construct their own interpretations. Chi and Wylie (2014) emphasise that constructive and interactive learning behaviours, particularly explaining concepts in one's own words and engaging in meaningful dialogue with peers, lead to deeper learning than merely listening or completing tasks without active intellectual engagement.

4.3 Step 3: Abhyāsa (Practise and retrieve)

In the NCF, this step strengthens understanding and skills through a range of interesting activities, including group work or small projects (NCERT, 2022). Repeated practice, recalling previously learned information, and reviewing content at regular intervals play an important role in strengthening long-term memory. Dunlosky et al. (2013) identified practice testing and

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distributed practice as two highly effective learning strategies. Similarly, Roediger and Karpicke (2006) demonstrated that students who actively retrieved information from memory retained considerably more knowledge after one week than those who repeatedly studied the same material.

4.4 Step 4: Prayoga (Apply learning)

Learners demonstrate their understanding by applying what they have learned to real-life situations through projects, case studies, laboratory activities, and other performance-based tasks. In the NCF, application is tied to the child's everyday life and is accomplished through activities and small projects (NCERT, 2022). Experiential learning theory similarly holds that understanding is consolidated when learners test ideas in new concrete situations and reflect on the results (Dewey, 1938; Kolb, 1984). The NCF-SE also expects assessment to be conducted increasingly as learning and for learning (NCERT, 2023). Although the NCF's Panchadi does not name assessment as a separate step, application tasks give teachers a natural occasion to offer constructive and specific feedback that helps learners recognise their strengths, address learning gaps, and improve their performance. Research has consistently highlighted the significant role of formative assessment and meaningful feedback in enhancing students' learning and academic achievement (Black & Wiliam, 1998; Hattie & Timperley, 2007).

4.5 Step 5: Prasāra (Share and expand)

In the NCF, the final step spreads learning beyond the immediate lesson: children share what they have understood through conversations with friends, new stories, songs, books and games, and teaching others is said to make learning clearer and longer-lasting (NCERT, 2022). This emphasis has a long precedent in Indian educational thought, in which dialogue, discussion and learning with peers are valued alongside the teacher's instruction and the learner's own effort (Mookerji, 1947). Contemporary research on learning by teaching offers partial support. In laboratory experiments, preparing to teach improved short-term learning, and preparing to teach combined with actually teaching produced the greatest long-term learning (Fiorella & Mayer, 2013, 2014), although studies of expecting to teach have not found advantages consistently (Bargh & Schul, 1980; Fiorella & Mayer, 2013). In the classroom, *Prasāra* can take the form of peer explanation, teach-back, short presentations, or sharing work with family and the wider community. Because it asks learners to explain ideas in their own words, it is also consistent with the interactive and constructive engagement that Chi and Wylie (2014) associate with deeper learning.

5. MAPPING PANCHADI TO ESTABLISHED INSTRUCTIONAL MODELS

Table 3. Alignment of Panchadi with classical and modern models

Panchadi step	Classical Indian concept	Herbartian steps (Herbart, 1901)	BSCS 5E (Bybee et al., 2006)	Kolb cycle (Kolb, 1984)	Revised Bloom level (Anderson & Krathwohl, 2001)
1. Aditi	Praśna (inquiry); jijñāsā (desire to know)	Preparation	Engage	Concrete experience (trigger)	Remember (prior knowledge)
2. Bodha	Śravaṇa (hearing) and manana (reflection)	Presentation; Association	Explore / Explain	Reflective observation; abstract conceptualisation	Understand / Analyse
3. Abhyāsa	Nididhyāsana / repetition	Generalisation	Elaborate (consolidation)	Active experimentation	Apply (procedural fluency)
4. Prayoga	Anubhava (realisation through experience)	Application	Elaborate (transfer to new situations)	New concrete experience	Apply / Create
5. Prasāra	Dialogue, discussion and learning with peers (Mookerji, 1947)	No direct equivalent	Nearest: Elaborate / Evaluate	Nearest: reflective observation on a new cycle	Evaluate / Create (explaining and teaching)

The correspondence is close for the first four steps and only partial for Prasāra. The mapping suggests that Panchadi does not contradict contemporary models but offers a culturally resonant vocabulary that may help teachers in Indian contexts adopt them. Two features distinguish it. Bodha brings guided input and reflection together in one step, and Prasāra gives sharing and teaching others an explicit place that the Herbartian and 5E models do not name as a separate stage. Conversely, the NCF's Panchadi has no separate assessment step, whereas the 5E model includes "Evaluate"; in this paper formative assessment is therefore treated as running through all five steps (Section 8).

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6. IMPLEMENTATION IN THE MODERN CLASSROOM

6.1 A sample 50-minute lesson

Table 4. Sample lesson plan using Panchadi (suggested timings)

Step	Suggested time	Example activity (science class, topic: photosynthesis)	Possible digital tool
1. Aditi	5 min	Show a wilting plant kept in dark vs light; students predict why	Poll or quiz tool, interactive whiteboard
2. Bodha	20 min	Mini-lecture with labelled diagram and short animation; think–pair–share: explain the light and dark reactions to a partner; draw a concept map	Slides, short video, collaborative whiteboard
3. Abhyāsa	12 min	Graded problem set; low-stakes retrieval quiz with no notes	Quiz platform, practice worksheets
4. Prayoga	8 min	Design a mini-experiment (for example, predict how plant growth changes under different light colours); receive rubric-based teacher feedback	Rubric, simulation, digital portfolio
5. Prasāra	5 min	Teach the concept back to a classmate from another group in two minutes; exit ticket noting one idea to share at home	Discussion board, short recorded explanation, exit-ticket form

Note. The lesson illustrates how the five steps might be sequenced in a middle- or secondary-school science class. The NCF describes Panchadi within the Foundational Stage, so this plan is an adaptation by the author; the timings and activities are suggestions only.

6.2 Adaptation across contexts

Table 5. Adapting Panchadi to different learning environments

Context	Adaptation	Key consideration
Foundational / primary school	Story- or object-based Aditi; play- and enquiry-led Bodha; play-based Abhyāsa; Prasāra through songs, stories and conversation, as the NCF describes	Short attention spans, concrete materials
Secondary school	Peer instruction and problem-solving in Bodha; project work in Prayoga; peer teaching in Prasāra	Exam pressure may narrow Prayoga to testing only
Higher education	Flipped input in Bodha; case-based Prayoga; student presentations in Prasāra	Large classes need technology-assisted feedback
Online / blended	Asynchronous input in Bodha; synchronous discussion; automated Abhyāsa; online sharing spaces for Prasāra	Connectivity and the digital divide
Vocational / skill training	Demonstration in Bodha; extended Abhyāsa on tools; Prayoga on authentic workplace tasks; peer demonstration in Prasāra	Authentic workplace tasks

6.3 Technology integration

The TPACK framework (Mishra & Koehler, 2006) indicates that technology should be chosen to serve pedagogy and content, not the reverse. Within Panchadi, technology is most useful for diagnostic polling (Step 1), multimedia delivery and collaboration spaces (Step 2), adaptive practice and spaced repetition (Step 3), simulations and e-portfolios (Step 4), and platforms for sharing and peer explanation (Step 5).

7. EVIDENCE SUPPORTING EACH STEP

No controlled trial of the Panchadi sequence as a named whole was identified in this review. The table therefore reports evidence for the component practices each step comprises. Formative assessment and feedback, which the NCF-SE treats as part of teaching more broadly, are listed as cross-cutting.

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Table 6. Empirical findings supporting component practices

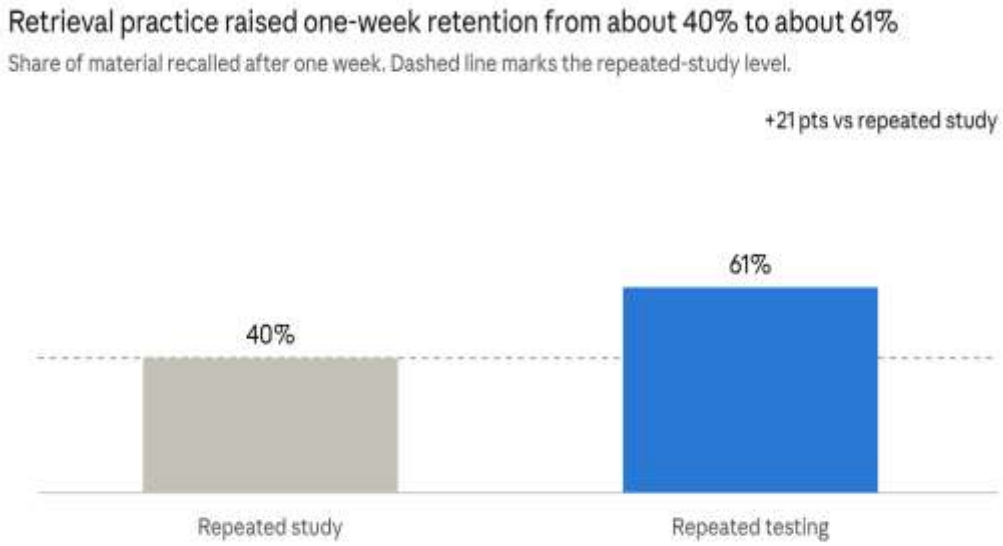
Step	Practice	Source	Finding
1	Prior-knowledge activation and curiosity	Ausubel (1968); Loewenstein (1994)	Prior knowledge strongly shapes new learning; information gaps drive curiosity (theoretical and experimental support)
2	Managed cognitive load	Sweller (1988)	Reducing extraneous load improves learning from problem-solving
2	Interactive engagement	Hake (1998)	Across 62 physics courses (N = 6,542), interactive-engagement courses achieved a mean normalised gain of about 0.48 vs about 0.23 for traditional courses
2	Active learning	Freeman et al. (2014)	Meta-analysis of 225 STEM studies: exam scores rose by about 0.47 standard deviations; failure rates were about 21.8% under active learning vs 33.8% under traditional lecturing
2	Constructive and interactive engagement	Chi & Wylie (2014)	Learning outcomes improve as engagement moves from passive to active to constructive to interactive
3	Retrieval practice	Roediger & Karpicke (2006)	After one week, about 61% retention with repeated testing vs about 40% with repeated study
3	Practice testing, distributed practice	Dunlosky et al. (2013)	Both rated high utility among ten learning techniques
4	Experiential application of learning	Kolb (1984); Dewey (1938)	Conceptual support: understanding is consolidated when ideas are tested in new situations and reflected upon (no effect estimate is cited here)
5	Learning by teaching and explaining	Bargh & Schul (1980); Fiorella & Mayer (2013, 2014)	Preparing to teach improved short-term learning, and preparing to teach plus actually teaching gave the greatest long-term learning in laboratory experiments; benefits of expecting to teach were not consistent across studies
All	Formative assessment	Black & Wiliam (1998)	Substantial gains in achievement from formative assessment across studies
All	Feedback	Hattie & Timperley (2007)	Feedback is among the most powerful influences on achievement, depending on its type and quality
All	Active learning, general	Prince (2004)	Evidence supports active, collaborative and problem-based approaches in engineering education

Figures from the evidence base

The charts below plot values reported in the studies above. They illustrate the magnitude of individual findings and are **not** pooled results for the Panchadi framework.

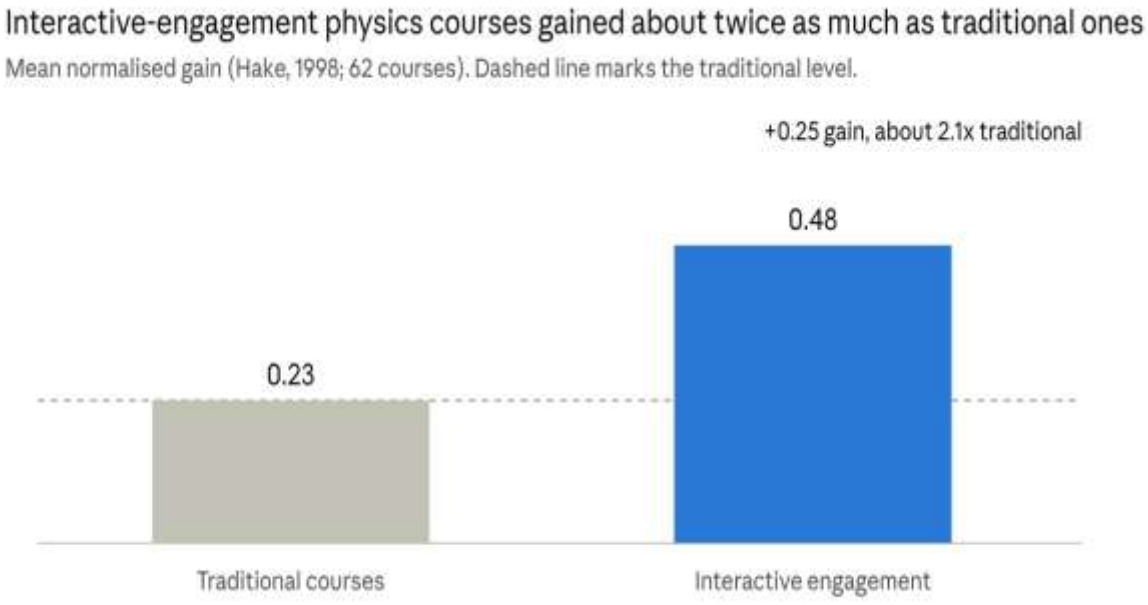
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Figure 2. Retrieval practice and retention (Step 3: Abhyāsa)



Values as reported in Roediger & Karpicke (2006) · illustrative of one component practice

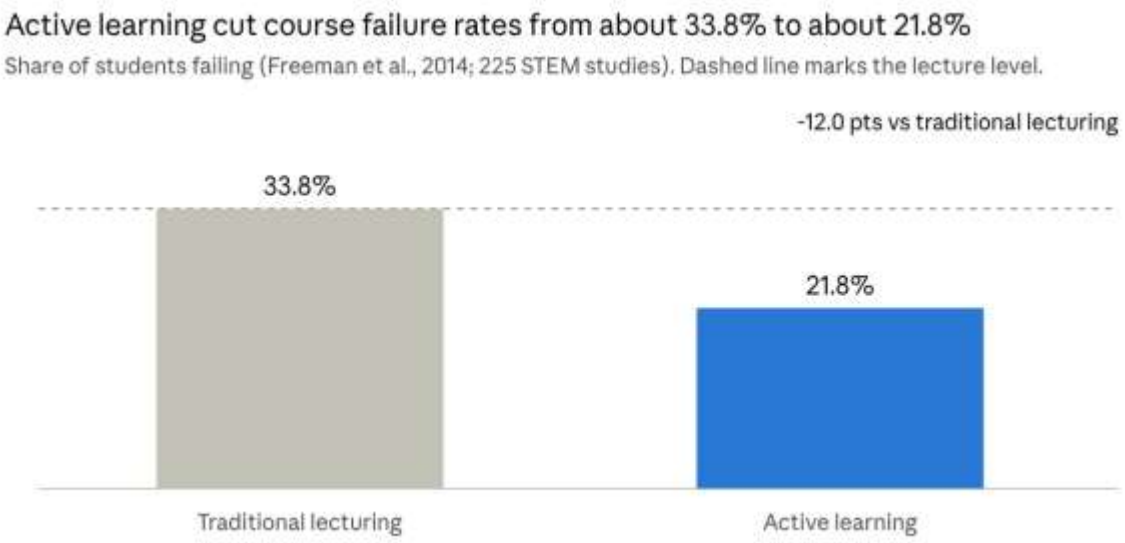
Figure 3. Interactive engagement and conceptual gain (Step 2: Bodha)



Values as reported in Hake (1998) · 62 introductory physics courses, N = 6,542

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Figure 4. Active learning and failure rates (Steps 2 to 4)



Values as reported in Freeman et al. (2014) · meta-analysis of 225 STEM studies

These three findings come from different populations (laboratory students, physics courses and a broad STEM meta-analysis), so they should be read as separate lines of support for the component practices, not as one combined effect of the Panchadi sequence.

8. ASSESSMENT OF LEARNING WITHIN PANCHADI

In the NCF-SE, assessment is expected to be conducted increasingly as learning and for learning, with teacher observation an important source of evidence in the early stages (NCERT, 2023). The NCF's Panchadi does not set out a separate assessment step, so the methods in Table 7 are the author's suggestions for gathering formative evidence within each step.

Table 7. Suggested assessment methods for each step

Step	Formative method	Evidence of learning	Possible indicator
1. Aditi	Pre-test, concept inventory, K-W-L chart	Prior knowledge, misconceptions	Baseline score; number and quality of student questions
2. Bodha	Quick comprehension check, discussion rubric, concept-map scoring	Basic comprehension; depth of reasoning	Correct responses on short checks; rubric score for explanation quality
3. Abhyāsa	Low-stakes quizzes, spaced tests	Retention and fluency	Retrieval accuracy over time
4. Prayoga	Project, performance task, portfolio	Transfer to new situations	Rubric score on authentic task; gain scores
5. Prasāra	Peer explanation or teach-back, short presentation, self-reflection	Ability to explain and communicate ideas; metacognition	Rubric score for clarity of explanation; peer and self-reflection ratings

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9. CHALLENGES AND LIMITATIONS

Table 8. Challenges and possible responses

Challenge	Description	Possible response
Time constraints	Five steps may seem long for a single period	Distribute steps across a lesson sequence; flip the input part of Step 2 (Bodha)
Large class sizes	Hard to facilitate dialogue and feedback	Peer instruction, structured groups, automated quizzes
Exam-driven culture	Pressure to prioritise content coverage	Align Step 4 (Prayoga) with formative rubrics and exam-style tasks
Teacher preparation	Need for training in active methods	Professional development with modelled lessons
Digital divide	Unequal access to devices and connectivity	Low-tech alternatives; printed practice sets
Stage of application	The NCF describes Panchadi within the Foundational Stage; its use at later stages is an extension made in this paper	Adapt activities to the stage (Table 5); test the adaptation empirically before generalising
Terminology and cultural framing	Risk of treating a traditional label as proof of effectiveness	Test the framework empirically; avoid appeals to tradition alone
Evidence gap	No direct trials of Panchadi as a whole	Design quasi-experimental and cluster-randomised studies

10. DISCUSSION

The review suggests that all five steps of the Panchadi learning model recommended in the NCF are closely connected with established practices in contemporary learning sciences. Among these, the strongest research support is found for active and interactive learning (Step 2, Bodha) and retrieval practice (Step 3, Abhyāsa), and formative feedback, which runs across the steps, is also well supported. Research on learning by teaching offers more limited and partly inconsistent support for Prasāra (Step 5). The role of curiosity-based openings (Step 1, Aditi) is supported mainly by theoretical explanations and experimental findings, large-scale evidence from classroom settings remains relatively limited, and Prayoga (Step 4) draws mainly on experiential learning theory.

The main contribution of Panchadi lies in the way it brings these practices together within a simple, meaningful, and culturally relevant learning sequence. By drawing on concepts from Indian knowledge traditions, and by being recommended in the NCF itself, it offers teachers a familiar vocabulary and a structured approach to classroom teaching, in keeping with the broader vision of NEP 2020 and NCF-SE 2023. Its similarities with Herbartian pedagogy and the 5E instructional model also make it easier for teachers who are already familiar with these approaches to understand and adopt Panchadi without making major changes to their existing teaching practices, while its explicit final step, Prasāra, adds a place for sharing and teaching others that those models do not name separately.

However, three important considerations need attention. First, although individual components of Panchadi have research support, this does not automatically establish that the complete five-step sequence is more effective than existing instructional models. Its overall effectiveness therefore needs to be examined through systematic classroom-based research. Second, learning outcomes may differ depending on the subject, learners' age, quality of implementation, and methods of assessment. Therefore, findings and effect sizes reported in STEM-related higher education studies should not be directly generalised to all school-level contexts. Moreover, differences in how researchers define and measure active learning make comparisons across studies somewhat challenging. Third, the NCF describes Panchadi within its Foundational Stage framework and as a recommended, non-binding way of planning lessons (NCERT, 2022, 2023); the elaborations in this paper for older learners, including the roles, activities, tools and assessment methods proposed, are the author's interpretation and require testing.

11. FUTURE RESEARCH DIRECTIONS

- Quasi-experimental and cluster-randomised trials comparing Panchadi-based instruction with lecture-based and 5E-based instruction.
- Studies across age groups, subjects and school types, including multilingual classrooms and stages beyond the Foundational Stage for which the NCF describes Panchadi.
- Development and validation of a fidelity-of-implementation checklist.
- Teacher professional-development studies and teacher perceptions research.
- Learning-analytics research on how digital tools support Steps 3 and 4.
- Qualitative studies of how Indian knowledge-system framing affects teacher and student motivation.
- Studies of how teachers interpret and implement the five NCF steps in practice, and of Prasāra (peer explanation and teaching others) in particular.

12. CONCLUSION

The Panchadi learning steps recommended in the NCF present a culturally rooted yet contemporary approach to teaching and learning through five interconnected steps: introducing a topic by connecting it with prior knowledge (Aditi), building conceptual understanding through enquiry and discussion (Bodha), strengthening understanding through practice and retrieval (Abhyāsa), applying learning in real situations (Prayoga), and sharing and expanding learning with others

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(Prasāra). These steps draw support from established educational research on active learning, retrieval practice, learning by teaching, and formative assessment, and they correspond closely to the classical Indian sequence of śravaṇa, manana and nididhyāsana. The framework also shares conceptual similarities with established instructional approaches, particularly Herbart's teaching steps and the 5E instructional model. However, while its individual steps are supported by existing educational principles, the effectiveness of Panchadi as an integrated pedagogical framework has yet to be established empirically, and its extension beyond the Foundational Stage, for which the NCF describes it, remains to be tested. Therefore, systematic classroom-based investigations are essential to examine its practical applicability, learning outcomes, and potential contribution to contemporary pedagogy.

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