

Cognitive Skill Taxonomy for Prospective Teachers: A Conceptual Framework for Holistic Development under NEP-2020

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Abstract

The National Education Policy 2020 (NEP-2020) attaches great importance on fostering higher-order cognitive competencies, critical thinking, creativity, problem-solving, and reflective abilities as essential elements of quality teacher education. In this context, the present conceptual study proposes a structured taxonomy of cognitive skills for prospective teachers by integrating established hierarchical learning theories with contemporary educational requirements. The study draws primarily upon Bloom's Taxonomy and its revised version developed by Anderson and Krathwohl, which conceptualize cognitive development as a progressive movement from foundational knowledge acquisition toward increasingly complex processes of understanding, application, analysis, evaluation, and creation. Based on these theoretical foundations, the paper develops a **Cognitive Skill Development Framework (CSDF)** designed specifically for prospective teachers. The framework organizes cognitive competencies into progressive levels while emphasizing their interrelationships and practical application within teacher education. It seeks to bridge the gap between theoretical knowledge and classroom practice by promoting inquiry, reasoning, reflection, decision-making, creativity, and problem-solving. The framework is further aligned with major principles of NEP-2020, particularly competency-based learning, multidisciplinary education, experiential learning, learner-centred pedagogy, and reflective professional practice. The study argues that systematic integration of a cognitive skill taxonomy into teacher education can strengthen prospective teachers' intellectual capabilities and enhance their capacity to design meaningful learning experiences. It may also contribute to greater curriculum coherence by establishing clear connections among learning objectives, pedagogical processes, and assessment practices. Furthermore, taxonomy-based assessment can facilitate the measurement of both foundational and higher-order cognitive competencies rather than relying predominantly on recall-oriented evaluation. The paper concludes that the proposed CSDF can serve as a conceptual foundation for curriculum developers, teacher educators, researchers, and policymakers seeking to operationalize the cognitive dimensions of NEP-2020. Its implementation may contribute to the preparation of reflective, analytical, innovative, and professionally competent teachers capable of responding effectively to the evolving demands of twenty-first-century education.

Keywords: Cognitive Skills, Teacher Education, NEP-2020, Bloom's Taxonomy, Anderson and Krathwohl, Critical Thinking, Higher-Order Thinking, Cognitive Skill Development Framework.

1. Introduction

The transformation of teacher education in the twenty-first century is increasingly associated with the development of sophisticated cognitive competencies that enable teachers to interpret complex situations, exercise critical judgment, solve educational problems, and design innovative learning experiences. In an era characterized by rapid technological advancement, increasing diversity in classrooms, interdisciplinary knowledge, and changing societal expectations, teachers require cognitive capabilities that extend beyond the acquisition and reproduction of subject knowledge. The National Education Policy 2020 (NEP-2020) places considerable emphasis on conceptual understanding, critical thinking, creativity, problem-solving, experiential learning, and competency-based education, thereby advocating a significant shift from rote memorization towards meaningful and higher-order learning.

Despite these policy priorities, conventional approaches to teacher education have often remained predominantly content-oriented, with comparatively limited emphasis on the systematic development of cognitive processes.

Such an imbalance may produce teachers who possess adequate disciplinary knowledge but experience difficulties in applying knowledge to unfamiliar contexts, analysing complex classroom situations, evaluating alternative pedagogical approaches, and generating innovative solutions to emerging educational challenges. Consequently, strengthening the cognitive dimensions of teacher preparation has become essential for developing reflective, adaptive, and professionally competent educators.

A cognitive skill taxonomy provides a systematic framework for identifying, organizing, and developing diverse levels of intellectual competencies. By classifying cognitive processes hierarchically, it facilitates a progressive movement from foundational processes such as remembering and understanding towards more complex abilities involving application, analysis, evaluation, and creation. Such a framework can support alignment among learning objectives, instructional strategies, learning experiences, and assessment practices within teacher education programmes.

Against this backdrop, the present conceptual paper proposes a **Cognitive Skill Development Framework (CSDF)** for prospective teachers, grounded in established cognitive learning theories and aligned with the vision of NEP-2020. The framework emphasizes holistic, competency-based, learner-centred, and reflective development, with particular attention to higher-order cognitive abilities. It seeks to provide a conceptual foundation for strengthening teacher preparation and fostering educators capable of critical inquiry, informed decision-making, creative problem-solving, and effective pedagogical innovation.

2. Rationale of the Study

NEP-2020 calls for a paradigm shift towards competency-based education, emphasizing critical thinking, problem-solving, and analytical reasoning. However, the policy lacks a detailed structural framework for implementing these cognitive competencies within teacher education programs.

Current teacher education practices exhibit several limitations:

- Overemphasis on theoretical knowledge
- Lack of structured cognitive progression
- Misalignment between teaching and assessment
- Limited focus on higher-order thinking

A taxonomy-based cognitive framework can address these issues by:

- Structuring cognitive skill development hierarchically
- Aligning curriculum, pedagogy, and assessment
- Promoting higher-order thinking skills
- Ensuring measurable learning outcomes

3. Objectives

1. To analyze the theoretical foundations of cognitive skill taxonomy
2. To examine cognitive skill requirements under NEP-2020
3. To develop a conceptual framework for cognitive skill development among prospective teachers
4. To align cognitive skill taxonomy with competency-based teacher education

4. Review of Literature

4.1 Bloom's Cognitive Taxonomy

Bloom et al. (1956) introduced the **Taxonomy of Educational Objectives: Cognitive Domain**, which became one of the most influential frameworks for classifying educational objectives. The original taxonomy organized

cognitive abilities into six hierarchical categories: **Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation**. The framework established the principle that meaningful learning should progress beyond factual recall towards increasingly complex intellectual processes. In teacher education, this taxonomy provides a useful foundation for identifying and sequencing cognitive competencies required for effective teaching.

4.2 Revised Taxonomy of Cognitive Processes

Anderson and Krathwohl (2001) revised Bloom's original framework by transforming the categories into active cognitive processes: **Remember, Understand, Apply, Analyze, Evaluate, and Create**. The revised taxonomy also introduced a two-dimensional structure consisting of the **Knowledge Dimension** and the **Cognitive Process Dimension**. The framework places *Create* at the highest level, highlighting the importance of knowledge construction, innovation, and creative problem-solving. This revised perspective is particularly relevant to contemporary teacher education, where prospective teachers are expected not merely to reproduce knowledge but to apply, evaluate, and generate pedagogical solutions.

4.3 Cognitive Skills in Teacher Education

Cognitive competencies constitute an essential component of professional teacher development. Effective teachers must interpret learners' needs, analyse classroom situations, evaluate instructional alternatives, make informed decisions, and develop innovative pedagogical strategies. Shulman (1986) emphasized the importance of integrating content knowledge with pedagogical knowledge, suggesting that effective teaching involves complex forms of professional reasoning. Schön (1983) further highlighted **reflective practice**, arguing that professionals develop expertise through reflection on action and reflection in action.

Darling-Hammond (2006) emphasized that effective teacher preparation should connect theoretical knowledge with practical experiences and opportunities for reflection. Similarly, Darling-Hammond, Hyler, and Gardner (2017) identified effective professional learning as involving active learning, collaboration, modelling, feedback, and reflection. These perspectives indicate that teacher education should provide systematic opportunities for prospective teachers to develop analytical, reflective, and problem-solving abilities.

4.4 Higher-Order Thinking and Cognitive Development

Resnick (1987) conceptualized higher-order thinking as complex cognitive activity involving non-algorithmic reasoning, uncertainty, self-regulation, and the construction of meaning. Her work established that higher-order thinking cannot be reduced to simple information retrieval and requires learners to engage actively with problems and alternative perspectives.

Paul and Elder (2006) emphasized critical thinking as a disciplined process involving analysis, evaluation, inference, interpretation, explanation, and self-regulation. Their framework is particularly relevant to teacher education because teachers need to evaluate evidence, question assumptions, and make reasoned pedagogical decisions.

Brookfield (2012) further argued that critical reflection enables educators to identify and examine assumptions underlying professional practice. Such reflective and analytical processes are fundamental to the development of teachers capable of responding constructively to complex educational environments.

4.5 Cognitive Skills and Constructivist Learning

Vygotsky's (1978) sociocultural perspective emphasized the role of social interaction, language, and guided learning in cognitive development. From a teacher education perspective, this approach suggests that cognitive competencies develop through interaction with peers, mentors, learners, and professional communities.

Bruner (1960) advocated discovery-oriented learning and argued that learners should be supported in actively constructing knowledge. This perspective complements higher levels of cognitive taxonomy, particularly analysis, evaluation, and creation. Prospective teachers therefore require learning environments that encourage inquiry, exploration, discussion, and independent problem-solving rather than passive reception of information.

4.6 Cognitive Skills, Met cognition, and Reflective Learning

Flavell (1979) introduced the concept of **metacognition**, referring broadly to individuals' awareness and regulation of their own cognitive processes. Metacognitive competence is particularly important for prospective teachers because teachers must continuously monitor their instructional decisions, evaluate their effectiveness, and modify their approaches according to learner needs.

Schön (1983) extended this principle into professional education through the concept of reflective practice. Teachers who systematically reflect on classroom experiences are better positioned to identify instructional challenges, evaluate alternatives, and improve professional practice. Consequently, metacognitive and reflective abilities should be incorporated into teacher education curricula alongside conventional cognitive competencies.

4.7 Cognitive Skills and Twenty-First-Century Competencies

The Partnership for 21st Century Learning (P21, 2009) identified critical thinking, creativity, communication, and collaboration as major competencies required for effective participation in contemporary society. These competencies are closely connected with higher levels of cognitive processing and have significant implications for teacher preparation.

The OECD (2019), through its **Learning Compass 2030**, emphasized student agency, transformative competencies, and the capacity to navigate complex and changing environments. Teachers consequently require cognitive flexibility and adaptive professional knowledge to facilitate these competencies among learners.

The UNESCO (2021) report *Reimagining Our Futures Together* emphasized the need for a new social contract for education based on cooperation, collective responsibility, creativity, and transformative learning. These ideas reinforce the need to reconceptualize teacher education around broader intellectual and professional competencies.

4.8 NEP-2020 Perspective

The **National Education Policy 2020** represents a significant shift in Indian education towards holistic, multidisciplinary, competency-based, and experiential learning. NEP-2020 emphasizes the development of **critical thinking, creativity, communication, problem-solving, inquiry, experiential learning, and conceptual understanding** rather than rote memorization.

The policy also advocates multidisciplinary education, learner-centred pedagogy, formative assessment, and teacher professional development. These provisions create a strong policy rationale for incorporating a systematic cognitive skill taxonomy into teacher education. The cognitive progression represented by Bloom's revised taxonomy can provide a conceptual mechanism for translating these broad policy aspirations into measurable learning outcomes.

4.9 Additional Literature on Cognitive Skills and Teacher Education

1. Bloom et al. (1956)

Bloom and colleagues established the foundational taxonomy of educational objectives in the cognitive domain. Their hierarchical classification demonstrated the importance of progressing from knowledge acquisition towards more complex cognitive operations. The taxonomy provided educators with a systematic basis for designing learning objectives and assessment activities.

2. Anderson and Krathwohl (2001)

The revised taxonomy transformed Bloom's static categories into active cognitive processes. The introduction of **Remember, Understand, Apply, Analyze, Evaluate, and Create** strengthened its relevance to contemporary competency-based education. The framework remains particularly useful for designing measurable cognitive learning outcomes.

3. Krathwohl (2002)

Krathwohl explained the theoretical and practical significance of the revised taxonomy and emphasized its application in curriculum planning, instructional design, and assessment. His work demonstrated how the taxonomy could be used to establish greater coherence between educational objectives and classroom practices.

4. Marzano and Kendall (2007)

Marzano and Kendall proposed a new taxonomy of educational objectives that incorporated cognitive processes, metacognitive processes, and the self-system. Their framework expanded conventional cognitive taxonomies by recognizing that learning is influenced by learners' metacognitive regulation and motivation. This provides an important basis for considering cognitive development as part of a broader professional competency framework.

5. Zohar and Dori (2003)

Zohar and Dori examined higher-order thinking within science education and emphasized the importance of instructional approaches that explicitly promote complex reasoning. Their work suggests that higher-order thinking should not be treated as an automatic outcome of subject learning but should be deliberately cultivated through instructional design.

6. Costa and Kallick (2009)

Costa and Kallick highlighted the importance of **habits of mind**, including persistence, flexible thinking, questioning, metacognition, and responsible decision-making. Their work extends cognitive development beyond discrete skills and emphasizes dispositions that support effective thinking and professional action.

7. Hattie (2009)

Hattie's synthesis of educational research identified factors influencing student achievement and demonstrated the importance of effective teaching practices, feedback, metacognitive strategies, and teacher clarity. The findings support the need for teacher education programmes to develop teachers' capacity to plan, monitor, and evaluate learning systematically.

8. Darling-Hammond (2006)

Darling-Hammond emphasized the importance of high-quality teacher preparation in developing teachers' professional knowledge and instructional competence. Her work supports the integration of theoretical understanding, practical experience, reflection, and evidence-based decision-making within teacher education.

9. Darling-Hammond, Hyler, and Gardner (2017)

The authors identified active learning, collaboration, modelling, feedback, coaching, and reflection as significant features of effective professional development. These components correspond closely with the development of higher-order cognitive and reflective competencies among prospective teachers.

10. Shulman (1986)

Shulman introduced the concept of **Pedagogical Content Knowledge (PCK)** and demonstrated that effective teaching requires more than mastery of subject matter. Teachers need to transform content into forms that learners can understand. This transformation involves substantial cognitive processing, pedagogical reasoning, and contextual decision-making.

11. Schön (1983)

Schön's theory of reflective practice established reflection as a central component of professional learning. Teachers are required to reflect both during and after professional action, making reflective cognition an important dimension of teacher competence.

12. Vygotsky (1978)

Vygotsky emphasized the social and cultural foundations of cognitive development. His concept of the Zone of Proximal Development demonstrates the importance of interaction, scaffolding, and guided participation in learning. The theory supports collaborative and socially mediated approaches to developing cognitive competencies.

13. Flavell (1979)

Flavell's work on metacognition established the importance of awareness and regulation of one's own cognitive processes. In teacher education, metacognition enables prospective teachers to monitor instructional decisions, recognize limitations, evaluate outcomes, and modify pedagogical strategies.

14. Facione (1990)

Facione's Delphi study conceptualized critical thinking through core cognitive skills including **interpretation, analysis, evaluation, inference, explanation, and self-regulation**. This framework provides substantial support for positioning critical thinking as a multidimensional cognitive competency within teacher preparation.

15. OECD (2019)

The OECD Learning Compass 2030 emphasized student agency, transformative competencies, and the ability to navigate complex social and educational environments. Its emphasis on creating new value, reconciling tensions and dilemmas, and taking responsibility reinforces the relevance of higher-order cognitive competencies for contemporary teachers.

4.10 Synthesis of the Reviewed Literature

The reviewed literature demonstrates a consistent movement from knowledge transmission towards **higher-order, reflective, analytical, and transformative learning**. Bloom et al. (1956) and Anderson and Krathwohl (2001) provide the hierarchical foundation for organizing cognitive processes, while subsequent scholarship has expanded the concept through critical thinking, metacognition, reflective practice, pedagogical reasoning, and twenty-first-century competencies.

The literature also indicates that cognitive skills are not developed effectively through content-oriented instruction alone. They require purposeful curriculum design, inquiry-based pedagogy, experiential learning, collaborative engagement, reflection, authentic problem-solving, and assessment practices that measure complex thinking. This requirement is strongly compatible with the vision of NEP-2020, which seeks to promote conceptual understanding, critical thinking, creativity, competency-based learning, multidisciplinary education, and holistic development.

However, a significant conceptual gap remains in the systematic integration of these cognitive dimensions into a **coherent taxonomy specifically designed for prospective teachers and explicitly aligned with NEP-2020**. Existing taxonomies provide valuable foundations but do not adequately operationalize the progression of cognitive competencies within the contemporary context of teacher education. The proposed **Cognitive Skill Development Framework (CSDF)** therefore seeks to address this gap by connecting hierarchical cognitive processes with pedagogical application, reflective practice, professional decision-making, and innovative problem-solving.

5. Theoretical Foundations

The proposed **Cognitive Skill Development Framework (CSDF)** is grounded in a set of complementary theoretical perspectives that explain how cognitive competencies develop, deepen, and transform through learning and professional experience. These theoretical foundations provide the conceptual basis for organizing cognitive skills progressively and integrating them into teacher education in alignment with the principles of **NEP-2020**. The framework draws particularly upon hierarchical learning theory, constructivism, metacognition, and transformative learning theory.

5.1 Hierarchical Learning Theory

Hierarchical learning theory provides the primary structural foundation of the proposed framework. It assumes that learning develops progressively from relatively simple cognitive processes towards increasingly complex forms of thinking. Bloom et al. (1956) initially conceptualized cognitive learning through a hierarchy comprising Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Anderson and Krathwohl (2001) subsequently revised these categories as **Remember, Understand, Apply, Analyze, Evaluate, and Create**, emphasizing the dynamic nature of cognitive processes.

Within teacher education, this hierarchical perspective suggests that prospective teachers should first acquire foundational conceptual knowledge before being expected to apply, analyse, evaluate, and creatively reconstruct that knowledge in authentic educational contexts. For example, knowledge of pedagogical theories represents a foundational cognitive level, whereas analysing classroom problems, evaluating instructional alternatives, and designing innovative teaching strategies represent increasingly sophisticated levels of cognition.

The proposed CSDF therefore adopts a **progressive cognitive continuum** in which each level provides a foundation for subsequent levels while recognizing that cognitive processes may interact rather than operate as strictly linear stages. This theoretical position supports systematic curriculum planning, formulation of learning outcomes, instructional sequencing, and development of assessment strategies capable of measuring different levels of cognitive complexity.

5.2 Constructivist Learning Theory

Constructivism provides a learner-centred foundation for understanding how cognitive competencies are developed. Constructivist theorists such as Piaget (1972) and Vygotsky (1978) emphasized that learners do not simply receive knowledge passively; rather, they actively construct and reconstruct understanding through interaction with experiences, social contexts, prior knowledge, and meaningful learning situations.

For prospective teachers, constructivism has particular significance because professional competence cannot be developed exclusively through lectures or theoretical instruction. Prospective teachers need opportunities to engage with authentic classroom situations, conduct inquiry, collaborate with peers, reflect on teaching experiences, and connect theoretical concepts with practical problems. Vygotsky's emphasis on social interaction and scaffolding further highlights the importance of collaborative learning and guided participation in cognitive development.

Accordingly, the CSDF incorporates **experiential, inquiry-based, collaborative, and problem-centred learning experiences**. These approaches encourage prospective teachers to apply theoretical knowledge to real educational contexts and progressively develop analytical reasoning, independent judgement, and creative problem-solving abilities.

5.3 Metacognitive Theory

Metacognition refers broadly to an individual's awareness, monitoring, and regulation of their own cognitive processes. Flavell (1979) established metacognition as an important dimension of cognitive development, emphasizing learners' ability to understand how they think and to regulate their learning effectively. Metacognitive processes include planning, monitoring, evaluating, and modifying one's cognitive strategies.

Metacognition is particularly significant in teacher education because effective teachers must continuously examine their instructional decisions and respond to learners' diverse needs. A prospective teacher should therefore be able to identify a pedagogical problem, select an appropriate strategy, monitor its effectiveness, evaluate the outcomes, and modify the approach when necessary.

Within the CSDF, metacognition functions as a **cross-cutting cognitive competency** rather than merely a final stage of cognitive development. It supports self-regulated learning, reflective practice, professional decision-making, and continuous improvement across all levels of the taxonomy. Reflective journals, self-assessment, peer feedback, teaching portfolios, action research, and post-lesson reflection can therefore be employed to strengthen metacognitive development among prospective teachers.

5.4 Transformative Learning Theory

Transformative Learning Theory, primarily associated with Mezirow (1991), explains how individuals can critically examine and revise previously held assumptions, beliefs, perspectives, and interpretations through reflection and meaningful learning experiences. Transformative learning occurs when learners encounter situations that challenge established perspectives and subsequently engage in critical reflection and reasoned discourse.

This perspective is highly relevant to teacher education because prospective teachers enter professional preparation programmes with pre-existing beliefs about teaching, learning, learners, authority, assessment, and classroom management. Teacher education should provide opportunities for them to critically examine these assumptions and develop more informed and contextually responsive professional perspectives.

The CSDF incorporates transformative learning by connecting **higher-order cognition with critical reflection and professional change**. The processes of analysing assumptions, evaluating evidence, questioning established practices, and creating alternative pedagogical approaches can facilitate changes in prospective teachers' professional beliefs and practices. Thus, cognitive development is understood not simply as the accumulation of intellectual skills but as a process that can contribute to deeper professional transformation.

5.5 Theoretical Integration

The four theoretical perspectives collectively provide a comprehensive foundation for the proposed **Cognitive Skill Development Framework**. Hierarchical learning theory establishes the progression of cognitive complexity; constructivism explains how learners actively construct knowledge through experience and interaction; metacognition emphasizes the monitoring and regulation of cognitive processes; and transformative learning explains how critical reflection and higher-order thinking can lead to changes in professional beliefs and practices.

The integration of these perspectives enables the CSDF to move beyond a conventional hierarchical taxonomy and towards a **dynamic, reflective, experiential, and professionally oriented model of cognitive development**. Such integration is consistent with NEP-2020's emphasis on conceptual understanding, critical thinking, experiential learning, competency-based education, multidisciplinary learning, and holistic teacher development.

Accordingly, the proposed framework conceptualizes cognitive development among prospective teachers as a multidimensional process involving **knowledge acquisition, conceptual understanding, application, analysis, evaluation, creation, metacognitive regulation, reflection, and professional transformation**. This integrated theoretical foundation provides the basis for the subsequent development of the dimensions, levels, and educational applications of the Cognitive Skill Development Framework.

6. Conceptual Framework: CSDF Model

The **Cognitive Skill Development Framework (CSDF)** is a conceptual model designed to systematically organize and strengthen the cognitive competencies of prospective teachers in accordance with the vision of **NEP-2020**. Drawing primarily upon the revised taxonomy of Anderson and Krathwohl (2001), the framework conceptualizes cognitive development as a progressive movement from foundational knowledge acquisition to higher-order thinking, critical evaluation, and creative knowledge generation.

The CSDF comprises six interconnected cognitive levels: **Remember, Understand, Apply, Analyze, Evaluate, and Create**. Although these levels are presented hierarchically, cognitive development is not considered strictly linear. Higher-order processes may require the simultaneous activation of lower-order cognitive processes, while reflection and metacognitive regulation operate across all levels. The framework therefore represents a progressive yet dynamic process of professional cognitive development.

6.1 Level I: Remember

The **Remember** level represents the foundational stage of cognitive development, involving the retrieval and recognition of previously acquired knowledge. For prospective teachers, this level includes familiarity with educational concepts, theories, principles, terminology, policies, and pedagogical approaches.

Key cognitive competencies include:

- Recalling concepts, definitions, principles, and educational terminology.
- Identifying major educational theories and pedagogical approaches.
- Recognizing principles of child development, learning, curriculum, and assessment.
- Recalling relevant provisions and objectives of NEP-2020.
- Retrieving previously learned information for subsequent cognitive processing.

At this level, the emphasis is on establishing a sound conceptual knowledge base that supports more complex forms of professional reasoning.

6.2 Level II: Understand

The **Understand** level involves developing meaningful comprehension of educational knowledge and the ability to interpret, explain, classify, compare, and summarize concepts. Prospective teachers move beyond memorization by demonstrating their ability to establish relationships among theories, principles, and educational practices.

Key cognitive competencies include:

- Interpreting educational concepts and pedagogical principles.
- Explaining theories and their relevance to teaching-learning processes.
- Summarizing major educational ideas and policy provisions.
- Comparing alternative pedagogical approaches.
- Illustrating theoretical concepts through appropriate educational examples.
- Establishing relationships between theoretical knowledge and classroom contexts.

This level ensures that prospective teachers develop conceptual clarity before applying knowledge in authentic educational situations.

6.3 Level III: Apply

The **Apply** level represents the transition from conceptual understanding to practical utilization of knowledge. At this stage, prospective teachers employ previously acquired theories, principles, and strategies to address instructional tasks and classroom requirements.

Key cognitive competencies include:

- Implementing appropriate teaching-learning strategies.
- Applying pedagogical theories to classroom situations.
- Preparing learner-centred and competency-based lesson plans.
- Selecting suitable instructional resources and assessment techniques.
- Applying differentiated teaching strategies according to learners' needs.
- Using theoretical knowledge to address routine educational problems.

Application enables prospective teachers to transform theoretical knowledge into effective professional action and establishes an important connection between teacher education and classroom practice.

6.4 Level IV: Analyze

The **Analyze** level involves systematically examining information, situations, relationships, assumptions, and problems by breaking them into meaningful components. This level is particularly important for developing teachers' diagnostic and problem-solving capabilities.

Key cognitive competencies include:

- Examining classroom situations from multiple perspectives.
- Identifying learning difficulties and instructional problems.
- Analysing learner behaviour, performance, and educational needs.
- Differentiating between relevant and irrelevant information.
- Examining relationships among teaching methods, learner characteristics, and learning outcomes.
- Identifying underlying causes of classroom and pedagogical problems.
- Analysing educational data to support instructional decision-making.

At this level, prospective teachers begin to develop systematic reasoning and evidence-informed professional judgement.

6.5 Level V: Evaluate

The **Evaluate** level represents advanced cognitive processing involving critical judgement, evidence-based decision-making, reflection, and appraisal. Prospective teachers are expected to assess the effectiveness, relevance, appropriateness, and limitations of educational practices using established criteria and evidence.

Key cognitive competencies include:

- Critically assessing teaching methods and pedagogical approaches.
- Evaluating curriculum content, instructional resources, and assessment strategies.
- Comparing alternative solutions to educational problems.
- Judging the effectiveness of teaching-learning interventions.
- Evaluating evidence and educational information critically.
- Engaging in reflective practice to identify strengths and areas for improvement.
- Making reasoned and evidence-based professional decisions.

Evaluation strengthens teachers' capacity to move beyond routine implementation and exercise informed professional judgement in complex educational contexts.

6.6 Level VI: Create

The **Create** level represents the highest level of cognitive processing within the CSDF and involves generating, designing, constructing, and developing original or substantially improved ideas, practices, products, or solutions. At this stage, prospective teachers integrate knowledge from multiple sources to address emerging educational needs creatively.

Key cognitive competencies include:

- Designing innovative curricula and instructional programmes.
- Developing new or adapted teaching-learning models.

- Creating learner-centred and technology-supported pedagogical strategies.
- Designing innovative assessment approaches.
- Developing solutions to complex classroom and educational problems.
- Integrating multidisciplinary knowledge into instructional practice.
- Designing educational resources and learning experiences appropriate to diverse learners.
- Generating innovative ideas for improving teaching effectiveness and learner outcomes.

The Create level reflects the development of teachers as **innovative educational practitioners** who are capable of generating knowledge and designing contextually relevant pedagogical solutions rather than merely implementing existing practices.

6.7 Cross-Cutting Dimensions of the CSDF

Although the six levels provide the principal hierarchical structure of the framework, the CSDF incorporates several **cross-cutting competencies** that operate throughout the entire cognitive progression. These include:

- **Critical thinking:** questioning assumptions, examining evidence, and making reasoned judgements.
- **Problem-solving:** identifying educational problems and generating appropriate solutions.
- **Metacognition:** monitoring, regulating, and evaluating one's own cognitive processes.
- **Reflection:** critically examining professional experiences and pedagogical decisions.
- **Creativity:** generating novel and contextually appropriate ideas and solutions.
- **Communication:** articulating reasoning, interpretations, evaluations, and innovative ideas effectively.
- **Collaboration:** engaging constructively with peers and professional communities to solve educational problems.
- **Digital and information literacy:** locating, evaluating, interpreting, and appropriately applying digital information and educational resources.

These dimensions ensure that cognitive development is understood as an interconnected process rather than a sequence of isolated skills.

6.8 Progressive Structure of the CSDF

The six levels can therefore be represented as a progressive cognitive continuum:

Remember → Understand → Apply → Analyze → Evaluate → Create

The progression begins with the acquisition and retrieval of foundational educational knowledge, advances towards conceptual understanding and practical application, and subsequently develops analytical reasoning, critical evaluation, and creative knowledge generation. At each level, prospective teachers are expected to demonstrate increasing cognitive complexity and greater capacity for independent professional judgement.

The framework is particularly compatible with the **competency-based and holistic orientation of NEP-2020**, as it establishes a conceptual relationship between learning outcomes, pedagogical processes, professional competencies, and assessment. It also supports the movement from **knowledge acquisition to knowledge application, critical inquiry, reflective judgement, and pedagogical innovation**.

6.9 Educational Significance of the CSDF

The proposed CSDF has potential significance for teacher education curriculum development, instructional planning, assessment design, and professional preparation. It can assist teacher educators in formulating measurable cognitive learning outcomes and selecting pedagogical approaches appropriate to different levels of

cognitive complexity. It can also facilitate the development of assessment strategies that move beyond recall-based examinations towards authentic tasks requiring analysis, evaluation, reflection, and creation.

Thus, the CSDF conceptualizes prospective teachers not merely as recipients of educational knowledge but as **critical thinkers, reflective practitioners, problem-solvers, and creators of innovative pedagogical knowledge**. In this respect, the framework provides a structured conceptual mechanism for translating the cognitive and competency-oriented aspirations of NEP-2020 into teacher education practice.

7. Alignment with NEP-2020

The **Cognitive Skill Development Framework (CSDF)** is closely aligned with the vision and guiding principles of the **National Education Policy 2020 (NEP-2020)**, particularly its emphasis on competency-based education, conceptual understanding, critical thinking, creativity, experiential learning, multidisciplinary engagement, and reflective professional practice. The six cognitive levels of the CSDF provide a systematic mechanism through which these broad policy objectives can be translated into identifiable and progressively developing competencies among prospective teachers.

The alignment between the major principles of NEP-2020 and the cognitive levels of the proposed CSDF is presented below.

NEP-2020 Principle	Cognitive Skill Alignment	Relevance to Prospective Teachers
Competency-Based Learning	Structured progression from Remember → Understand → Apply → Analyze → Evaluate → Create	Enables prospective teachers to progress from foundational knowledge to the demonstration of complex professional competencies through measurable learning outcomes.
Conceptual Understanding	Remember and Understand	Develops a strong foundation in educational concepts, theories, principles, policies, and pedagogical knowledge rather than relying on rote memorization.
Critical Thinking	Analyze and Evaluate	Enables prospective teachers to examine educational issues, identify assumptions, interpret evidence, compare alternatives, and make reasoned professional judgements.
Experiential Learning	Apply	Facilitates the translation of theoretical knowledge into authentic teaching situations through lesson planning, practice teaching, classroom activities, projects, and field experiences.
Inquiry-Based Learning	Analyze and Evaluate	Encourages prospective teachers to investigate educational problems, examine evidence, formulate interpretations, and develop evidence-informed solutions.
Problem-Solving	Apply, Analyze, and Evaluate	Develops the ability to identify classroom challenges, analyse their underlying causes, consider alternative strategies, and select appropriate solutions.
Creativity and Innovation	and Create	Encourages the development of innovative teaching strategies, learning resources, curricula, assessment

		practices, and context-sensitive pedagogical models.
Multidisciplinary Education	Analyze, Evaluate, and Create	Promotes integration of knowledge from different disciplines to understand complex educational issues and develop comprehensive learning experiences.
Reflective Teaching	Evaluate	Enables prospective teachers to critically examine their teaching practices, assess learning outcomes, identify areas for improvement, and make informed professional decisions.
Learner-Centred Education	Apply, Analyze, and Create	Supports the design of teaching-learning experiences responsive to learners' abilities, interests, backgrounds, learning needs, and individual differences.
Holistic Development	All Six Cognitive Levels	Provides a progressive cognitive foundation for developing intellectually capable, reflective, creative, adaptive, and professionally competent teachers.
Technology-Enabled Learning	Apply, Analyze, Evaluate, and Create	Develops teachers' ability to select, use, evaluate, and creatively integrate appropriate digital tools and educational technologies into teaching and learning.
Formative and Competency-Based Assessment	Understand, Apply, Analyze, Evaluate, and Create	Promotes assessment practices that measure not only knowledge recall but also application, reasoning, critical judgement, problem-solving, and creative performance.

7.1 Cognitive Progression and NEP-2020

The alignment demonstrates that the CSDF can function as a conceptual bridge between the policy aspirations of NEP-2020 and the cognitive development of prospective teachers. The progression from **Remember and Understand** establishes foundational conceptual knowledge; **Apply** facilitates experiential and practice-oriented learning; **Analyze and Evaluate** promote critical inquiry, problem-solving, and reflective professional judgement; and **Create** supports innovation, creativity, and pedagogical transformation.

7.2 Contribution to Competency-Based Teacher Education

NEP-2020 advocates a shift from content-centred education towards **competency-based and holistic learning**. In this context, the CSDF provides a structured cognitive progression through which competencies can be articulated, developed, practised, and assessed. Each cognitive level can be translated into observable learning outcomes and authentic assessment tasks, thereby strengthening the coherence between curriculum objectives, instructional strategies, learning experiences, and assessment.

7.3 Implications for Teacher Educators

For teacher educators, the CSDF provides a systematic basis for designing learning experiences that progressively increase cognitive complexity. Rather than limiting prospective teachers to theoretical knowledge, teacher education programmes can incorporate case analysis, reflective journals, classroom inquiry, lesson-design tasks, action research, collaborative problem-solving, simulations, projects, and innovative curriculum development.

7.4 Overall Alignment

The proposed CSDF is therefore conceptually consistent with the transformative vision of NEP-2020. It shifts the focus of teacher preparation from **knowledge acquisition to knowledge application, from routine implementation to critical analysis, and from reproduction of existing practices to creative and reflective professional action**. By integrating hierarchical cognitive development with experiential, inquiry-based, reflective, and innovative learning, the framework can contribute to the preparation of teachers who are capable of responding effectively to the diverse and evolving demands of twenty-first-century education.

8. Curriculum Implications

The proposed **Cognitive Skill Development Framework (CSDF)** has significant implications for the design and implementation of teacher education curricula. It suggests a progressive curriculum structure in which prospective teachers move from foundational knowledge towards application, critical analysis, reflection, and creative innovation.

8.1 Foundational Stage

The foundational stage should focus on **Remembering and Understanding**. Prospective teachers should develop conceptual clarity regarding educational theories, pedagogical principles, curriculum, assessment, learner development, and relevant provisions of NEP-2020. Interactive lectures, concept mapping, discussions, and guided learning may be employed.

8.2 Application Stage

The application stage should emphasize the **practical use of knowledge** through teaching practice, lesson planning, micro-teaching, simulations, and classroom-based activities. Prospective teachers should be encouraged to apply pedagogical theories and strategies in authentic or simulated teaching situations.

8.3 Analytical Stage

The analytical stage should develop **critical thinking and problem-solving abilities** through case studies, classroom observation, educational research, action research, group discussions, and problem-based learning. These experiences should enable prospective teachers to analyse classroom situations and make evidence-informed decisions.

8.4 Transformative Stage

The transformative stage should emphasize **evaluation, creativity, innovation, and reflective practice**. Prospective teachers should engage in curriculum design, development of innovative teaching-learning resources, reflective portfolios, technology-integrated pedagogy, and creative problem-solving activities.

Overall, the curriculum should facilitate a progressive movement from **knowledge acquisition to application, analysis, evaluation, and creation**, thereby supporting the competency-based and holistic vision of NEP-2020.

9. Assessment Framework

9. Assessment Framework

The proposed **Cognitive Skill Development Framework (CSDF)** requires an assessment system that progressively measures cognitive development from foundational knowledge to higher-order thinking, critical judgement, reflection, and creative production. In alignment with NEP-2020, assessment should move beyond conventional recall-based examinations and incorporate **formative, authentic, competency-based, and performance-oriented strategies**.

Cognitive Level	Primary Cognitive Focus	Suggested Assessment Strategy	Expected Evidence of Learning
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Remember	Recall recognition knowledge	and of	Objective tests, quizzes, short-answer questions	Accurate recall of concepts, theories, principles, terminology, and educational facts
Understand	Interpretation explanation	and	Concept mapping, explanatory writing, presentations, discussions	Ability to explain, summarize, classify, compare, and interpret educational concepts
Apply	Practical use of knowledge		Micro-teaching, lesson planning, teaching demonstrations, simulations	Ability to apply pedagogical theories and strategies in authentic teaching situations
Analyze	Examination of relationships problems	of and	Case analysis, classroom observation, problem-based tasks, research activities	Ability to identify problems, analyse causes, distinguish relevant information, and interpret classroom situations
Evaluate	Critical judgement and reflection		Reflective journals, peer assessment, teaching portfolios, critical reviews	Ability to critically assess teaching practices, evaluate evidence, justify decisions, and reflect on professional experiences
Create	Innovation knowledge generation	and	Innovation projects, curriculum design, instructional material development, action research	Ability to generate original ideas, design innovative solutions, and develop context-sensitive pedagogical practices

9.1 Formative Assessment

Formative assessment should be integrated continuously throughout the cognitive progression. Feedback from teacher educators, peers, and self-assessment can help prospective teachers identify strengths, address learning gaps, and progressively improve their cognitive and professional competencies.

9.2 Authentic and Performance-Based Assessment

Assessment at the higher cognitive levels should emphasize authentic tasks that resemble real professional responsibilities. **Micro-teaching, case studies, classroom-based projects, action research, reflective portfolios, curriculum development, and innovation projects** can provide meaningful evidence of prospective teachers' ability to apply, analyse, evaluate, and create.

9.3 Reflective and Self-Assessment

Reflective journals, self-assessment tools, peer feedback, and teaching portfolios should be incorporated to strengthen **metacognitive awareness and reflective practice**. These approaches encourage prospective teachers to monitor their learning, evaluate their professional decisions, and identify areas for continuous improvement.

9.4 Overall Assessment Progression

The assessment framework follows the progression:

Objective Assessment → Conceptual Assessment → Performance Assessment → Analytical Assessment → Reflective Assessment → Creative Assessment

Thus, the proposed assessment framework ensures that prospective teachers are assessed not merely on **what they know**, but also on **how they apply, analyse, evaluate, reflect upon, and creatively use knowledge** in educational contexts. This approach supports the competency-based, holistic, and higher-order learning objectives emphasized by NEP-2020.

10. Discussion

The integration of cognitive taxonomy with **NEP-2020** provides a systematic approach to developing higher-order cognitive competencies among prospective teachers. The proposed **Cognitive Skill Development Framework (CSDF)** organizes cognitive development progressively from **Remember and Understand to Apply, Analyze, Evaluate, and Create**, enabling prospective teachers to move beyond knowledge acquisition towards critical thinking, problem-solving, reflection, and innovation.

The framework strengthens **curriculum coherence** by connecting learning outcomes with progressively complex cognitive competencies. Foundational courses can emphasize conceptual understanding, while teaching practice, case studies, action research, and project-based activities can promote application and analysis. Advanced activities such as reflective practice, curriculum development, and innovation projects can further develop evaluation and creative thinking.

The CSDF also supports alignment between **pedagogy and assessment**. Learner-centred, experiential, inquiry-based, and problem-solving approaches can provide opportunities for higher-order thinking. Similarly, assessment can progress from objective tests and concept mapping to micro-teaching, case analysis, reflective journals, portfolios, and innovation projects. This enables assessment to measure not only what prospective teachers know but also how effectively they apply, analyse, evaluate, and create.

The framework further promotes **reflective and professional development** by encouraging prospective teachers to examine classroom problems, evaluate pedagogical decisions, and develop context-sensitive solutions. The Create level particularly supports the development of teachers as innovators capable of designing new teaching strategies, learning resources, and assessment practices.

Although the CSDF provides a theoretically grounded and policy-aligned framework, its effectiveness requires empirical validation. Overall, the integration of cognitive taxonomy with NEP-2020 offers a coherent pathway for developing **critical, reflective, creative, and professionally competent teachers** equipped to meet the demands of twenty-first-century education.

11. Implications

The proposed **Cognitive Skill Development Framework (CSDF)** has implications for institutional practice, educational policy, and future research. Its systematic integration can strengthen cognitive, reflective, and competency-based teacher preparation.

11.1 Institutional Implications

- **Curriculum Restructuring:** Align teacher education curricula, learning outcomes, pedagogy, and assessment with progressive cognitive levels.
- **Faculty Development:** Provide continuous training to teacher educators on higher-order thinking, innovative pedagogy, reflective practice, and competency-based assessment.

11.2 Policy Implications

- **Competency Standards:** Incorporate clearly defined cognitive competencies into teacher education standards and professional frameworks.
- **Assessment Reforms:** Promote assessment practices that measure application, analysis, evaluation, creativity, and problem-solving alongside foundational knowledge.

11.3 Research Implications

- **Empirical Validation:** Test the reliability, validity, applicability, and effectiveness of the CSDF through diverse empirical studies.
- **Longitudinal Studies:** Examine the development of cognitive competencies over time and their relationship with teaching effectiveness and professional growth.

Overall, the CSDF provides a practical conceptual basis for strengthening **competency-oriented, reflective, and higher-order cognitive development** in teacher education.

12. Limitations

The proposed **Cognitive Skill Development Framework (CSDF)** is conceptual in nature and therefore has certain limitations:

- **Conceptual Scope:** The framework is primarily grounded in existing theoretical perspectives and does not present empirical evidence of its effectiveness in teacher education.
- **Need for Empirical Validation:** The proposed cognitive levels, competencies, and relationships require systematic validation through quantitative and qualitative studies involving prospective teachers and teacher educators.
- **Contextual Applicability:** Its effectiveness may vary across institutions, disciplines, learner groups, and educational contexts; therefore, context-specific adaptations may be necessary.

Future research should empirically examine the framework's **reliability, validity, applicability, and impact** on the cognitive and professional development of prospective teachers.

13. Conclusion

The present conceptual study proposes the **Cognitive Skill Development Framework (CSDF)** as a structured taxonomy for strengthening the cognitive competencies of prospective teachers in alignment with the vision of **NEP-2020**. Grounded in established perspectives of cognitive development, constructivism, metacognition, and transformative learning, the framework organizes cognitive development progressively from **Remember and Understand to Apply, Analyze, Evaluate, and Create**.

The CSDF moves beyond knowledge acquisition by emphasizing **critical thinking, problem-solving, reflective practice, creativity, innovation, and professional decision-making**. Its integration into teacher education can facilitate greater alignment among curriculum objectives, pedagogy, learning experiences, and assessment practices, thereby supporting a shift from content-oriented preparation towards competency-based and holistic teacher development.

The framework provides a conceptual foundation for teacher educators, curriculum designers, policymakers, and researchers to systematically promote higher-order cognitive competencies among prospective teachers. However, its effectiveness requires empirical investigation across diverse educational contexts. Future research should therefore focus on validating the framework and examining its impact on teaching competence and professional development.

Overall, the CSDF offers a theoretically grounded and policy-aligned pathway for preparing **reflective, analytical, creative, and professionally competent teachers** capable of responding effectively to the evolving demands of twenty-first-century education.

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