Impact Factor (SJIF): 6.126 E-ISSN: 2583-1615, P-ISSN: 3049-3498

International Journal of Research in Academic World

Received: 04/November/2025 IJRAW: 2025; 4(12):112-115 Accepted: 16/December/2025

Universal Design for Learning as a Pedagogical Framework for Implementing NEP 2020 in School Science Education

*1(a, b)Jyoti

*1(a)Research Scholar, IGNOU, Delhi, India.

(b)Assistant Professor, SCERT, Delhi, India.

Abstract

The National Education Policy 2020 envisions a reorientation of school science education toward competency-based, inclusive, and learner-centred pedagogical practices that prioritise conceptual understanding, inquiry, and meaningful engagement with scientific ideas. While the policy outlines a progressive curricular vision, science teachers often encounter challenges in translating these expectations into everyday classroom practices, particularly in contexts marked by learner diversity, varied readiness levels, and differing modes of participation. Addressing this gap requires instructional frameworks that can systematically connect policy intent with classroom-level pedagogy.

This paper examines Universal Design for Learning (UDL) as a pedagogical framework capable of operationalising the vision of NEP 2020 in school science education. Originally developed by the Center for Applied Special Technology (CAST), UDL is grounded in research-based principles that emphasise multiple means of representation, engagement, and expression in instructional design. Adopting a qualitative, practice-oriented approach, the study analyses the conceptual alignment between UDL principles and the pedagogical expectations articulated in national curriculum reforms. Policy and curriculum analysis is complemented by classroom-informed instructional perspectives to illustrate how UDL can support conceptual clarity, inquiry-oriented learning, and inclusive participation in science classrooms.

The analysis highlights the potential of UDL to function as a mediating framework that bridges curriculum policy and classroom practice by embedding flexibility within lesson design, learner engagement strategies, and assessment practices, without compromising academic rigour. By positioning UDL as an instructional pathway rather than a compensatory strategy, the paper contributes to the discourse on curriculum implementation and inclusive pedagogy. The study underscores the relevance of UDL for realising the goals of NEP 2020 in school science education, with implications for teachers, curriculum developers, and teacher education programmes.

Keywords: Universal Design for Learning, School Science Education, National Education Policy 2020, Inclusive Pedagogy, Curriculum Implementation, Learner-Centred Instruction.

1. Introduction

School science education in India is currently experiencing a period of substantial curricular and pedagogical transformation, shaped by growing recognition of learner diversity, changing societal needs, and the demand for meaningful engagement with scientific knowledge. Contemporary educational discourse increasingly emphasises that science learning should move beyond factual recall to foster conceptual understanding, inquiry, reasoning, and application of knowledge in real-life contexts. In response to these shifts, the National Education Policy 2020 articulates a comprehensive vision for school education that foregrounds competency-based learning, inclusivity, and learner-centred pedagogy [1]. Within this vision, science education is positioned as a means to develop scientific temper, critical thinking, and problem-solving abilities rather than as a vehicle for rote memorisation.

While NEP 2020 provides a strong policy foundation, the realisation of its goals depends on curriculum frameworks and pedagogical approaches that can effectively translate policy intent into classroom practice. The National Curriculum Framework for School Education 2023 operationalises the vision of NEP 2020 by outlining specific curricular expectations, pedagogical principles, and assessment orientations for school education, including science [2]. NCFSE 2023 emphasises learner-centred instruction, inquiry-based learning, conceptual clarity, and flexibility in pedagogy and assessment. It explicitly acknowledges learner variability in terms of prior knowledge, linguistic background, learning pace, and motivational factors, calling for instructional designs that respond to such diversity while maintaining common learning goals.

Despite the clarity of policy and curricular guidance, several recent studies indicate that science teachers often face difficulties in enacting inclusive and competency-oriented practices in everyday classroom contexts [3, 4] Traditional instructional approaches—characterised by uniform teaching methods, textbook-driven explanations, and limited

*Corresponding Author: Jyoti

assessment formats—continue to dominate many science classrooms. Such approaches may inadequately support diverse learners and can restrict opportunities for active engagement with abstract scientific concepts, particularly for students who require varied representations, flexible pacing, or alternative modes of expression. This persistent gap between curriculum aspirations and classroom realities highlights the need for pedagogical frameworks that support intentional, flexible, and inclusive instructional design.

Universal Design for Learning (UDL) has emerged in recent literature as a research-informed framework that addresses learner variability through proactive instructional planning rather than reactive accommodations [5]. Developed by the Center for Applied Special Technology (CAST), UDL is grounded in neuroscience and learning sciences and is structured around three core principles: multiple means of representation, engagement, and expression. Contemporary research over the last five years has increasingly highlighted the relevance of UDL for inclusive classroom practices, curriculum implementation, and teacher professional development across subject areas, including science [6, 7]. Rather than lowering academic expectations, UDL emphasises maintaining shared learning goals while offering flexibility in how learners access content, participate in learning, and demonstrate understanding.

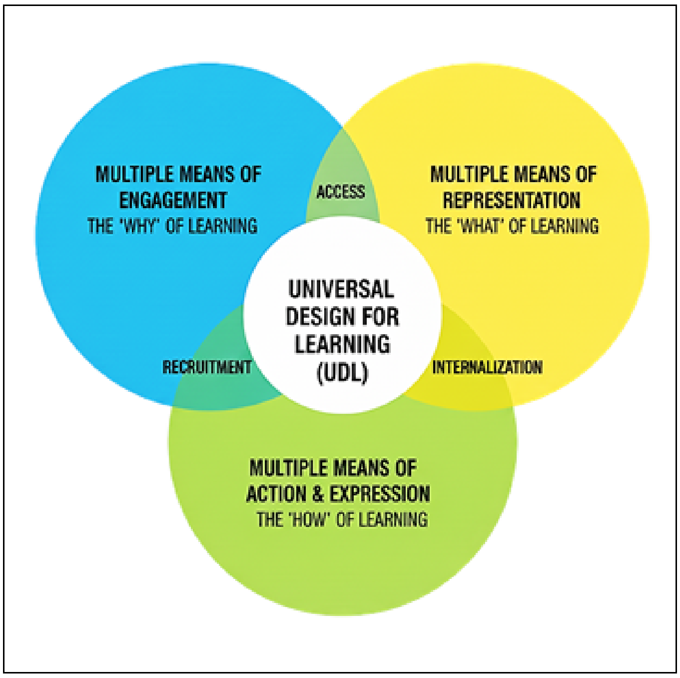

Fig 1: UDL principles: Engagement, Representation, and Expression.

The relevance of UDL is particularly pronounced in school science education, where abstract concepts, symbolic representations, and inquiry-based processes can pose challenges for learners with differing levels of readiness, confidence, and prior experience. Recent studies suggest that UDL-aligned instructional design can support conceptual understanding, learner engagement, and inclusive participation in science classrooms by integrating varied representations, meaningful contexts, and flexible assessment practices [8]. However, despite growing international interest, there remains limited analytical work within the Indian context that explicitly examines how UDL can serve as a pedagogical bridge between national education policy and curriculum frameworks in science education.

Against this backdrop, the present paper examines Universal Design for Learning as a pedagogical framework for implementing the vision of NEP 2020 in school science education, using NCFSE 2023 as the operational curriculum reference. The purpose of the study is to analyse the conceptual alignment between UDL principles and national curriculum expectations and to explore how UDL can function as a practical instructional pathway for inclusive and competency-based science education. The scope of the paper is limited to a qualitative, conceptual analysis of policy, curriculum, and pedagogy, without examining student achievement outcomes. While this limits empirical generalisation, the analysis offers theoretically grounded and practice-oriented insights that may inform teachers, curriculum developers, and teacher education programmes engaged in implementing contemporary science education reforms.

2. Materials & Methods

The study adopted a qualitative, descriptive, and analytical research design to examine how the pedagogical vision articulated in the National Education Policy 2020 can be operationalised in school science education through the instructional framework provided by the National Curriculum Framework for School Education 2023, using Universal Design for Learning (UDL) as the guiding analytical lens [1, 2]. The design was non-experimental in nature and did not involve intervention testing or outcome measurement. Instead, it focused on systematic policy–curriculum–pedagogy analysis to generate conceptually grounded and reproducible instructional insights relevant to science education.

The primary materials for the study consisted of official national policy and curriculum documents. The National Education Policy 2020 served as the foundational policy source outlining national priorities related to competency-based learning, inclusion, learner-centred pedagogy, and scientific temper. The National Curriculum Framework for School Education 2023 functioned as the principal operational document, detailing curricular expectations, pedagogical principles, and assessment orientations specific to school science education in alignment with NEP 2020. In addition, authoritative and recent scholarly literature on Universal Design for Learning was consulted to identify and define its core principles of multiple means of representation, engagement, and expression, as developed by the Center for Applied Special Technology (CAST) [5, 9]. Supporting peer-reviewed studies in science education and inclusive pedagogy published within the last five years were used to contextualise classroom-level instructional implications [6, 8].

The study followed a clearly articulated, step-by-step analytical procedure to ensure transparency and reproducibility. In the first step, key policy directives related to school science education were identified from the National Education Policy 2020, with particular emphasis on competency-based learning, conceptual understanding, inquiry orientation, learner agency, and inclusive practices [1]. In the second step, pedagogical and curricular expectations for science education were systematically extracted from the National Curriculum Framework for School Education 2023, focusing on instructional flexibility, learner diversity, experiential learning, and assessment reform [2].

In the third step, the core principles of Universal Design for Learning were delineated from recent and authoritative UDL literature to establish an instructional design framework capable of addressing learner variability [5, 9]. In the fourth step, an analytical mapping process was undertaken to examine how UDL principles align with and support the implementation of NEP 2020 goals as operationalised through the NCFSE 2023 science framework. This mapping informed the conceptual linkages presented in the Results and Discussions section.

In the final step, classroom-informed pedagogical interpretations were applied to illustrate how the aligned principles could be enacted in school science instruction through lesson design, engagement strategies, and flexible modes of learner expression. By following this structured procedure, other researchers may replicate the analysis by applying the same framework to curriculum documents or instructional contexts guided by NEP 2020 and NCFSE 2023, thereby ensuring methodological transparency and scholarly rigour.

3. Results & Discussion

The results of the present analysis indicate a strong conceptual and pedagogical alignment between the principles of Universal Design for Learning (UDL) and the vision of school science education articulated in the National Education Policy 2020 [1]. The analysis is based on systematic examination of policy directives, curriculum expectations, and instructional principles rather than numerical observations or statistical testing, as the study is qualitative and analytical in nature. The findings are therefore presented in terms of thematic convergence, pedagogical coherence, and instructional feasibility, which are appropriate indicators for curriculum and policy implementation studies.

Alignment of UDL with Competency-Based Science Education

One of the most significant findings is the close correspondence between NEP 2020's emphasis on competency-based science learning and UDL's focus on learner variability and flexible instructional design. NEP 2020 foregrounds conceptual understanding, inquiry, scientific reasoning, and application of knowledge as central outcomes of science education [1]. These priorities align directly with UDL's principle of multiple means of representation, which encourages teachers to present scientific concepts through varied formats such as diagrams, models, demonstrations, simulations, contextual examples, and guided discussions. This alignment supports the development of deep conceptual understanding without altering curricular goals or content standards [5, 9].

Recent studies indicate that UDL-aligned instructional approaches enhance learners' access to complex scientific concepts by offering multiple representations that accommodate differences in cognitive strengths and prior knowledge [5, 6]. Such approaches enable learners to engage with content through varied pathways, thereby supporting deeper conceptual understanding. Compared to traditional single-mode instruction, UDL-based practices provide greater instructional flexibility while preserving disciplinary rigour [7]. This balance is particularly significant within competency-based science education reforms, where sustaining conceptual depth alongside inclusive participation remains a central pedagogical concern. Furthermore, recent science education research suggests that UDL-aligned instructional design supports inquiry-oriented learning and active student engagement without fragmenting curricular goals, thereby strengthening coherence between instructional intent and learning outcomes in diverse classrooms [8].

Table 1: Alignment of UDL Principles with NEP 2020 Expectations in Science Education

UDL Principle	Instructional Focus in Science	Alignment with NEP 2020
Multiple Means of Representation	Conceptual clarity and understanding	Emphasis on conceptual learning
Multiple Means of Engagement	Inquiry, motivation, relevance	Learner agency and active participation
Multiple Means of Expression	Demonstration of learning	Flexible and formative assessment

Learner Engagement and Inquiry-Oriented Science Learning

The analysis further highlights the relevance of UDL in addressing learner engagement, which is identified in NEP 2020 as a critical requirement for effective science education [1]. Inquiry-based learning, curiosity-driven exploration, and meaningful student participation are central to the policy's vision. UDL's engagement principle supports these aims by encouraging varied instructional entry points, real-life contexts, collaborative learning opportunities, and choice-based activities.

Compared with conventional instructional approaches that rely heavily on teacher explanation and textbook exercises, UDL-based engagement strategies provide multiple pathways for learners to connect with scientific ideas. Empirical reviews conducted in the last five years suggest that such flexibility contributes to improved motivation, sustained attention, and active participation, particularly among learners who may otherwise remain disengaged in uniform instructional settings [6, 7]. The present analysis reinforces these findings by demonstrating that UDL offers a structured framework for embedding engagement within lesson design rather than treating it as an incidental outcome.

Inclusion and Equity in Science Classrooms

Inclusive education emerges as another area of strong alignment between NEP 2020 and UDL. The policy positions equity and inclusion as foundational principles across all stages of schooling, emphasising the need to address diverse learner needs within mainstream classrooms [1]. UDL operationalises these principles by embedding accessibility within instructional planning, thereby reducing reliance on remedial or post-instructional accommodations.

The principle of multiple means of expression is particularly relevant in science education, where traditional assessment practices often privilege written responses and numerical problem-solving. UDL allows learners to demonstrate understanding through varied modes such as oral explanations, diagrams, models, practical demonstrations, and digital artefacts, while still working toward shared learning objectives. Recent literature indicates that such flexibility supports inclusive participation without compromising assessment validity [7, 8].

Table 2: Pedagogical Applications of UDL in School Science Instruction

Instructional Dimension	UDL-Based Pedagogical Approach
Explanation of concepts	Use of multiple representations and contextual examples
Student participation	Flexible engagement strategies and inquiry-based tasks
Assessment of learning	Varied modes of expression and formative feedback

Classroom Feasibility and Resource Considerations

From a classroom feasibility perspective, the analysis indicates that UDL-based science instruction does not require extensive technological infrastructure. While digital tools can enhance UDL implementation, many strategies—such as varied questioning techniques, use of physical models, peer discussion, and flexible assessment formats—can be implemented using low-threshold resources. This finding aligns with recent studies that caution against equating UDL exclusively with technology-driven instruction and instead emphasise its value as an instructional design framework adaptable to diverse school contexts [5, 6].

This aspect is particularly significant for public and resource-constrained school settings, where infrastructure limitations often pose challenges to curriculum reform. By focusing on instructional design rather than material abundance, UDL offers a realistic pathway for implementing NEP 2020's science education vision across varied contexts.

In comparison with earlier studies on inclusive pedagogy and science education, the present analysis extends existing work by explicitly linking national policy, curriculum framework, and instructional design within a single analytical framework [4, 10]. While previous research has documented the benefits of UDL for learner engagement and accessibility, fewer studies have examined its role as a mediating framework for curriculum implementation in the context of national education reforms. The findings of this study therefore contribute to the literature by positioning UDL as a practical instructional pathway for translating policy aspirations into classroom practice.

The findings of this study should be interpreted in light of certain limitations. As a qualitative, analytical study, the results are based on policy and curriculum analysis rather than empirical measurement of student outcomes. While this limits statistical generalisation, the study offers theoretically grounded and practice-oriented insights that are valuable for curriculum implementation and instructional planning. Future empirical studies may build upon this framework to examine classroom enactment and learner outcomes in greater detail.

Overall, the results indicate that Universal Design for Learning provides a structured yet adaptable pedagogical framework for implementing the science education vision of NEP 2020. By aligning instructional design with curriculum expectations, UDL supports conceptual understanding, learner engagement, and inclusive participation in school science classrooms. The findings address a critical gap between policy intent and classroom practice and offer actionable insights for teachers, curriculum developers, and teacher education programmes engaged in contemporary science education reform.

Conclusion

The present paper positions Universal Design for Learning as a pedagogically coherent and practically viable framework for realising the vision of school science education articulated in the National Education Policy 2020. By foregrounding competency-based learning, conceptual understanding, inquiry, and inclusion, NEP 2020 calls for instructional approaches that move beyond uniform teaching methods and respond effectively to learner variability. The analysis demonstrates that the principles of UDL align closely with these curricular priorities and offer concrete pathways for translating policy intent into classroom practice.

The alignment between UDL and NEP 2020 is particularly evident in the context of science education, where abstract concepts, diverse learner needs, and inquiry-based processes demand flexible instructional design. Through multiple means of representation, engagement, and expression, UDL enables science teachers to design lessons that maintain disciplinary rigor while accommodating differences in readiness, motivation, and learning preferences. Importantly, this flexibility is embedded within instructional planning rather than treated as an add-on, thereby supporting inclusive participation as a core classroom norm.

From an implementation perspective, the study highlights that UDL-based science instruction is feasible within regular school settings and does not depend on extensive technological or infrastructural resources. Instead, it emphasises thoughtful lesson design, varied instructional strategies, and formative assessment practices that align with the broader goals of curriculum reform. By functioning as a mediating framework between curriculum policy and classroom enactment, UDL supports teachers in addressing the practical challenges associated with implementing NEP 2020 in science education.

Overall, the paper contributes to the discourse on curriculum implementation by establishing UDL as an instructional framework that strengthens coherence between national education policy and everyday science teaching practices. Integrating UDL within school science education holds significant promise for advancing inclusive, engaging, and conceptually meaningful learning experiences envisioned under NEP 2020.

References

1. Ministry of Education. *National Education Policy 2020*. New Delhi: Government of India; 2020.
2. National Council of Educational Research and Training. *National Curriculum Framework for School Education 2023*. New Delhi: NCERT; 2023.
3. Rao K, Meo G. Using Universal Design for Learning to design inclusive instruction. *Interv Sch Clin*. 2021;56(4):225–232.
4. Florian L, Beaton M. Inclusive pedagogy in policy and practice: Implications for curriculum reform. *Curric J*. 2021;32(2):179–197.
5. Rose DH, Meyer A, Gordon D. Universal Design for Learning: Theory, principles, and practice. *J Spec Educ Technol*. 2021;36(1):1–12.
6. Al-Azawei A, Serenelli F, Lundqvist K. Universal Design for Learning (UDL): A content analysis of peer-reviewed journal papers from 2012 to 2021. *Int Rev Res Open Distrib Learn*. 2022;23(1):1–21.
7. Ok MW, Rao K, Bryant BR, McDougall D. Universal Design for Learning in pre-K–12 classrooms: A systematic review of research. *Remedial Spec Educ*. 2021;42(2):116–129.
8. Kennedy MJ, Thomas CN, Meyer JP. Designing instruction for learner variability in science classrooms using Universal Design for Learning. *Sci Educ*. 2022;106(4):742–764.
9. CAST. *Universal Design for Learning Guidelines Version 3*. Wakefield: Center for Applied Special Technology; 2024.
10. Darling-Hammond L, Flook L, Cook-Harvey C, Barron B, Osher D. Implications for educational practice of the science of learning and development. *Appl Dev Sci*. 2020;24(2):97–140.