



International journal of interdisciplinary and multidisciplinary research

ISSN 2456-4567 (O)

Applied Mathematics in Secondary Education: A Critical Analysis of Resource Gaps and Assessment Discrepancies in Grades IX and XII

Ms Mansi Singh

Abstract: The introduction of Applied Mathematics (Subject Code 241) by the central Board of Secondary Education (CBSE) in 2020 marked a paradigm shift toward competency-based learning, as envisioned by National Education Policy (NEP) 2020. Designed to provide practical mathematical tools for Commerce and Humanities students, the subject promised a departure from theoretical rigor toward real-world utility. However, five years post-implementation, the curriculum faces a "credibility crisis." This paper critically analyses the systemic resource gaps, specifically the absence of standardized National Council of Educational Research and Training (NCERT) textbooks and the consequent over-reliance on private publishers. Furthermore, it examines the 2026 Class XII Board Examination as a case study for assessment discrepancies, where "out-of-syllabus" content and technical errors (such as missing Poisson distribution constants) led to significant student distress. By evaluating the "Institutional Transition Cost" (ITC) and pedagogical fatigue among educators, this study highlights the growing chasm between curriculum intent and classroom reality. The paper concludes with a call for urgent regulatory intervention, standardized resources, and transparent moderation policies to restore the integrity of the Applied Mathematics stream.

Keywords: Applied Mathematics, CBSE, NEP, Commerce, Humanities, Competency based learning.

Introduction:

Applied Mathematics (Subject Code 241) was introduced by the Central Board of Secondary Education in the 2020–2021 academic session as an elective subject at the secondary and senior secondary levels (1,2). It was a strategic move by the CBSE to align school education with the National Education Policy (NEP) 2020, focusing on competency-based learning.



This initiative aimed to bridge the gap between mathematical concepts and their practical applications in real-life contexts which is designed primarily for students in the Commerce and Humanities streams, the subject focuses on equipping learners with mathematical tools relevant to disciplines such as Economics, Finance, and Social Sciences. Unlike Core Mathematics (Subject Code 041), which emphasizes theoretical rigor, proofs, and advanced trigonometric concepts, Applied Mathematics prioritizes practical problem-solving and data-oriented approaches. The introduction of this subject marked a shift from a uniform mathematical curriculum toward a more flexible and application-driven model in Indian school education. The first batch of Class XII students studied and were assessed under this curriculum in 2021, establishing Applied Mathematics as a credible and meaningful academic alternative. The applied mathematics

Year	Evolution of Applied Mathematics in senior secondary education
2020	Introduction of Applied Mathematics (241) for Class XI elective stream
2021	Inaugural Class XII Board Examination for Applied Mathematics
2022	CBSE has conducted board first time
2023	Release of NCF-SE mandate for practical, application-based lower-grade learning
2026	Implementation of revised Class IX syllabus with integrated applied modules

Eligibility Criteria for CBSE Applied Mathematics (Class XI) (2)

Students who have successfully passed Basic Mathematics (241) or Standard Mathematics (041) in the Class X CBSE examination are eligible to pursue Applied Mathematics at the Senior Secondary level (Classes XI-XII).

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Key Clarifications:

- I. Dual Qualification Eligibility: Both Basic Math (241) and Standard Math (041) passers from Class X qualify for Applied Mathematics (Subject Code: 241).
- II. Restriction on Standard Mathematics: Students who passed only Basic Mathematics (241) in Class X cannot opt for Mathematics Standard (041) at Senior Secondary level.

This is reflected in **CBSE Circular No. CBSE/Coord/Maths-041-241/2025**, the board extended a crucial relaxation for the 2025–26 session, allowing students who opted for "Mathematics Basic" in Class X to choose either Applied or Core



Mathematics in Class XI, provided the Head of the Institution is satisfied with their aptitude (3).

Major Challenges:-

- I) **Non availability of official standard text book:** Even after 5-year inclusion of applied math in curriculum, NCERT has not release official test book.
- II) **Dependence private publisher:** While NCERT remains the gold standard for board preparation, the delay in releasing a dedicated Applied Math text has led to private publishers (4,5).
- III) **Lack of government-issued alternatives to Schools:** They are currently reliant on external authors such as **M.L. Aggarwal and Neeraj Raj Jain**, whose 2026–27 editions have become the de facto standard due to the lack of government-issued alternatives (4,5).
- IV) **Syllabus Inconsistency:** Without a centralized text, teachers report difficulty in gauging the "depth of treatment" for complex units like *Inferential Statistics* and *Time-Based Data*, leading to varied teaching standards across regions
- V) **Institutional Transition Cost (ITC):-** In this context refers to the loss of educational quality during the switch from Core to Applied Math.
- VI) **Skill Gaps:** As noted in contemporary pedagogical reviews, many senior educators are trained in "Pure Mathematics" (calculus-heavy). The shift toward **Financial Mathematics** (EMI calculations, sinking funds, and taxation) requires a different skill set that many schools have not yet supported with formal training workshops.
- VII) **Unavailability teacher in school:** - This mainly seen in 2nd and 3rd tier city and rural school affiliated to school. Author has faced problem to find school with applied math teacher Gorakhpur city. There is high demand of core mathematics demotivate teacher to focus applied mathematics,
- VIII) **Pedagogical Fatigue:** Educators articulate dissatisfaction over the shifting criteria of the syllabus, wherein sample examinations frequently incorporate application-based reasoning absents from the restricted study resources provided.
- IX) **Increased Workload:** Teachers must create or source additional materials to bridge the gap, leading to stress and burnout.
- X) **Bad Impact on Students:** Students may lose confidence or interest if what they study does not reflect what is tested.
- XI) **Financial Burden on parents** – To buy private publisher book and tuition cost



The 2026 Examination Controversy

- a) The Class XII Board Examination in March 2026 became a flashpoint for students. Reports across educational forums highlighted several "out-of-syllabus" and "technical error" concerns.
- b) **Section D and E Discrepancies:** Multiple questions in the 2026 paper were flagged for requiring values (e.g., specific log values or $e^{-\lambda}$ for Poisson Distribution) that were not provided in the paper, a requirement clearly stated in the **CBSE Sample Question Paper 2025–26**: Question number 19 was asked inverse trigonometry which was not in the syllabus of applied mathematics. Similarly question number 35 and 37(ii) were out of syllabus (6).
- c) **Topic Overlap:** Questions from Core Math (such as advanced Inverse Trigonometry) reportedly appeared in the Applied Math paper, despite being excluded from the official Code 241 syllabus update.
- d) **QR code Controversies:** -During the CBSE Class 12 Mathematics examination in 2026, students in Noida and other regions reported that a QR code printed on the official question paper led to a "Rickroll"—a famous internet prank where users are redirected to Rick Astley's 1987 music video, "Never Gonna Give You Up." The discovery caused immediate confusion and speculation regarding the security and authenticity of the examination materials. While QR codes are typically used by the board for administrative tracking, logistics, and preventing paper leaks, this specific code functioned as an active hyperlink to external entertainment content. *The Times of India* independently verified the claims by scanning the code, confirming it redirected to the 10-second music clip. The board later clarified that these codes are meant for internal encryption and urged students to focus on their academic performance rather than social media speculation (7,8,9,10). The CBSE's official stance is typically that these codes are not for student use. From their perspective, the "carelessness" lies in students using mobile devices or scanning codes they were not instructed to scan. However, in 2026, where digital literacy is high, placing a "live" prank on a formal document is widely regarded by educational experts as a significant administrative embarrassment

We came to know that during evaluation, 6 marks were awarded to the student who has awarded 6 mark who have attempted these questions (11,12,13).

Impact on Students in the Examination Hall



Increased Stress and Anxiety: Encountering out-of-syllabus and technically erroneous questions can cause immediate panic and self-doubt, raising students' anxiety levels and disrupting their focus.

Wasted Time: Students may spend precious minutes struggling to recall or solve unfamiliar problems, reducing the time available for questions they could have confidently answered.

Loss of Confidence: Facing unexpected topics (such as Inverse Trigonometry in Applied Math) may cause students to question their preparation, leading to a significant drop in self-confidence during the exam.

Inequity Among Students: Those with access to extra coaching or advanced material might attempt such questions, while others relying solely on prescribed resources feel disadvantaged and demoralized.

Reduced Performance: The psychological impact of unclear or out-of-syllabus questions can affect overall performance, with students potentially making mistakes even in familiar sections due to shaken confidence.

Distrust in the System: Experiencing such discrepancies firsthand can lead to a long-term distrust in the examination process and educational authorities, impacting students' motivation and faith in academic fairness. Such controversies not only undermine students' performance on the day of the exam but also have lasting effects on their confidence and perception of the education system.

Steps to Be Taken by Regulators

Strict Paper Moderation and Verification: Implement multi-level scrutiny of question papers by subject experts to ensure alignment with the official syllabus and sample papers before finalization.

Transparent Communication: Clearly communicate any syllabus changes or clarifications to all stakeholders—schools, teachers, and students—well in advance of the examination.

Prompt Redressal Mechanism: Establish a dedicated helpline or portal for students and teachers to report discrepancies immediately after the exam, ensuring their concerns are heard and addressed promptly.

Fair Evaluation Policies: If out-of-syllabus or erroneous questions are discovered post-exam, adopt student-friendly evaluation methods, such as awarding full marks for problematic questions or providing alternative grading options.

Regular Syllabus Updates: Update official textbooks, sample papers, and online resources regularly to accurately reflect the current curriculum and assessment standards.



Awareness and Training: Organize periodic workshops for teachers and paper setters to familiarize them with the latest syllabus, exam patterns, and common pitfalls in question setting.

Public Accountability: Commit to releasing detailed post-exam reports addressing student complaints, actions taken, and steps for future improvement to restore trust in the examination system.

By implementing these steps, regulators can help ensure fairness, reduce anxiety, and restore confidence among students, teachers, and the broader educational community.

To fulfil the promises of NEP 2020, educational regulators must move beyond policy drafting and into active resource provision. This includes:

- **Standardization:** Immediate release of NCERT-backed resources to eliminate the financial and academic burden of private-textbook dependency.
- **Capacity Building:** Targeted workshops to bridge the skill gap between "Pure" and "Applied" mathematics for veteran educators.
- **Accountability:** Establishing a transparent, pre-exam audit of question papers to ensure technical accuracy (e.g., providing log/Poisson values) and syllabus adherence.

Ultimately, the success of Applied Mathematics depends not on the complexity of its modules, but on the reliability of the ecosystem that supports it. Only by addressing these resource gaps and assessment discrepancies can the CBSE ensure that this "application-driven model" remains a viable and respected pathway for the future workforce.

Conclusion -The evolution of Applied Mathematics from a strategic elective to a core component of senior secondary education has reached a critical juncture. While the intent—to bridge the gap between abstract theory and financial literacy—remains sound and necessary, the execution has been marred by a lack of institutional scaffolding. The findings of this analysis reveal that the "Applied" stream is currently being treated as a secondary priority compared to Core Mathematics, evidenced by the persistent absence of official NCERT textbooks and the lack of specialized teacher training in tier-2 and tier-3 cities like Gorakhpur. The 2026 examination controversy serves as a stark reminder that without strict paper moderation and syllabus alignment, students are unfairly penalized for systemic failures. The awarding of compensatory marks, while a necessary short-term fix, does not address the underlying "Pedagogical Fatigue" or the erosion of student confidence in the examination board.

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DOI: <https://doi.org/10.54121/202111519>