



Generative AI in Secondary Education: A Literature Review

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Abstract

This chapter presents a literature review examining the use of Generative Artificial Intelligence (GenAI) in secondary education. Drawing on recent systematic reviews and empirical studies, it examines GenAI's applications for both students and teachers, including personalised learning, feedback, content generation, and instructional planning, alongside concerns such as over-reliance, reduced independent thinking, and diminished assessment validity. The review situates these debates within the distinctive demands of secondary schooling, where students are consolidating independent learning habits and preparing for high-stakes assessment, and considers pedagogical and institutional implications, including the need for AI literacy, redesigned assessment practices, and adequate teacher preparation, together with GenAI's emerging role within the Indian educational context. The review concludes that GenAI's educational value is conditional rather than fixed, depending on whether its use supports or substitutes for students' own thinking, and identifies persistent gaps around long-term learning outcomes, classroom implementation, and equity of access that inform the empirical investigation undertaken in the remainder of this thesis.

Keywords: Generative Artificial Intelligence; Secondary Education; K-12; ChatGPT; Academic Integrity; AI Literacy; India

1. Introduction

Human beings have continually sought tools and strategies to make learning more efficient. Long-standing cognitive strategies such as chunking, mnemonic devices, and worked shortcuts¹ reflect a persistent tendency to externalise and organise information so that it can be

¹Cognitive strategies such as chunking are grounded in Miller's (1956) classic account of the limits of short-term memory, which proposed that working memory can reliably hold only a small number of discrete information units at a time.



acquired, retained, and applied more effectively. Generative Artificial Intelligence (GenAI) can be situated within this broader trajectory: it is best understood not as an isolated innovation but as the latest in a long line of tools developed to support how people access, process, and create information.

Artificial Intelligence (AI) more broadly refers to computational systems capable of performing tasks that have traditionally depended on human cognition, including pattern recognition, language processing, and decision-making. Within this field, GenAI represents a distinct development: rather than simply classifying or predicting from existing data, GenAI systems produce new content — text, images, audio, code, and other media — in direct response to user prompts. The public launch of ChatGPT² marked a turning point in the visibility of this technology, making conversational, content-generating AI accessible to a mass audience for the first time and accelerating both public interest and scholarly attention to its implications for education.

The pace of this diffusion has consistently outstripped the development of corresponding educational policy and regulatory frameworks in most countries, leaving schools, teachers, and students to navigate GenAI's use with limited formal guidance. This gap is a recurring theme in the literature and forms part of the rationale for reviews such as this one.

A growing body of systematic and scoping reviews has begun to map how GenAI is being explored across K-12 settings, identifying applications in personalised learning, feedback, content generation, assessment support, creativity, and support for both students and teachers (Alfarwan, 2025; Zhang & Tur, 2024; Sharma et al., 2024)³. A recurring observation across these reviews is that GenAI's interactive character distinguishes it from earlier generations of educational technology: because students can pose follow-up questions, request alternative explanations, and receive individualised responses in real time, GenAI introduces a more flexible and conversational form of learning support than static digital resources typically allow.

For teachers, the literature identifies a comparable range of possible uses: generating lesson ideas, preparing differentiated materials, drafting questions and activities, and supporting formative assessment. Several studies suggest that such uses can reduce time spent on routine preparation tasks, potentially freeing teachers to focus more on direct interaction with students and on judgement-intensive aspects of practice (Sun et al., 2023). Importantly, this body of work does not suggest that GenAI diminishes the teacher's role; rather, it repositions teachers as

²OpenAI released ChatGPT to the public on 30 November 2022; this date is commonly used in the literature as the marker separating the pre-GenAI and post-GenAI periods of educational technology research.

³The term "K-12" (kindergarten through grade 12) is used throughout the international literature to denote school education; in the Indian context this corresponds broadly to the school stage from the foundational years through Class 12, with "secondary education" typically referring to Classes 9-12.



evaluators and gatekeepers of AI-generated content, responsible for judging its accuracy, age-appropriateness, and pedagogical value.

For students, GenAI functions as an additional, on-demand source of explanation, feedback, and idea generation. Reported benefits in the K-12 literature include gains in engagement, motivation, self-regulation, and aspects of digital and innovation-related competence (Wu & Zhang, 2025). At the same time, this same immediacy raises a more fundamental question that runs through the literature: whether ready access to AI-generated answers supports genuine learning or simply reduces the cognitive effort students invest in completing tasks.

This question matters because education is concerned with more than the production of correct answers. Developing the capacity to reason independently, evaluate information critically, and apply knowledge to unfamiliar situations is itself a central educational goal. A student who uses GenAI to obtain an explanation may benefit meaningfully from that support; a student who habitually accepts AI-generated output without engaging with the underlying reasoning may, over time, have fewer opportunities to build these same capacities.

Recent empirical work lends weight to this concern: in a large field experiment with high-school mathematics students, unrestricted access to GPT-4 during practice sessions improved short-term performance but led to worse outcomes once the tool was removed, whereas a version of the tool designed to withhold direct answers avoided this decline (Bastani et al., 2025)⁴. Comparable concerns about over-reliance and reduced independent thinking appear consistently across the wider GenAI-in-education literature (Chan, 2023).

These issues carry particular weight in secondary education. This stage of schooling is when students are expected to consolidate independent learning habits, strengthen reasoning and problem-solving abilities, and prepare for high-stakes examinations and further study. The implications of GenAI use at this stage may therefore differ meaningfully from its use among adult learners in higher education, where independent academic identity is already more established.

Assessment is one area where these tensions become especially concrete. Traditional assessment practices — essays, take-home assignments, and coursework — have long relied on the assumption that submitted work reflects a student's own understanding. The availability of tools capable of generating fluent, plausible written responses complicates this assumption and raises questions about the continued validity of such assessment formats. At the same time, the literature increasingly cautions against treating outright prohibition as a sufficient or sustainable response, given how widely accessible these tools have become (Kofinas et al., 2025). Instead, a growing number of scholars argue for redesigning assessment to make students' reasoning and process more visible, rather than relying solely on finished products.

⁴The Bastani et al. (2025) trial involved close to 1,000 students across grades 9-11 in a Turkish high school and compared an unrestricted GPT-4 interface with a tutor-style interface designed to withhold direct answers; only the latter avoided post-access performance decline.



The pedagogical implications extend beyond assessment alone. Simply providing access to a GenAI tool does not, by itself, improve learning; the evidence base suggests that outcomes depend heavily on how activities are designed, how much guidance teachers provide, and how well students are equipped to evaluate AI-generated content critically. This points to the growing importance of AI literacy — encompassing technical understanding, critical evaluation, and ethical awareness — as a companion competency to GenAI access itself.

International guidance reinforces this emphasis: UNESCO's global guidance on GenAI in education calls for a human-centred, age-appropriate approach⁵, highlighting data privacy, equity, pedagogical design, and a recommended minimum age for independent use of such tools (Miao & Holmes, 2023).

These questions take on additional significance in the Indian context. India's school education system is large and highly diverse, and students' experiences vary considerably by geography, socioeconomic background, school resourcing, language, and digital access. The potential benefits of GenAI are unlikely to be distributed evenly across this landscape: students with reliable access to devices, connectivity, and informed guidance are better positioned to benefit than those without. India's linguistic diversity adds a further layer of complexity, since the quality and reliability of GenAI output can vary across languages and cultural contexts (Gujrati et al., 2026). Teacher preparedness compounds these concerns: effective integration requires not only operational familiarity with AI tools but also the capacity to evaluate their outputs, design appropriate activities, and guide students towards responsible use (Sharma et al., 2024).

The wider opportunities and challenges associated with GenAI in education are not neatly separable; the same feature that creates a benefit in one context can create a risk in another. Personalised explanations can support struggling learners while also fostering dependence if used uncritically; automated feedback can accelerate revision while also being accepted without scrutiny; and expanded access to information can coexist with new forms of inequality rooted in uneven access to devices, connectivity, and digital literacy.

Literature on GenAI and educational equity highlights this same tension between personalisation and the risk of reproducing existing inequalities through unequal access, algorithmic bias, and structural disadvantage⁶ (BERA, 2025).

The literature on GenAI in education has expanded rapidly since 2022, with a growing cluster of systematic reviews mapping its applications and implications specifically within K-12

⁵UNESCO's guidance recommends a minimum age of 13 for independent, unsupervised use of generative AI tools in educational settings, alongside calls for national data-protection standards and mandatory teacher training (Miao & Holmes, 2023).

⁶Digital equity is distinguished in the literature from the narrower notion of the digital divide: the latter refers primarily to access to devices and connectivity, while the former also encompasses skills, support, and the quality of use once access exists.



settings (Alfarwan, 2025; Zhang & Tur, 2024). These reviews converge on several observations: much of the early literature concentrated heavily on ChatGPT to the relative exclusion of other tools; empirical research conducted in actual school settings remains comparatively limited next to the higher-education literature; and considerably more evidence is needed on how GenAI is being integrated into everyday teaching and learning across varied educational contexts.

Within this developing body of work, the Indian secondary-school context warrants focused attention in its own right. Findings generated in other national systems cannot be assumed to transfer directly, given differences in curriculum structure, classroom practice, assessment design, language, and socioeconomic conditions. A focused review can help establish what is currently known — and what remains insufficiently examined — about GenAI's role in Indian secondary education specifically, avoiding both uncritical optimism and blanket scepticism in favour of a more conditional, evidence-based account.

Against this background, the present chapter reviews the literature on Generative AI in secondary education, with particular attention to the Indian context, organised around three interconnected areas: teaching, learning, and assessment. It examines the opportunities associated with GenAI — including personalised learning, feedback, resource development, and support for both students and teachers — alongside the challenges of academic integrity, over-reliance, misinformation, equity, AI literacy, privacy, and teacher preparedness. It then considers the broader pedagogical implications of GenAI integration and identifies gaps that motivate the empirical work undertaken later in this thesis.

2. Review of the Literature

2.1 Generative AI in Secondary Education

The emergence of GenAI has introduced possibilities for teaching and learning that differ meaningfully from earlier generations of educational technology⁷. Where much prior edtech provided access to pre-existing content, GenAI systems generate responses tailored to individual prompts, enabling a more conversational and adaptive form of interaction. This has made tools such as ChatGPT increasingly relevant across K-12 contexts, where research has examined their use for learning support, content creation, feedback, problem-solving, programming, writing, and creative activities (Alfarwan, 2025).

Secondary education is a particularly important site for examining these developments, since students at this stage are expected to build independent learning habits, critical thinking, problem-solving ability, and subject-specific expertise. GenAI may support these goals by supplying additional explanation and resources, but it may equally undermine them when used to bypass rather than engage with the underlying learning process. Consistent with this, much

⁷This chapter follows a structured narrative review approach rather than a full PRISMA-style systematic review; search and selection choices are described briefly in the methods section that follows this review, consistent with common practice for doctoral literature review chapters.



of the recent literature frames the central research question not as whether students use GenAI, but how, why, and under what conditions they do so.

2.2 Student Use of Generative AI

Empirical studies describe a wide range of student uses for GenAI: asking questions, clarifying difficult concepts, brainstorming, summarising material, structuring assignments, generating written content, seeking feedback, and working through technical or programming problems. In several studies, students describe GenAI as a source of on-demand explanation that helps them approach material they find difficult, functioning as a form of learning scaffold (Wu & Zhang, 2025).

However, student use is not uniformly directed towards learning. Some students use GenAI primarily as a shortcut for completing tasks more quickly, submitting generated material with little independent engagement. This distinction matters because the same tool can support learning in one context and displace it in another: asking questions, comparing explanations, and revising one's own work suggests active engagement, whereas requesting and submitting complete answers without scrutiny suggests the opposite.

Research with secondary-age participants indicates that many students are themselves aware of this tension. A mixed-methods study of Greek high-school students using ChatGPT-5 in a formal classroom setting found that, after encountering inaccurate or fabricated outputs, students often narrowed their AI use to domains where they could independently verify the answers — a strategy the authors termed "epistemic safeguarding" (Sivenas, 2026). Such findings suggest that student behaviour and its educational consequences cannot be inferred simply from frequency-of-use data; the manner and purpose of use matter at least as much.

2.3 Perceived Usefulness and Learning Outcomes

A consistent finding across the literature is that students generally perceive GenAI as useful, reporting that it saves time, simplifies difficult material, generates ideas, and assists with assignments. These perceived benefits may be especially valuable for students who need additional explanation or who prefer to work at their own pace.

Perceived usefulness, however, does not equate to demonstrated learning gain. Feeling more confident after receiving an AI-generated explanation does not establish that a student can subsequently explain the concept independently, apply it to an unfamiliar problem, or retain it over time. This distinction is central to evaluating GenAI's educational value, and the literature increasingly calls for research that measures actual learning outcomes — through objective assessment rather than self-reported confidence or satisfaction alone (Alfarwan, 2025).

Direct evidence on this point remains limited but instructive. In a randomised field trial, GPT-4 access improved practice performance substantially, yet students who had relied on an unrestricted version of the tool performed markedly worse than a no-access control group once the tool was withdrawn for a final assessment (Bastani et al., 2025). This finding illustrates precisely the gap the literature is concerned with: technology that appears to help in the moment can leave students less prepared once that support is removed.



This issue carries particular weight in secondary education, where students are still developing the cognitive and academic capacities that later stages of education and employment will demand. If GenAI becomes a routine source of answers without adequate guidance, students may have fewer opportunities to practise independent reasoning and problem-solving at precisely the stage when these capacities are being consolidated.

2.4 Opportunities of Generative AI in Secondary Education

2.4.1 Personalised Learning

Personalisation is among the most frequently discussed opportunities associated with GenAI. Because these systems can respond to individual queries with alternative explanations, examples, or levels of detail, they may allow students to seek additional help without waiting for a teacher or feeling exposed in front of classmates. This capacity may also accommodate differences in learning pace, letting faster learners move ahead while slower learners seek further explanation. Even so, personalisation should not be treated as inherently equivalent to better learning; the accuracy of the generated content and the student's capacity to evaluate it critically remain decisive factors (Wu & Zhang, 2025).

2.4.2 Feedback and Learning Support

GenAI can also supply near-instant feedback on writing, explanations, and other student work, potentially helping students identify weaknesses and revise iteratively rather than treating an assignment as a single, final submission. A direct comparison of human and ChatGPT-generated feedback on secondary students' history essays found that AI feedback approached, though did not quite match, the quality of feedback from experienced human writing instructors, with the largest gap in tailoring advice to a student's developmental stage⁸ (Steiss et al., 2024). This suggests a genuine but bounded role for AI-generated feedback: useful as a supplement, particularly where human feedback capacity is constrained, but not yet a full substitute for expert human judgement.

2.4.3 Creativity and Idea Generation

GenAI is also used to support brainstorming, project ideation, and exploration of alternative approaches to a problem, including in creative subjects such as art and design. At the same time, such use raises questions about originality, authorship, and the extent to which students are developing their own creative capacities rather than curating AI output. The literature suggests GenAI is most valuable in this domain when it scaffolds students' own creative process rather than substituting for it.

2.4.4 Teacher Support

For teachers, GenAI can assist with developing lesson ideas, generating questions and examples, adapting explanations for different learner levels, and preparing instructional

⁸In Steiss et al. (2024), trained evaluators rated ChatGPT-generated feedback on secondary students' history essays as lower quality than feedback from experienced human writing instructors on most measures, though the gap was described by the authors as modest rather than large.



materials, potentially reducing time spent on certain routine tasks (Sun et al., 2023). Teachers nonetheless remain responsible for verifying that AI-generated material is accurate, age-appropriate, and curriculum-aligned; the literature is consistent in framing GenAI as a support for professional judgement rather than a replacement for it.

2.5 Challenges of Generative AI in Secondary Education

2.5.1 Over-Reliance and Reduced Independent Thinking

Student dependency is among the most frequently raised concerns in the literature. Because GenAI can supply answers rapidly, students may come to rely on it instead of working through problems independently, particularly on tasks intended to build reasoning, writing, or problem-solving skills. The concern is not simply that students use AI, but that AI may perform too much of the cognitive work students are meant to do themselves; when generated answers are accepted without being questioned, revised, or explained, opportunities for independent learning diminish (Chan, 2023; Bastani et al., 2025).

2.5.2 Accuracy and Misinformation

GenAI systems can produce fluent, convincing responses that are nonetheless inaccurate or entirely fabricated. This poses a particular risk for secondary students, who may not yet have developed strong information-evaluation skills. Evidence suggests some secondary students place considerable confidence in AI-generated information despite its documented unreliability, creating a mismatch between confidence and verification capacity that AI literacy instruction needs to address directly (Sivenas, 2026).

2.5.3 Academic Integrity

Academic integrity is a further major concern, since students can use GenAI to produce essays, assignments, and code in ways that make it difficult to determine whether submitted work reflects independent understanding. This challenges the continued validity of traditional assessment formats. Detection alone is an incomplete response⁹: AI-text detectors remain unreliable and are themselves contested in the literature, which is one reason recent scholarship increasingly favours redesigning assessment to make students' reasoning and process visible rather than relying on after-the-fact detection (Kofinas et al., 2025).

2.5.4 Privacy, Copyright, and Ethical Issues

The use of GenAI raises further questions about what information students enter into these systems, how it is stored, and how generated material may subsequently be used, including questions of copyright and ownership when AI is used to produce images, text, or other content. Secondary students may not yet possess strong awareness of these issues, indicating that AI education needs to combine ethical understanding with technical skill-building rather than treating the two separately (Miao & Holmes, 2023).

⁹AI-text detection tools have themselves been criticised in the literature as unreliable, with reported false-positive rates that disproportionately flag the writing of non-native English speakers, which complicates their use as a stand-alone response to integrity concerns.



2.5.5 Inequality and Access

The benefits associated with GenAI depend on access to devices, connectivity, digital skills, and opportunities to learn effective use, and differences along these dimensions can generate new forms of educational inequality. This concern is especially salient in India, where school experiences already vary substantially across geography, socioeconomic status, and institutional type; introducing GenAI without attention to this variation risks widening rather than narrowing existing disparities (Gujrati et al., 2026).

2.6 Pedagogical Implications

The literature consistently indicates that GenAI's educational impact depends heavily on pedagogical design rather than on access alone. Teachers need to design activities in which AI contributes to, rather than substitutes for, students' thinking, evaluation, and decision-making. This points to the growing importance of AI literacy, encompassing not only prompt-writing skill but also a working understanding of how GenAI operates, its limitations, and how misinformation and bias can arise (Mishra et al., 2023).

A related implication concerns the changing role of teachers, who may increasingly act as facilitators helping students evaluate AI-generated information rather than as the primary source of information itself. Rather than competing with AI in the delivery of content, teachers can focus on helping students interpret information, formulate better questions, and construct and defend arguments. The literature also points to a need for more process-oriented learning activities: when students are assessed only on a finished product, it becomes difficult to determine how much of the work reflects their own thinking, whereas activities requiring students to explain their reasoning, document revisions, and compare AI output against other sources make that thinking more visible (Sun et al., 2023).

2.7 Assessment in the Age of Generative AI

Assessment is one of the areas most directly affected by GenAI. Traditional take-home assignments that require students to produce essays or answers outside the classroom may no longer reliably indicate independent learning once AI assistance is easily available. Recent scholarship in higher education, where these pressures have been felt earliest, similarly argues that GenAI compromises the integrity of many established assessment formats and calls for a shift towards authentic, process-visible assessment design (Kofinas et al., 2025).

Consistent with this, the literature points towards assessment practices that make the learning process itself more visible — staged assignments, drafts, oral explanations, annotated work, and explicit reflection on how and why AI was used. This does not necessarily require banning GenAI outright; instead, many scholars argue for distinguishing acceptable from unacceptable uses, permitting AI for brainstorming, language support, feedback, or revision, while holding students responsible for verifying information and demonstrating their own understanding. Such an approach reframes the guiding assessment question from "did the student use AI?" to "how did the student use AI, and what did the student learn?"



2.8 Teacher Preparedness and Institutional Support

GenAI's effectiveness in secondary education depends substantially on teacher preparedness. Teachers need more than operational familiarity with a given tool; they need to understand its capabilities and limitations, evaluate the accuracy of its outputs, design appropriate learning activities, and guide students towards responsible use. TPACK¹⁰-based professional development programmes offer one model for building this capacity: a quasi-experimental intervention with in-service computer science teachers found measurable gains in AI knowledge, teaching skill, and self-efficacy following a structured, TPACK-aligned training programme (Sun et al., 2023).

Research also suggests that teachers see clear potential benefits in areas such as lesson preparation, troubleshooting, and resource development, while raising concerns about inaccurate AI-generated content, insufficient training, privacy, and unequal access to technology across schools. Professional development therefore needs to extend beyond operational training to cover pedagogical strategy, ethical considerations, information verification, and assessment redesign, supported by institutional policies that give teachers and students clear guidance on acceptable use (Mishra et al., 2023).

2.9 Generative AI in the Indian Context

The Indian context warrants particular attention given the scale and diversity of its school system. Students attend different types of schools and experience marked differences in access to technology, connectivity, educational resources, language support, and teacher capacity¹¹. These pre-existing disparities shape how GenAI's potential benefits are likely to be distributed: students with limited digital access may not benefit to the same extent as their better-resourced peers, even where GenAI in principle offers useful language support and access to additional resources (Gujrati et al., 2026).

Teacher preparedness is a further critical issue in this context. Successful integration of GenAI into Indian secondary education requires teachers able to evaluate AI outputs, design contextually appropriate activities, and guide students in responsible use — which in turn depends on the availability of infrastructure, training, and institutional support, not merely on tool access (Sharma et al., 2024). Existing scholarship specific to Indian K-12 settings, while still limited, has begun to map both the opportunities GenAI presents — including support for personalised learning and administrative efficiency — and the structural barriers, including

¹⁰TPACK refers to Technological Pedagogical Content Knowledge, a framework describing the interaction between a teacher's knowledge of technology, pedagogy, and subject content; several recent studies have proposed extending it with GenAI-specific dimensions such as prompt literacy.

¹¹According to UDISE+ 2023-24 figures, a substantial proportion of Indian students do not complete secondary schooling, and learning-outcome indicators decline between the early and later grades, underlining the pre-existing disparities into which GenAI is being introduced.



infrastructure gaps and the need for algorithmic-bias mitigation and data-privacy safeguards, that will shape its responsible integration (Gujrati et al., 2026).

The evidence base specific to India therefore needs to be treated with some caution rather than assumed to mirror international findings. Differences in curriculum, assessment structure, language, socioeconomic conditions, and school infrastructure are all likely to shape how GenAI is experienced by Indian secondary students and teachers, providing a clear rationale for examining Indian evidence in its own right alongside the broader international literature.

2.10 Research Gaps

Although research on GenAI in education has expanded rapidly, several limitations remain evident in the existing literature.

First, a considerable proportion of studies rely on perception and self-report data rather than objective measures of learning; students may report that GenAI is useful or that it improves their confidence without this translating into demonstrated gains in knowledge, retention, transfer, or critical thinking (Alfarwan, 2025).

Second, many studies are based on small samples, single institutions, short interventions, or cross-sectional designs, which offer valuable early evidence but limit what can be concluded about the longer-term consequences of sustained GenAI use.

Third, there remains a need for more research examining actual classroom implementation rather than individual, out-of-classroom use; considerably more evidence is needed on how teacher-mediated approaches, AI-supported activities, and redesigned assessment practices function in real secondary classrooms (Alfarwan, 2025).

Fourth, questions of equity and educational context require greater attention, including differences across public and private schools, rural and urban settings, socioeconomic groups, languages, subjects, and levels of digital access.

Finally, the Indian context specifically requires further empirical examination. International evidence provides a useful foundation but cannot fully account for how GenAI will affect Indian secondary students and teachers; more context-specific research is needed on the interaction between GenAI, existing pedagogical practice, educational inequality, teacher preparedness, and assessment systems within India (Gujrati et al., 2026; Sharma et al., 2024).

Taken together, these gaps suggest that future research needs to move beyond asking whether GenAI is useful, towards examining how it is used, under what pedagogical conditions it proves beneficial, what risks emerge over time, and for whom these benefits and risks are experienced.

2.11 Summary of the Literature

Overall, the literature presents GenAI as a technology carrying both considerable educational potential and significant risk. It can support students through explanation, brainstorming, feedback, personalisation, and creative activity, while assisting teachers with instructional planning and resource development. These benefits, however, are not automatic.



The most consistently raised concerns across the literature include over-reliance, inaccurate information, reduced independent thinking, academic integrity, privacy and copyright, unequal access, and inadequate teacher preparation. The literature increasingly suggests that restricting access alone cannot resolve these challenges; instead, meaningful change is needed in pedagogy, assessment design, AI literacy provision, teacher preparation, and institutional policy (Chan, 2023; Miao & Holmes, 2023).

The emerging evidence therefore supports a conditional rather than categorical view of GenAI in secondary education: its educational value appears to depend on whether it is used to support students' thinking or to substitute for it. This distinction carries particular weight in secondary education, where students are actively developing the independent cognitive and academic capacities that will shape their subsequent education and working lives.

At the same time, the evidence base remains comparatively young, and important questions concerning long-term learning outcomes, classroom implementation, equity, and the Indian educational context in particular remain insufficiently answered. These gaps provide the basis for the empirical investigation undertaken in the remainder of this thesis.

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