



## USE OF GENERATIVE AI IN TEACHING- LEARNING: A DATA-BASED ANALYSIS OF ADOPTION, IMPACT AND CHALLENGES

**Dr. Manju Jethi**

Assistant Professor

Department of Education

Ras Bihari Bose Subharti University, Dehradun, U.K.

### ABSTRACT

*Generative Artificial Intelligence (GenAI) tools such as ChatGPT, Gemini and Copilot have moved from experimental novelty to everyday academic instruments within a very short span of time. This paper presents a data-based analysis of the adoption, impact and challenges of GenAI in teaching-learning, drawing on secondary data from recent global and Indian surveys, institutional reports and peer-reviewed meta-analyses. Evidence compiled from more than a dozen large-scale surveys shows that student adoption of GenAI has crossed 85–95% in several developed higher-education systems and is expanding rapidly across Indian schools and colleges, while teacher adoption, though rising, continues to trail student use. Meta-analytic evidence spanning over 150 primary studies indicates a moderate, consistently positive effect of GenAI on learning outcomes (Hedges'  $g$  in the range of 0.57 to 0.67), with somewhat larger gains reported for school-level learners than for undergraduates. At the same time, the data reveal serious concerns: a steep rise in AI-related academic-integrity violations, an unresolved faculty-readiness gap, a widening digital divide between well-resourced and under-resourced learners, and anxieties around over-reliance, accuracy and job displacement. The paper concludes that GenAI's net contribution to teaching-learning will depend less on the technology itself than on how quickly institutions build AI literacy, redesign assessment and put equitable access and clear policy frameworks in place.*

**Keywords:** *Generative AI, ChatGPT, Teaching-Learning, Higher Education, Learning Outcomes, Academic Integrity, EdTech, India*

### INTRODUCTION

The release of publicly accessible generative AI tools since late 2022 has triggered one of the fastest technology-adoption curves ever recorded in education. Unlike earlier generations of educational technology, which typically diffused into classrooms over a decade or more, generative AI tools capable of producing human-like text, code, images



# THE STANFORD JOURNAL

(AN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH) IJIN VALUE/

**IMPACT FACTOR : 8.3**

Volume-3, Issues-3

July-September: 2026

and explanations have been absorbed into everyday study and teaching practice within two to three academic years. Learners now routinely use these tools to brainstorm ideas, summarise readings, draft and edit assignments, obtain instant explanations, and prepare for examinations, while teachers increasingly use them to plan lessons, generate classroom material, create assessments and manage routine administrative communication.

This rapid diffusion has outpaced the ability of most institutions to design corresponding policy, pedagogy and assessment frameworks, creating what several recent surveys describe as a widening governance gap. It has also generated a large and growing body of empirical data — institutional surveys, national reports and controlled experimental studies — that can be used to move the discussion on generative AI in education from anecdote and opinion towards an evidence-based understanding of what is actually happening in classrooms and what effects, positive and negative, are being observed. The present paper undertakes precisely this exercise: it assembles and analyses secondary data from a wide range of recent, credible sources to build a data-based picture of the use of generative AI in teaching-learning, with particular attention to adoption levels among students and teachers, measured effects on learning outcomes, and the challenges accompanying this rapid uptake, including the specific situation in India.

A substantial and fast-growing literature has examined generative AI in educational settings from multiple angles. Large-scale student surveys such as the Higher Education Policy Institute's (HEPI) annual Student Generative AI Survey in the United Kingdom, the Digital Education Council's Global AI Student and Faculty Surveys, and national surveys by Chegg and the College Board have tracked adoption levels among students and, to a lesser extent, teachers, documenting a swift year-on-year rise in usage. Institution-level studies, such as the Middlebury College analysis and comparable data from Harvard, provide corroborating evidence that adoption exceeding four out of every five students is now common at research-intensive universities in developed economies.

A parallel and equally important strand of research consists of experimental and quasi-experimental studies measuring the effect of generative AI tools, chiefly ChatGPT, on learning outcomes, which have now been synthesised in several independent meta-analyses. These meta-analyses, though carried out by different teams using different sets of primary studies, converge on a similar conclusion: generative AI use is associated with a moderate, statistically significant improvement in learning outcomes, though the magnitude of benefit varies by educational level, subject area, and how the tool is integrated into instruction.



A third strand focuses on teacher and institutional perspectives, exploring adoption barriers, training needs, and the perceived benefits and risks of classroom integration, as seen in studies from Saudi Arabia, Malta, the United States and India. Finally, a growing set of studies addresses the risks side of the ledger — academic integrity, the digital divide, and over-reliance — an area that has attracted particular attention as detection systems such as Turnitin have begun reporting measurable increases in AI-assisted submissions. Taken together, this literature provides a rich, if still rapidly evolving, evidence base, which this paper draws upon to build a structured, data-based analysis.

## OBJECTIVES OF THE STUDY

- To examine the extent of adoption of generative AI tools among students and teachers, globally and in India, on the basis of recent survey data.
- To analyse, using available meta-analytic and experimental evidence, the impact of generative AI use on learning outcomes.
- To identify, from institutional reports and empirical studies, the principal challenges and risks associated with the growing use of generative AI in teaching-learning.
- To draw data-based implications and recommendations for educators, institutions and policymakers.

## RESEARCH METHODOLOGY

This paper follows a descriptive, analytical research design based entirely on secondary data. Data were compiled from (a) large-scale institutional and national surveys of students, teachers and higher-education institutions conducted between 2024 and 2026 by organisations such as HEPI, the Digital Education Council, Chegg, the College Board, CENTA, EY-Parthenon-FICCI, the Central Square Foundation and Coursera; (b) peer-reviewed meta-analyses and systematic reviews published in journals including Humanities and Social Sciences Communications, the Journal of Computer Assisted Learning, and the International Review of Research in Open and Distributed Learning, which quantitatively synthesise the results of experimental and quasi-experimental primary studies; and (c) institutional and academic-integrity reports, including data released by Turnitin. Data were screened for recency (predominantly 2024–2026), relevance to teaching-learning contexts, and credibility of the issuing body, and were then organised thematically into adoption, impact and challenge categories for tabular presentation and discussion in the sections that follow. As a secondary, data-based study, the paper does not involve primary data collection from human participants; it synthesises and interprets figures already published by the cited sources.



## DATA ANALYSIS AND DISCUSSION

### Adoption of Generative AI among Students

Table 1 summarises adoption data drawn from major student surveys conducted globally between 2024 and 2026. The figures show a strikingly consistent pattern: across very different countries, institution types and survey methodologies, four out of five to nineteen out of twenty students now report having used generative AI for academic purposes, and a majority use it at least weekly.

**Table 1: Adoption of Generative AI among Students — Select Global Surveys (2024–2026)**

| S.No | Source / Survey                                                                 | Key Finding                                                                                                                                             |
|------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | HEPI Student Generative AI Survey 2025 (United Kingdom; ~1,000+ undergraduates) | Overall AI use rose to 92% (from 66% in 2024); use of AI for assessed work rose to 88% (from 53% in 2024).                                              |
| 2    | HEPI Student Generative AI Survey 2026 (United Kingdom; 1,054 undergraduates)   | 95% report using AI in some way; 94% use it for assessed work; share embedding AI-generated text directly rose to 12% (from 8% in 2025 and 3% in 2024). |
| 3    | Digital Education Council Global AI Student Survey                              | 86% of students use AI in their studies; 54% use it weekly and 25% daily.                                                                               |
| 4    | Chegg Global Student Survey (11,706 students, 15 countries)                     | 80% of students worldwide have used generative AI to support university study.                                                                          |
| 5    | Inside Higher Ed / Student Voice Survey 2025 (United States)                    | 85% of college students used AI for coursework in the past year.                                                                                        |
| 6    | Harvard Undergraduate                                                           | 87.5% of undergraduates reported using generative AI.                                                                                                   |



| S.No | Source / Survey                                                                                   | Key Finding                                                                                                                          |
|------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
|      | Survey (2024)                                                                                     |                                                                                                                                      |
| 7    | Middlebury College Study 2025 (1,000+ students, corroborated by a 1,026-respondent campus survey) | 82.5% of students use generative AI for academic purposes; independent survey found 85.2% usage.                                     |
| 8    | College Board Survey of U.S. High Schools (2024–25)                                               | Share of high-schoolers using GenAI for schoolwork rose from 79% to 84% between January and May 2025; 69% used ChatGPT specifically. |

The year-on-year comparisons are especially informative: the HEPI survey series shows overall UK student AI use climbing from 66% in 2024 to 92% in 2025 and 95% in 2026, while use specifically for assessed work rose from 53% to 88% to 94% over the same three years. This trajectory, repeated with variations in the Chegg, Digital Education Council, Middlebury and Harvard data, indicates that generative AI adoption among students has moved past the early-adopter phase and is now close to universal in many higher-education systems, with school-level adoption in the United States following a similar upward curve.

### Adoption of Generative AI among Teachers

Table 2 presents comparable data on teacher and faculty adoption. The figures show meaningfully lower and more uneven adoption than on the student side, alongside a persistent readiness gap: many teachers who have adopted generative AI report using it only for a narrow set of tasks, and self-rated confidence does not always match demonstrated understanding.

**Table 2: Adoption of Generative AI among Teachers and Faculty — Select Surveys (2025)**

| S.No | Source / Survey                                         | Key Finding                                                                      |
|------|---------------------------------------------------------|----------------------------------------------------------------------------------|
| 1    | Digital Education Council Global AI Faculty Survey 2025 | 61% of faculty have used AI in teaching, but 88% of these use it only minimally. |



| S.No | Source / Survey                                                | Key Finding                                                                                                                                                                                          |
|------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2    | EdWeek Teacher Survey 2025 (United States)                     | 59% of teachers said AI enabled more personalised instruction; usage was highest among high-school teachers (69%), followed by elementary (42%) and pre-K teachers (33%).                            |
| 3    | Gallup-Walton Family Foundation Survey (1,000+ U.S. teachers)  | AI use is reducing administrative burden, chiefly through lesson planning, grading support and drafting parent communication.                                                                        |
| 4    | CENTA National Teacher Survey 2025 (India; 5,000+ educators)   | 70% of teachers use AI tools in classrooms, mainly for lesson planning; 67% rate their own AI skills as above average, yet only 57% could identify a basic AI misconception.                         |
| 5    | Alwaqdani (2025) Teacher Survey, Saudi Arabia (1,101 teachers) | 64% have used AI in education; 40% report limited AI knowledge; teachers value AI for saving time and personalising learning but worry about training gaps and creativity/critical-thinking effects. |

Two patterns recur across these teacher-focused surveys. First, adoption is driven primarily by time-saving applications — lesson planning, generating classroom material, grading support and routine communication — rather than by deeper pedagogical redesign. Second, there remains a measurable gap between teachers' self-assessed AI competence and their demonstrated ability to identify AI errors or misconceptions, a gap that several sources link directly to insufficient training and professional-development opportunity.

### **Generative AI in Indian Education: Institutional and Student Data**

Because generative AI adoption varies considerably by national context, Table 3 isolates recent India-specific data covering higher-education institutions, school-level ed-tech use, and skilling platforms.



**Table 3: Generative AI Adoption and Perception — India-specific Data (2025–26)**

| S.No | Source / Survey                                                                    | Key Finding                                                                                                                                                                                  |
|------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | EY-Parthenon & FICCI, “Future-Ready Campuses” Report 2025 (30 leading Indian HEIs) | 60% of institutions permit student use of AI tools; over 50% use GenAI to build learning material; 56% have adopted AI-related policies; 40% deploy AI-powered tutoring systems or chatbots. |
| 2    | IIT-Madras & CeRAI National Study 2025 (60 Indian institutions)                    | Students use GenAI for brainstorming, summarising and writing; faculty use it for lecture preparation; the study flags plagiarism and over-reliance as key concerns.                         |
| 3    | Turnitin / Vanson Bourne Six-Country Survey (3,500 respondents, incl. India)       | 93% of Indian respondents feel positive about AI's impact on education — the highest of all countries surveyed — while 85% also find the volume and availability of AI tools overwhelming.   |
| 4    | Bharat Survey for EdTech 2025–26 (12,500 households, 2,500 educators, 10 states)   | 35% of children who use ed-tech platforms are now incorporating generative AI tools into their studies.                                                                                      |
| 5    | Coursera Global Skills Report 2025 (31 million Indian learners)                    | India recorded a 107% year-on-year rise in generative AI course enrolments, exceeding 2.6 million enrolments to date.                                                                        |

The Indian data present a distinctive profile: institutional openness to generative AI is high, with a majority of surveyed higher-education institutions already permitting or actively deploying GenAI tools, and Indian respondents report the most positive overall sentiment toward AI's impact on education among the countries covered in the Turnitin-commissioned survey. At the same time, the same respondents report the highest sense of being “overwhelmed” by the volume and availability of AI tools, and school-level adoption, while growing quickly, still remains a minority practice (around one in three ed-tech users), suggesting that access and awareness continue to expand unevenly across urban, semi-urban and rural settings.



### Impact of Generative AI on Learning Outcomes

Perhaps the most decision-relevant data for educators concerns measured impact on learning outcomes. Table 4 summarises five independent meta-analyses, together synthesising well over 150 individual experimental and quasi-experimental studies conducted mainly between 2022 and 2025.

**Table 4: Meta-Analytic Evidence on the Impact of Generative AI on Learning Outcomes**

| S.No | Study                                                                                   | Scope                                                 | Key Finding                                                                                                                                 |
|------|-----------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Meta-analysis, Humanities and Social Sciences Communications (2026)                     | 35 experimental studies; 4,193 participants (2022–24) | Moderate positive effect of ChatGPT on learning outcomes, Hedges' $g = 0.670$ , enhancing both cognitive and non-cognitive skills.          |
| 2    | Liu, Journal of Computer Assisted Learning (2025)                                       | 37 studies / 37 effect sizes (2022–25)                | Moderate positive effect on academic achievement, $g = 0.577$ (95% CI 0.395–0.759); no significant difference across educational levels.    |
| 3    | Meta-analysis, International Review of Research in Open and Distributed Learning (2026) | 22 studies (Nov 2022–Dec 2024)                        | Overall effect on learning achievement $g = 0.573$ ; larger effect for school students ( $g = 0.928$ ) than undergraduates ( $g = 0.538$ ). |
| 4    | Ma, Journal of Computer Assisted Learning (2025)                                        | Systematic synthesis of GenAI studies                 | Confirms a moderately positive overall impact of generative AI on learning outcomes across disciplines and instructional modes.             |
| 5    | Liu, Guo, He & Hu, meta-analysis (2025)                                                 | K–12 and higher-education studies                     | Generative AI shows a consistent, moderate positive effect on learning outcomes across both school and university levels.                   |



The convergence across these independently conducted meta-analyses is notable: effect sizes cluster tightly between Hedges'  $g = 0.57$  and  $g = 0.67$ , a range generally interpreted in educational research as a moderate, educationally meaningful effect. Sub-group analysis further suggests that the benefit is somewhat larger for school-level learners than for university undergraduates, and that gains extend beyond test scores to non-cognitive outcomes such as engagement, motivation and self-efficacy. This body of quantitative evidence supports the view that, when integrated thoughtfully into instruction, generative AI can meaningfully aid learning — while also cautioning that the effect is moderate rather than transformative, and is sensitive to the subject, duration and instructional mode of the intervention.

### Challenges and Risks Reported in the Data

Alongside these positive findings, the same body of survey and institutional data documents a set of significant risks that have grown in parallel with adoption. Table 5 summarises the principal challenges reported across the sources reviewed.

**Table 5: Key Challenges Associated with Generative AI in Teaching-Learning**

| S.No | Challenge                                    | Supporting Data                                                                                                                                                                                                                                   |
|------|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Academic integrity and misuse                | AI-related cheating incidents in UK universities rose from 1.6 to 7.5 per 1,000 students between 2022–23 and 2024–25 (~400% increase); Turnitin's analysis of 200+ million assignments found AI-use signals in 11% and heavy AI generation in 3%. |
| 2    | Faculty/staff readiness gap                  | Only 42% of UK students feel institutional staff are well-equipped to support AI use, though this is up from 18% in 2024.                                                                                                                         |
| 3    | Digital divide in access and use             | Male students, STEM/health-discipline students and more socio-economically advantaged students are more likely to use AI (HEPI, 2025); low-connectivity and low-resource settings show markedly lower adoption.                                   |
| 4    | Over-reliance and critical-thinking concerns | Educators report risks of reduced independent effort and “metacognitive laziness,” alongside worries about creativity and critical-thinking development.                                                                                          |



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(AN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH) IJIN VALUE/

**IMPACT FACTOR : 8.3**

Volume-3, Issues-3

July-September: 2026

| S.No | Challenge                                     | Supporting Data                                                                                                                                        |
|------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5    | Trust, accuracy and job-displacement concerns | 84% of Indian survey respondents (teachers, students and parents) flagged concerns such as job displacement (34%) and AI accuracy (23%) (CENTA, 2025). |

These figures point to a common thread: the pace of student adoption has consistently outrun institutional capacity to respond, whether in the form of updated assessment design, staff training, equitable infrastructure, or clear academic-integrity policy. The near four-fold rise in detected AI-related misconduct in UK universities within two academic years is a particularly sharp illustration of this lag, as is the finding that fewer than half of UK students feel their institution's staff are well-equipped to support AI use, despite a marked year-on-year improvement.

## MAJOR FINDINGS

- Student adoption of generative AI has become near-universal in several higher-education systems, rising from roughly two-thirds of students in 2024 to over nine in ten by 2025–26 in repeated national surveys.
- Teacher and faculty adoption, while rising, continues to lag student adoption and remains concentrated in time-saving tasks such as lesson planning and grading rather than deeper instructional redesign.
- In India, institutional openness to generative AI is comparatively high and sentiment toward its educational impact is strongly positive, but school-level adoption remains a minority practice and awareness/access gaps persist across geographies.
- Independent meta-analyses covering more than 150 primary studies converge on a moderate, positive effect of generative AI on learning outcomes (Hedges'  $g \approx 0.57$ – $0.67$ ), with somewhat stronger effects for school-level learners than for undergraduates.
- The rapid rise in adoption has been accompanied by a comparably rapid rise in AI-related academic-integrity violations, alongside persistent gaps in staff readiness, equitable access and learner critical-thinking safeguards.

## EDUCATIONAL IMPLICATIONS AND RECOMMENDATIONS

On the strength of this data-based analysis, several implications follow for teaching-learning practice and policy. First, given that a large majority of students are already using generative AI regardless of institutional policy, assessment design needs to be revisited so that it remains valid in an AI-accessible environment, rather than relying on prohibition alone. Second, the persistent faculty-readiness gap indicates that structured,

hands-on professional-development programmes — not one-off orientation sessions — are needed to bring teacher confidence and competence in line with student-side adoption. Third, because meta-analytic evidence shows a real but moderate benefit rather than a transformative one, generative AI is best positioned as a supplement to sound pedagogy — for tasks such as personalised practice, immediate feedback and scaffolded explanation — rather than as a substitute for direct instruction. Fourth, the documented digital divide, both globally and within India, calls for deliberate attention to equitable access, bandwidth-light tools and offline-compatible resources so that the benefits of generative AI do not accrue disproportionately to already-advantaged learners. Finally, institutions should treat academic-integrity policy, AI literacy curricula and clear usage guidelines as core infrastructure for generative AI adoption, not as an afterthought.

## CONCLUSION

The data reviewed in this paper show that generative AI has, within a remarkably short period, become a routine feature of teaching-learning for a large majority of students worldwide, including in India, and that its use is associated with a real, moderate improvement in learning outcomes according to converging meta-analytic evidence. At the same time, the same data reveal that this rapid diffusion has significantly outpaced institutional readiness, producing measurable increases in academic-integrity concerns, an uneven digital divide, and a persistent gap between student and teacher adoption and confidence. The overall picture that emerges from the evidence is neither uncritically optimistic nor alarmist: generative AI is a powerful and increasingly unavoidable feature of the educational landscape whose ultimate contribution to teaching-learning will be determined less by the technology itself than by the speed and quality of institutional response — in assessment redesign, teacher training, equitable access and policy clarity. Continued, data-based monitoring of adoption, impact and risk, of the kind assembled in this paper, will remain essential as the technology and its use in classrooms keep evolving.

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# THE STANFORD JOURNAL

(AN INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH) IJIN VALUE/

**IMPACT FACTOR : 8.3**

Volume-3, Issues-3

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