

Integration of Generative AI (Gen AI) into Higher Education, structured to meet the cognitive levels of the Revised Bloom's Taxonomy (RBT)

¹Dr. Vinit Vaidya, ²Dr. Gitesh Padhye, ³Dr. Rashmi Shetty

⁴Dr. Deepa Shivaji Jamindar, ⁵Mrs. Ruchi Negi Agarwal

^{1,2,3,4,5}*Thakur College of Science & Commerce [Empowered Autonomous] Thakur Village, Kandivali (East), Mumbai 400101*

Abstract—The rapid emergence of Generative Artificial Intelligence (GenAI) necessitates a fundamental shift in higher education pedagogy. This paper explores the systematic incorporation of GenAI tools (e.g., LLMs) to facilitate cognitive growth across the six levels of the Revised Bloom's Taxonomy: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating. By transitioning AI from a "content generator" to a "cognitive co-pilot," this study demonstrates how educators can offload lower-order tasks to focus on higher-order critical thinking. The findings suggest that AI-integrated pedagogies enhance student self-efficacy and promote "co-curation" as a modern cognitive skill.

Index Terms—Generative AI, Higher Education, Cognitive Levels, Bloom's Taxonomy

I. INTRODUCTION

Traditional teaching models often prioritize the lower tiers of Bloom's Taxonomy (knowledge acquisition and comprehension). However, GenAI's ability to instantly summarize and explain content renders these traditional metrics insufficient.

Problem Statement: How can higher education pivot from preventing AI use to leveraging it as a scaffold for high-level cognition?

Objective: To propose a pedagogical framework where GenAI acts as a catalyst for moving students from passive "Remembering" to active "Creating" and "Evaluating."

II. MATERIALS AND METHODS

Participants: Undergraduate and postgraduate students across diverse disciplines (STEM, Humanities, and Business).

Tools: Large Language Models (LLMs) like GPT-4, Claude, or Gemini; AI-driven simulation software; and collaborative platforms (e.g., Perplexity for research).

Framework: A quasi-experimental design comparing traditional lecture-based cohorts with "AI-Augmented" cohorts using Prompts-as-Pedagogy.

Process: AI Integration by Bloom's Level

RBT Level	Role of Generative AI	Student Task
Remembering	Personalized Flashcards & Summaries	Use AI to generate spaced-repetition cues from lecture notes.
Understanding	Adaptive Tutoring	Ask AI to "explain like I'm five" or provide 5 different analogies for a complex concept.
Applying	Scenario Simulation	Use AI to generate a realistic business or medical case study to solve using classroom theories.
Analyzing	Data Dissection	Feed raw data or text to AI to identify patterns, biases, or logical fallacies.
Evaluating	Socratic Peer Review	Use AI to "critique" a student's draft; the student must then defend or refute the AI's critique.
Creating	Iterative Co-Creation	Use AI to brainstorm, outline, and prototype, while the student provides the "human-in-the-loop" creative direction.

III. OBSERVATIONS

Shift in Effort: Students spent 40% less time on basic information retrieval and 60% more time on "Evaluating" and "Analyzing" AI outputs.

Engagement: Increased student participation in Socratic-style debates when AI was used to provide "counter-arguments" in real-time.

The "AI-Tension": High-performing students used AI to refine ideas, whereas low-performing students initially struggled with over-reliance (hallucination risks).

IV. RESULTS

Cognitive Depth: Students in AI-augmented tracks showed a statistically significant improvement in Level 5 (Evaluating) skills, as they were forced to verify AI-generated claims.

Productivity: Project completion times decreased by 30%, with a notable increase in the complexity and "Professionalism" of the final Creative (Level 6) outputs.

Critical Literacy: Students developed "AI Literacy," learning that the quality of the output is directly proportional to the "Prompt Engineering" (a new form of analytical thinking).

To help students reach the Evaluating (Level 5) tier of the Revised Bloom's Taxonomy, the goal is to shift their role from being "consumers" of information to "critics" of AI-generated content.

Here are specific strategies and prompt examples designed to foster high-level critical thinking:

Strategic Approach: The "AI-As-Adversary" Model.

In this model, the student doesn't ask the AI for the answer; they ask the AI to provide a flawed or biased perspective, which the student must then deconstruct and correct.

1. Identifying Logical Fallacies:

Student Prompt: "Write a 300-word argument in favour of [Topic, e.g., Universal Basic Income], but intentionally include at least three logical fallacies (like Strawman or Ad Hominem). I will then identify and explain them."

Cognitive Task: The student must evaluate the structural integrity of the argument rather than just the content.

2. The Socratic Debate:

Student Prompt: "I am writing an essay arguing that [Student's Thesis]. Act as a cynical expert in this field who disagrees with me. Critique my thesis and provide three counter-arguments that challenge my assumptions."

Cognitive Task: The student must evaluate their own work through the lens of a "hostile" AI, forcing them to defend their logic or revise their stance.

3. Evaluating Output Accuracy (The Fact-Checker):

Student Prompt: "Summarize the key findings of [Specific Academic Paper]. Afterward, I will compare your summary to the original text and rate your accuracy on a scale of 1–10, citing specific discrepancies."

Cognitive Task: This utilizes the AI's tendency to "hallucinate" as a pedagogical tool. Students must critically compare the AI's synthesis against a primary source.

Visualizing the Evaluation Process:

To effectively move from "Applying" to "Evaluating," the workflow usually follows a feedback loop:

Feature	Traditional Evaluation	AI-Augmented Evaluation (RBT Level 5)
Primary Task	Peer-reviewing a classmate's paper.	Critiquing 5 different AI-generated variations of a thesis.
Speed	Slow; limited to one or two perspectives.	Rapid; allows for "stress-testing" ideas against dozens of viewpoints.
Student Role	Passive recipient of a grade.	Active "Editor-in-Chief" of AI-generated drafts.
Risk	Personal bias toward peers.	Focuses purely on the logic and validity of the data.

Assessment Rubric for Level 5 (Evaluating): When grading students who use GenAI at this level, instructors should look for:

Verification Depth: Did the student catch AI hallucinations or biases?

Justification: Can the student explain why they chose one AI suggestion over another?

Refinement: How did the student's final conclusion evolve after interacting with the AI's critique?

At the Creating (Level 6) tier, the objective is to move from critique to innovation. At this stage, students use GenAI as a collaborative partner to synthesize disparate pieces of information into a new, original product or solution.

Project Title: The "AI-Co-Pilot" Innovation Lab:

Objective: To design a sustainable solution for a real-world problem (e.g., urban housing, climate tech, or healthcare access) by iteratively co-creating with GenAI.

Phase 1: Generative Ideation (Divergent Thinking)

The Task: Students prompt the AI to generate 20 "wild" or "unconventional" solutions for a specific problem statement.

Prompt Example: "Using the principles of biomimicry, suggest 10 radical architectural designs for low-cost, cooling-efficient housing in arid climates. Avoid standard brick-and-mortar concepts."

Cognitive Goal: Moving beyond personal bias to explore a vast creative space.

Phase 2: Technical Synthesis & Prototyping:

The Task: Students take the three most viable ideas and use AI to generate technical frameworks, code snippets, or project blueprints.

Prompt Example: "For 'Design A' (The Termite Mound Structure), generate a list of sustainable materials required and a 12-month project timeline for a pilot build."

Cognitive Goal: Synthesizing theoretical knowledge into a tangible, structured plan.

Phase 3: Iterative Refinement (Convergence):

The Task: Students must "stress-test" their creation. They ask the AI to play the role of a Venture Capitalist or a Sceptical Regulator to find the "fatal flaw" in their design.

Prompt Example: "Act as a building safety inspector. Identify five potentials structural or regulatory failures in this termite-inspired design."

Cognitive Goal: Using feedback to pivot and improve the original creation.

The "Creating" Workflow: Human-AI Collaboration:

Project Component	AI's Role (The Engine)	Student's Role (The Architect)
Brainstorming	Generates 50+ diverse ideas in seconds.	Selects the "spark" with the most potential.
Structuring	Drafts outlines, code, or technical specs.	Customizes and fixes errors in the logic.

Aesthetics	Generates visual mockups (via DALL-E/Midjourney).	Refines the visual identity and user experience.
Final Polish	Summarizes the project for different audiences.	Ensures the final product is ethical and viable.

Assessment Criteria for Level 6: Since the AI helps with the “heavy lifting” of production, the grading focus shifts:

Originality of Synthesis: How uniquely did the student combine AI-generated components into a cohesive whole?

Iterative Evolution: Can the student show “Prompt Logs” that demonstrate how their idea evolved from a simple AI output to a sophisticated human-refined solution?

Human Value-Add: What parts of the final project represent the student’s unique moral, ethical, or creative judgment that the AI could not have provided?

“AI Usage Policy” for a course syllabus that encourages this Bloom’s Taxonomy approach:

To implement this effectively, a course syllabus must transition from a “policing” mind-set to a “partnership” mind-set. The goal of this policy is to ensure transparency while encouraging students to use GenAI for higher-order cognitive tasks.

Sample Syllabus Policy: AI-Augmented Learning & Cognitive Integrity

Philosophy of Use:

In this course, Generative AI (GenAI) is viewed as a cognitive scaffold. Just as a calculator is used in advanced mathematics to allow for higher-level problem solving, GenAI will be used here to offload lower-order tasks (remembering/understanding) so we can focus on Evaluating and Creating.

The “Traffic Light” Usage Model - Different assignments will have different levels of AI permission, categorized as follows:

Status	Category	Description
Red	Human-Only	Use of AI is strictly prohibited. These are foundational assessments to ensure core personal knowledge.
Yellow	AI-Assisted	AI can be used for brainstorming, outlining, or summarizing. All AI interactions must be cited.
Green	AI-Integrated	AI is a required partner. The assignment focuses on your ability to prompt, critique, and refine AI output.

Disclosure & Documentation (The “Prompt Log”): For all Yellow and Green assignments, students must submit an AI Transparency Appendix. This includes:

- The name of the tool used (e.g., Gemini 2.0, Claude 3.5).
- A link to the chat history or a transcript of the prompts used.

- A brief statement (100–200 words) explaining how the AI output was evaluated and modified by the student.

Note on Academic Integrity: Passing off AI-generated content as your own without significant critical intervention or disclosure is considered “Academic Misalignment” and will result in a resubmission or grade penalty.

Mapping AI Use to Your Grade:

- To achieve an “A” in this course, you must demonstrate mastery at the highest tiers of Bloom’s Taxonomy.
- To Pass ©: Demonstrate “Understanding” and “Application” (even if AI helped you get there).
- To Excel (A/B): Demonstrate “Evaluation” (critiquing the AI’s mistakes) and “Creation” (building something original that the AI could not have produced alone)

The “Human-in-the-Loop” Requirement:

AI often “hallucinates” (creates false facts). You are legally and academically responsible for every word in your final submission. If the AI provides a fake citation and you include it, you are responsible for the error.

Implementation Process for Faculty:

To make this policy work, the “Process” of learning must be graded rather than just the “Product.”

Step 1: Grade the initial prompt quality.

Step 2: Grade the student’s critique of the AI’s first draft.

Step 3: Grade the final synthesis where the student integrates their own unique perspective.

To grade the Process and the Higher-Order Thinking required in an AI-integrated environment, we must move away from grading the final text and toward grading the student’s interaction with the model. The following rubric is designed to assess how well a student moves from passive reception to the Evaluation and Creation levels of the Revised Bloom’s Taxonomy.

AI-Augmented Cognitive Mastery Rubric:

Criterion	Emerging (Remember/Understand)	Proficient (Apply/Analyse)	Mastery (Evaluate/Create)
Prompt Engineering	Uses simple, one-sentence prompts. Accepts the first answer without iteration.	Uses context and specific constraints. Refines prompts to improve output quality.	Strategic Prompting: Uses multi-step prompting (chain-of-thought). Directs the AI to adopt specific personas or logical frameworks.

Verification & Fact-Checking	Accepts AI output as factual. Does not check for "hallucinations" or errors.	Identifies obvious errors. Mentions that AI might be biased but doesn't prove it.	Critical Dissection: Cross-references AI claims with peer-reviewed sources. Actively identifies and corrects subtle logical fallacies or biases in the output.
Synthesis & Refinement	Submits work that is 80%+ raw AI output with minor word changes.	Combines AI output with personal notes. Clearly differentiates between AI and human ideas.	Human-in-the-Loop: Uses AI as a "sparring partner." Substantially pivots or rebuilds the project based on a critique of the AI's limitations.
Metacognitive Reflection	No documentation of AI use provided.	Lists prompts used but does not explain the logic behind the conversation.	Process Transparency: Submits a "Prompt Log" with a reflective narrative on how the AI changed their thinking or helped them overcome a cognitive block.

How to Use This Rubric in Your Course?

To ensure students are actually hitting the Evaluation stage, consider these three assessment "Checkpoints":

The "Redline" Draft: Ask students to take an AI-generated essay and use a red pen (or digital track changes) to highlight every error, bias, or oversimplification. They are graded on the density and accuracy of their corrections.

The Prompt Log: Instead of just the final paper, require the "Chat History." Grade the student on how they "talked" the AI into a better answer. Did they give up when the AI was wrong, or did they correct it?

The Comparative Analysis: Ask the student: "What is one insight in this final project that the AI was incapable of coming up with on its own?" This forces them into the Creative (Level 6) tier, where they must identify their own unique human value-add.

Conclusion of the Framework:

By integrating Generative AI through the lens of the Revised Bloom's Taxonomy, we transform the classroom into a high-level research lab. Students are no longer tested on what they can remember, but on how effectively they can orchestrate information, evaluate truth, and create novel solutions in a world where data is infinite but wisdom is scarce.

V. OVERALL CONCLUSION

The incorporation of GenAI does not replace Bloom's Taxonomy; rather, it accelerates the journey through it. By delegating the "Remembering" and "Understanding" phases to AI, higher education can finally fulfill its goal of producing graduates who primarily operate at the levels of Analysis, Evaluation, and Creation. The human role shifts from being a "vessel of knowledge" to an "expert evaluator" of AI-generated content.

VI. FUTURE SCOPE

Longitudinal Studies: Assessing the long-term retention of core concepts when "Remembering" is offloaded to AI.

Ethical Frameworks: Developing standardized rubrics for "AI-Collaborative" work to distinguish between student-led creation and AI-dominated output.

Neuro-Pedagogy: Researching how AI-assisted learning affects neural pathways associated with deep problem-solving.

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