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Scaffolded Integration: Aligning AI Literacy with Authentic Assessment through a Revised Taxonomy in Education

BY
James Hutson
Lindenwood University, USA

Abstract
The accelerating prevalence of generative artificial intelligence in educational and professional spheres necessitates a reevaluation of when and how such technologies are introduced within pedagogical practice. The principal challenge for educators is not merely the imperative to prepare students for an AI-driven world, but rather to ensure that assessment practices remain authentic—providing an accurate measure of what students can independently achieve before leveraging the augmentation potential of intelligent systems. This article contends that the incremental introduction of AI, mapped onto a scaffolded framework aligned with a revised Bloom's Taxonomy, constitutes a methodologically sound approach for maintaining academic integrity, fostering transferable skills, and developing true AI literacy. In this model, student abilities and conceptual knowledge occupy a privileged position; only after demonstrable independent proficiency can AI tools be used to extend, refine, and synthesize student work. This phased model is not merely a theoretical exercise, but an actionable policy framework that incorporates formative assessment, transparency, process documentation, and ethical use as core design principles. By situating AI as both a tutor and collaborator—never a surrogate for student cognition—educators can ensure that learners are equipped to navigate the epistemological, ethical, and professional challenges of a world shaped by automated intelligence. The analysis draws upon constructivist pedagogy, authentic assessment theory, Universal Design for Learning, and current research on educational technology adoption, proposing practical strategies to preserve both rigor and relevance in a rapidly evolving landscape.
Keywords: AI literacy, scaffolded assessment, Bloom's Taxonomy, educational technology, authentic learning

1. Introduction

The unprecedented speed of integration seen with generative artificial intelligence into educational contexts compels a radical rethinking of literacy for the twenty-first century—one that reaches well beyond traditional competencies in reading, writing, and numeracy. AI literacy, now formally articulated in international mandates and policy initiatives, has rapidly shifted from aspirational goal to curricular imperative (Almatrafi, Johri, & Lee, 2024; Popa, 2024; Yim, 2024). As Mills et al. (2024) observe, the capacity to comprehend, implement, and critically evaluate AI technologies is now fundamental for responsible participation in contemporary society, as ubiquitous algorithmic systems increasingly shape media, communication, and decision-making. Educational leaders, in response, are actively embedding AI literacy throughout curricular frameworks, extending its reach from K–12 classrooms to tertiary settings and adult education programs, with the aim of cultivating citizens who are not only adept users of automated tools but also discerning interpreters of their social, ethical, and epistemological ramifications (Biagini, 2025; Tan & Tang, 2025; Yi, 2021).

The case for AI literacy, however, is not merely a reaction to technological acceleration but a reflection of deep epistemic shifts within education itself. Recent research underscores the centrality of metacognition, ethical discernment, and critical inquiry as core attributes of AI literacy—skills indispensable for anticipating and navigating uncertain futures (Goyal, 2025; Levin, Marom, & Kojukhov, 2025; Tadimalla & Maher, 2024). Yet, these ambitions give rise to a vexing pedagogical dilemma: How can educators reliably ascertain what students genuinely understand and can independently produce in an environment where generative AI platforms so easily generate sophisticated, human-like outputs? In other words, AI is an assessment problem because "How do we know what students actually know?" This predicament, far from being a peripheral concern, goes to the heart of the educational mission—threatening to undermine not only the authenticity of student work, but the integrity of academic assessment as a whole (Balalle & Pannilage, 2025; Schallert-Vallaster et al., 2025).

Distinguishing authentic student achievement in this context is no trivial task. The proliferation of advanced language models, capable of producing nuanced arguments and polished prose, creates unprecedented challenges for verifying the locus of agency in submitted work. By merely asking a large language model (LLM) like ChatGPT to "write this essay as an eighth grader," students can tailor outputs to the expectations of educators at different levels. Thus, as educators have begun to witness, the line between independent cognition and algorithmic augmentation grows ever more elusive, especially in disciplines where the assessment of learning is inseparable from the demonstration of process, judgment, and originality (Gu & Ericson, 2025).

Without methodological innovation, traditional assessments risk rewarding technological fluency rather than genuine intellectual engagement, thereby eroding the evidentiary foundations upon which educational judgment rests (Rodrigues et al., 2025).

Addressing this challenge demands a paradigmatic shift—a reorientation of both assessment and instruction around the principles of transparency, developmental progression, and scaffolded integration of generative tools. Recent studies suggest that educators must reclaim assessment as a site of rigorous inquiry, privileging process documentation, iterative work, and the explicit demonstration of skill acquisition prior to the introduction of AI augmentation (Chee et al., 2024; van Niekerk, Delport, & Sutherland, 2025). In this model, educators function not as gatekeepers of information, but as designers of learning environments that enable students to first internalize core concepts and then engage critically with technological augmentation in full view of both their capabilities and limitations (Allen & Kendeou, 2023). Central to this transformation is the alignment of AI literacy initiatives with a scaffolded instructional architecture, anchored in something like the revised Bloom's Taxonomy. This taxonomic hierarchy, spanning from foundational knowledge acquisition to the creation and evaluation of new knowledge, provides a robust schema for phased AI integration: students must independently demonstrate mastery at lower cognitive levels before being permitted to use generative systems for higher-order tasks

such as synthesis, analysis, and creative production. By mapping the introduction of these smart systems to these developmental benchmarks, educators can preserve the integrity of assessment while preparing learners for authentic, ethical participation in an AI-saturated world (Gu & Ericson, 2025).

The approach advanced herein is not an appeal for blanket prohibition or uncritical adoption of generative tools. Rather, it is a call for a principled, incremental model of integration—one that recognizes the epistemic stakes of the present moment while ensuring that human intellect, judgment, and creativity remain central to the educational enterprise. This scaffolded framework,
deeply informed by the research consensus and pedagogical theory, seeks to balance the necessity of technological fluency with the enduring values of authenticity and rigor. As such, it serves as both a blueprint for instructional design and an ethical anchor for assessment, guiding educators in navigating the profound transition now underway. Therefore, the purpose of this article is to elaborate this scaffolded methodology in depth, demonstrating how incremental, transparent, and developmentally attuned integration of these tools can be achieved without sacrificing the core values of educational practice. Drawing upon empirical studies, theoretical frameworks, and practical exemplars, the discussion will articulate not only the rationale for this approach, but also actionable strategies for implementation across disciplines and institutional contexts. In so doing, the analysis aims to offer a durable pathway for educational institutions seeking to harmonize the promises of AI with the imperatives of authentic learning and trustworthy assessment..

2. Faculty Concerns and the Case for Incremental AI Adoption

Educators across academic domains are increasingly voicing alarm over what is perceived as a direct threat to the epistemological core of education: the progressive erosion of student skills precipitated by the indiscriminate use of generative media solutions. Core intellectual competencies—critical thinking, analytic reasoning, and expressive clarity—can no longer be presumed as outcomes when large language models are capable of fabricating essays, solving disciplinary problems, or generating visual works with little user effort or expertise. This dislocation is particularly acute within the humanities and social sciences, where the quality of intellectual engagement is assessed not simply by the correctness of the answer but by the process through which insight and understanding are developed (Yitages & Kasai, 2024). The apprehension, widely shared among faculty, is that reliance on algorithmic shortcuts fundamentally circumvents the cognitive labor that sustains interpretation, meta cognitive awareness, and disciplined inquiry (Khatri & Karki, 2023). Such anxieties are not speculative: recent studies have documented patterns of superficial engagement and diminished intellectual persistenceinenvironmentswherestudentsinteractwithgenerativeplatformsabsentstructured pedagogical scaffolding (Gustilo et al., 2024). Faculty consistently report that learners are less able to navigate ambiguity or produce original insights—capacities historically regarded as central to both academic and professional excellence. Many institutions have responded by revisiting academic integrity policies, yet these measures, often reactive in nature, tend to misrecognize the deeper pedagogical disconnect. The substantive issue is not merely that generative engines may assist students, but that they may displace the formative activities

Through which individuals are shaped as thinkers, writers, and ethical participants in scholarly life.

Concerns about academic integrity have become especially pronounced, as faculty increasingly regard the problem as existential for the scholarly enterprise. In the current landscape, where content generators can produce grammatically flawless, citation-rich, and contextually plausible essays in mere moments, distinguishing authentic student work from machine-generated text has become an arduous task (Qureshi, 2024). Classic signifiers of originality—voice, tonal subtlety, and conceptual complexity—are now within reach of any individual with access to a contemporary generative suite trained on extensive human datasets. The resulting ambiguity has precipitated a crisis of confidence regarding assessment: educators now routinely question whether a given submission reveals genuine learning or merely technical acumen in manipulating a generative tool (Jose &Jose, 2024). This epistemological opacity undermines the credibility of credentials and the principle of fairness in evaluation, both of which rely upon the presumption that student outputs reflect their unaided intellectual capacities. Institutions are increasingly deploying detection technologies and requiring usage declarations, yet these approaches are frequently circumvented or enforced inconsistently, revealing their limited pedagogicaltraction.Furthermore,thepunitivetoneofacademicintegritydiscoursemayalienate students already accustomed to exploring these tools as creative or assistive resources. Absent strategies that meaningfully differentiate between augmentation and substitution, academic honesty risks devolving into an ideal that is both impractical and misaligned with the realities of contemporary learning environments.

Perhaps most consequential is the apprehension that the use of generative platforms may precipitate a broad diminution of creativity and expressive individuality among learners. Faculty in creative disciplines contend that the mechanical fluency of outputs produced by such systems has the potential to crowd out imaginative risk-taking, intellectual divergence, and authentic expressive voice (Balachandar & Gurusamy, 2024). Media engines such as ChatGPT, DALL·E, and analogous platforms offer prepackaged compositions that optimize for coherence and fluency but frequently lack emotional resonance, conceptual tension, or genuine novelty—qualities fundamental to creative production. Reliance on these systems can result in conformity to algorithmically normalized conventions, thereby flattening students' creative repertoires and diminishing their distinctive intellectual signatures (Khup & Bantugan, 2025). Instructors have increasingly observed the emergence of technically competent but narratively generic work, provoking questions regarding the cultivation of authorial identity, vision, and original though tin settings pervasively mediated by algorithmic agents. This concern reaches beyond questions of style and speaks directly to the ethical formation of learners, who must be equipped not only to articulate but to stand behind their own ideas with conviction and personal understanding.

Without a principled, pedagogically robust approach to integration, generative systems threaten to reduce creativity to mere customization and authorship to algorithmic synthesis. The imperative, then, is for faculty to design in structional environments in which human creativity is protected and amplified precisely through productive tension with technological efficiency.

These intersecting anxieties recall enduring debates about the fundamental aims of higher education: is the purpose of the academy to credential competence or to cultivate the capacities for self-discovery and critical engagement that constitute intellectual character? For those who view the university as a crucible of moral and cognitive transformation, algorithmic augmentation is perceived as a force that may disrupt the slow, non-linear, and affectively rich trajectories by which genuine learning unfolds (Kotsis, 2025). The danger is not only that students will circumvent the requirements of academic rigor, but that they will deprive themselves of the opportunity to struggle, reflect, and grow through iterative engagement with challenging materials. Such developmental arcs—marked by ambiguity, failure, and ultimately resilience—are inherently resistant to compression into transactional exchanges with a computational system. In response, faculty increasingly advocate for learning architectures that prioritize process, feedback, and embodied participation, all of which fore ground the humanistic elements of scholarly practice (Ali, 2024). While more difficult to automate or scale, such approach hesfunctionasvital counter weights to the instrumental logic that often accompanies the rapid adoption of digital technologies. By grounding curriculum and assessment in deliberate, student-centered methodologies, educators reclaim their vocation as shapers of intellectual disposition and character, rather than mere content deliverers. This humanistic stance serves as a necessary corrective to the logic of technical efficiency that dominates much contemporary discourse on educational technology.

Equally pressing are concerns regarding the adequacy of institutional responses, which frequently manifest as top-down restrictions or surveillance measures, reflecting administrative prioritiesratherthanpedagogicalwisdom.Thesemanagerialapproachesriskbypassingthedeep, discipline-specific expertise of faculty, who possess nuanced understanding of what authentic learning looks like within their own fields (Francis et al., 2025). Faculty consistently express the need for not only technological resources, but also institutional trust: opportunities to pilot new methods, develop context-specific guidelines, and participate in reflective communities of practice are all regarded asessential for meaningful engagement with generative technologies. In the absence of such support, many report feelings of disempowerment, professional frustration, and even marginalization (Yitages & Kasai, 2024). In contrast, when faculty are empowered to lead innovation and craft policies attuned to the ethos of their disciplines, a greater sense of coherence, ownership, and collective responsibility emerges. The challenge, then, is not merely technical but cultural: how to construct educational ecologies that recognize algorithmic media as a pedagogical variable, rather than as an existential threat or panacea. Faculty, given the requisite authority and support, are well-positioned to steward environments that sustain academic integrity while acknowledging the inevitability of technological transformation. This stewardship demands more than compliance with administrative mandates; it requires the cultivation of a renewed pedagogy rooted in trust, critical inquiry, and principled adaptability.

3. Theoretical Framework: Constructivism, Bloom's Taxonomy, and UDL

At the heart of the proposed approach to integrating generative tools in education lies a commitment to constructivist pedagogy, which asserts that knowledge is actively constructed through learner engagement, not passively received. Constructivism foregrounds the learner's experience, emphasizing that cognition develops through iterative cycles of exploration, reflection, and contextual problem-solving. In this view, learning is a social and developmental process grounded in scaffolding—incremental instructional support that evolves as learners internalize new concepts and skills (Pande& Bharathi, 2020). Scaffolding ensures that students encounter manageable challenges, with support fading appropriately as competence increases. The integration of algorithmic media, when aligned with constructivist principles, demands careful calibration: tools must serve to extend cognitive effort, notcircumventit. When students rely on systems without having first developed baseline understanding, the result is not augmentation but substitution—a fundamental breach of constructivist ethics. Conversely, if these tools are introduced after independent cognitive mastery, they can support meta cognitive reflection, alternative representations, and novel synthesis. In this context, scaffolding becomes the mechanism by which instructors preserve epistemic integrity while preparing students to function within digitally mediated knowledge ecologies (Tarman & Kuran, 2015).

The scaffolding framework also intersects with Vygotsky's notion of the Zone of Proximal Development (ZPD), which identifies the optimal spacefor learning—tasks that a student cannot yet perform independently but can achieve with guidance. This model is particularly relevant in environments where learners engage with generative technologies: such tools can be positioned within the ZPD when their use is contingent upon prior demonstration of independent proficiency (Sideeg, 2016). This prevents overreliance on automation and ensures that cognitive effort remains fore grounded. Moreover, scaffolding allows for differentiated pacing, encouraging learners to develop conceptual mastery at variable rates without forgoing rigor or depth.

Instructors can structure assignments that progress from skill demonstration to AI-augmented refinement, maintaining visibility overreach phase of the learning process. This staged structure aligns with constructivist commitments to learner autonomy, meaningful struggle, and developmental progression. By situating the use of algorithmic tools within a scaffolded sequence, educators uphold the principle that technology should support—not replace—the construction of knowledge. Such an approach mitigates concerns over skill erosion while reinforcing the instructional value of gradual release and reflective practice.

Crucially, the use of constructivist scaffolding in AI-integrated contexts also preserves the integrity of assessment. In traditional settings, instructors observe students' interpretive processes through outlines, drafts, and revisions; in mediated contexts, similar transparency must be retained. Scaffolded frameworks require students to submit not only final outputs but the steps
leading to them—manual drafts, prompt histories, and revision logs. These artifacts re-establish the evidentiary trail of cognition, allowing faculty to assess not merely the product but the learning process itself. This constructivist orientation insists that outputs be evaluated not in isolation but in relation to the thinking they reflect and the supports through which they evolved. Without this attention to developmental context, assessments risk rewarding fluency in tool usage rather than depth of understanding. Scaffolded integration, then, becomes not simply an

instructional convenience, but a philosophical necessity for protecting the cognitive aims of education in a computational age.

Likewise, the Revised Bloom's Taxonomy offers a hierarchical model of cognitive engagement, ranging from lower-order processes such as remembering and understanding to higher-order capacities such as analyzing, evaluating, and creating. This taxonomy serves as a critical structuring principle for any instructional model that seeks to preserve and assess student thinking within technology-rich environments (Andersen, 2024). Generative systems complicate this hierarchy: they are most powerful at simulating higher-order outputs—particularly in the creative domain—yet they require little from users in terms of comprehension, analysis, or evaluative judgment. As such, a taxonomy-aligned framework must resist the premature introduction of tools at the upper tiers until foundational competencies have been demonstrated. Students must first be able to recall and interpret key concepts before using digital systems to expand or synthesize those ideas. This phased alignment ensures that technology supports authentic progression rather than obfuscating gaps in understanding (Gonsalves, 2024).

Pedagogical models informed by Bloom's framework can incorporate generative tools in sequenced phases. For example, an assignment might begin with comprehension-based exercises—summarizing a concept or analyzing a source—before introducing the option to use generative assistance in the development of an argument or artifact. In this configuration, the taxonomy acts as both a gatekeeping mechanism and a roadmap for responsible integration: progression through the cognitive levels determines the permissible scope of tool use (Pesovski et al., 2024). In programming education, for instance, learners might be asked to critique or refine AI-generated code only after demonstrating mastery of syntax and logic independently. Such mapping avoids the reversal of pedagogical sequence, wherein students begin with creation—enabled by automation—before developing the skills required to analyze or understand. Misalignment of this nature not only distorts assessment but undermines the developmental logic upon which the taxonomy is built. A properly scaffolded taxonomy-based model thus demands evidentiary progression: only those who can explain, justify, and critique should be permitted to generate.

Moreover, revised implementations of Bloom's hierarchy in algorithmic contexts can prompt new questions about the nature of higher-order thinking itself. Is creativity that relies on predictive generation truly equivalent to original synthesis? Can analysis occur without the ability to deconstruct the system that generated the artifact? These questions are not merely semantic; they bear directly on how educators define, reward, and verify learning outcomes in AI-enabled settings. Studies now advocate for a reconceptualization of creative and evaluative stagesthatincludescriticalreflectionontoolusage,biasidentification,andprocesstransparency as core competencies (Shaik et al., 2023). In this updated taxonomy, creativity is not simply production but involves articulating the rationale for choices made, assessing the quality of generative contributions, and iterating toward improvement. Similarly, evaluation includes not only judgment of claims but scrutiny of the methods—algorithmic or human—through which those claims were constructed. These additions reinforce the need for revised rubrics and outcome descriptors that align with the epistemological realities of mediated cognition.

At the same time, Universal Design for Learning (UDL) provides a neurodiversity-informed framework that advocates for flexible learning environments responsive to the variability of learners. Rooted in the neuroscience of learning, UDL emphasizes three core principles: providingmultiplemeansofengagement,representation,andaction/expression.Theseprinciples align powerfully with the affordances of generative technologies, which can be leveraged to individualize support, diversify cognitive access, and expand modalities of demonstration (Isabel, Romero-Esquinas, & Teresa, 2023). However, without intentional integration into instructional design, these tools can just as easily reinforce existing inequities or encourage passive consumption. UDL thus offers a vital corrective, reminding educators that technology is only inclusive when aligned with deliberate strategies to reduce barriers and foreground learner agency. In this framework, generative systems must be harnessed not as replacements for cognitive effort but as customizable scaffolds that adapt to diverse learning profiles.

In the context of assessment, UDL calls for tools that allow learners to demonstrate understanding in ways that align with their strengths—visual, linguistic, spatial, or kinesthetic. Generative tools, when introduced judiciously, can support this diversity by enabling multimodal expression: students might visualize complex systems, simulate historical scenarios, or verbalize abstract concepts through structured prompts. Such flexibility is particularly beneficial for neurodivergent learners, who may struggle with conventional modes of output but flourish when given adaptive tools (Gonsalves, 2024). However, to avoid reducing rigor, these affordances must be paired with clear criteria, reflective documentation, and evidence of intentionality. For instance, students might be required to annotate generative outputs, explaining how choices were made, what was retained or discarded, and how the tool enhanced (rather than determined) the final product. In this way, UDL is not a dilution of expectations but a reconfiguration of pathways—ensuring that rigor is accessible, not exclusive..

Finally, the intersection of UDL and Bloom's Taxonomy within a constructivist paradigm offers a triadic framework for inclusive and rigorous assessment in the era of generative media. UDL addresses the diversity of learner profiles; Bloom's Taxonomy provides a scaffolded hierarchy for cognitive development; and constructivism foregrounds the epistemic importance of process and self-authorship. Together, these frameworks can be operationalized through assignment design, assessment rubrics, and instructional feedback loops. For example, a taxonomy-aligned prompt might ask students to analyze a generative summary (Bloom: Analyze), critique its reliability (Evaluate), and revise it using course materials (Create), while UDL principles ensure that students can engage these tasks through modalities suited to their cognitive profiles. When embedded within a constructivist instructional arc, students not only complete the task but reflect
on how they learned, why they chose certain tools, and what they would do differently. This multidimensional approach reframes generative media not as a threat to education, but as a catalyst for reimagining pedagogical coherence, inclusivity, and intellectual integrity.

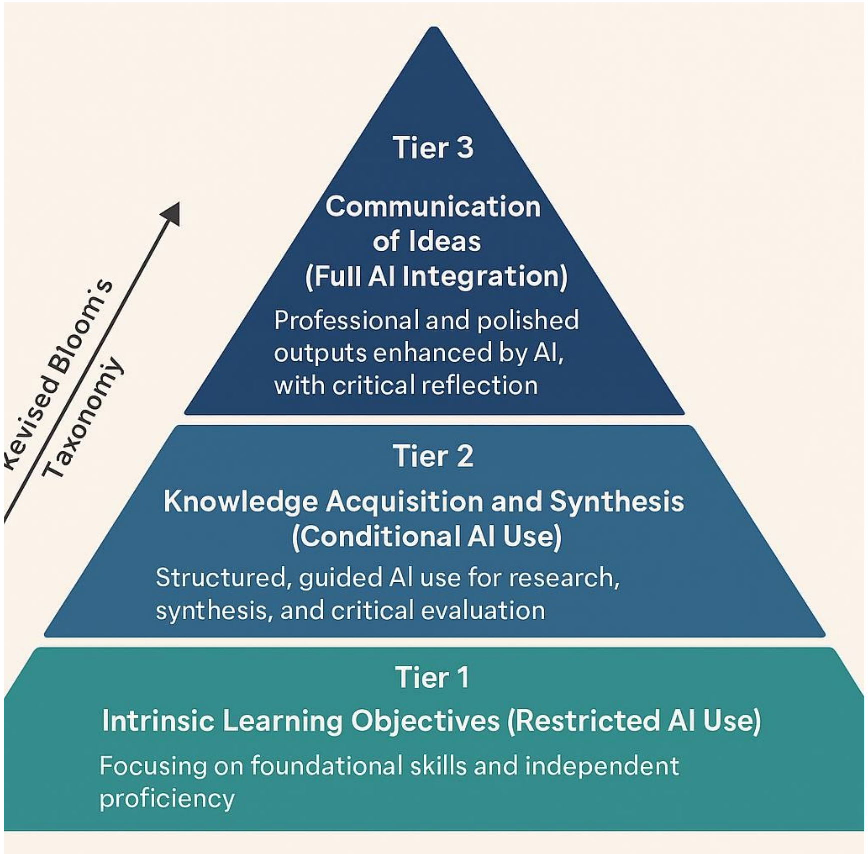
4. A Tiered Framework foray Integrationin Learning and Assessment

A robust framework for integrating generative technologies in educational practice must balance the imperative of authentic skill development with the realities of an AI-driven world. This is achieved through a scaffolded, three-tiered progression **(Table 1)**—each tier intentionally sequencedtocultivateautonomy,criticalengagement,andethicaldiscernmentbeforepermitting algorithmicaugmentation.Drawingonconstructivistpedagogy,Bloom'srevisedtaxonomy,and Universal Design for Learning, the framework operationalizes a graduated pathway where technology never substitutes for foundational knowledge, but rather acts as a lever for reflective practice, knowledge synthesis, and professional communication **(Figure 1)**. Below, each tier is expanded in detail, with reference to strategies, rationales, and research-aligned best practices.

Table1. A Tiered Framework for Generative Tool Integrationin Learning and Assessment

Tier	Purpose & Scope	Allowable Use of Generative Tools	Assessment Strategies	Documentation &Transparency	Key Developmental Focus	Ethical& Reflective Practice
Tier1:IntrinsicLearning Objectives(Restricted Use)	Develop foundational, discipline-specific skills (critical thinking, analytic writing, problem-solving)	Minimal and tightly managed; generative tools may be used for scaffolded, tutor-like activities only (e.g., syntax drills, exploration—not content generation or final outputs)	Timed, in-class tasks; independent drafts; oral defenses; process-focused rubrics	Submission of all drafts, margin notes, revision logs; meta-cognitive journals	Independent mastery, struggle, and direct engagement with primary materials; building habits of mind	Reflection on learning processes; prohibition or restriction of tool use; confirmation of authentic student knowledge
Tier2:KnowledgeAcquisition& Synthesis(ConditionalUse)	Synthesize, analyze, and integrate knowledge; scaffolded engagement with research, data, or complex problems	Conditional; permitted after independent proficiency is demonstrated; tools may support organization, expansion, critique, and synthesis	Two-phaseassignments (independentthen augmented);criticalevaluationofoutputs;scaffoldedrubricsevaluatingbothprocessandproduct	Transparency logs detailing prompts, outputs, editorial decisions; submission of both independent and augmented versions	Development of digital literacy, critical evaluation, and reflective synthesis	Mandatoryattributionoftooluse;reflectiveessayscritiquinggenerativecontributions; emphasisondistinguishingaugmentation From substitution
Tier3:Communication of Ideas(FullIntegration)	Produceprofessional,polishedoutputs;simulatereal-worldcollaborativeandcommunicativecontexts	Full integration permitted; generative tools can be used for drafting, editing, presentation, and formatting	Scenario-based, collaborative, or portfolio assignments; professional-quality deliverables; rubrics evaluating both output and ethical engagement	Comprehensive process documentation (prompt history, workflow records, decision logs); explicit attribution of generative input	Adaptive, ethical, andtransparentcommunication;collaborativeproblem-solvingandpresentation	Metacognitive reflection on tool use, bias detection, process improvement; explicit articulation of ethical standards and accountability

Figure1. Scaffolded AI Integration Aligned with Revised Bloom's Taxonomy



4.1 Tier1: Intrinsic Learning Objectives (Restricted AI Use)

The first tier is organized around the development of core disciplinary competencies in an environment insulated from algorithmic intervention. Here, the central aim is to ensure that learners internalize the foundational skills—analytic reading, disciplined writing, creative problem-solving, and independent reasoning—that form the basis for all advanced learning. Generative tools are not wholly excluded; rather, their use is strictly managed to prevent circumvention of essential cognitive labor. Instructors may, for example, introduce "AI as Tutor" activities in which students explore the nuances of coding syntax or literary devices in a tightly scaffolded and transparent manner—these tools deepen understanding but are not used to generate finished outputs. Most assignments, however, prioritize direct engagement with primary sources and require learners to construct meaning independently: annotated close readings, original argumentative essays, manually-drafted models, and unscripted class discussions all exemplify activities in which the locus of agency remains with the student.

Assessment in this tier is deliberately process-focused. Timed, in-class exercises and oral defenses ensure that the knowledge demonstrated is indeed the learner's own, not an artifact of algorithmic synthesis. Students are asked to submit portfolios, including all drafts, margin notes, and revision histories, so instructors can trace the development of understanding over time. These process artifacts are complemented by reflective essays or metacognitive journals in which students articulate the reasoning behind their interpretive or problem-solving choices, evaluate the challenges encountered, and outline plans for future growth. Peer review further reinforces accountability and critical engagement, requiring students to comment constructively on each other's independent work. In select cases, educators may incorporate oral presentations or viva-style defenses, requiring learners to explain their rationale and respond to critical questions in real time. In all cases, the assessment rubric foregrounds analytic depth, originality, and clarity of expression, while penalizing overreliance on any outside source. This rigorous approach assures faculty and students alike that the competencies developed are genuine, transferable, and verifiable.

Tier 1 is, above all, protective. It shields the formative stages of learning from premature automation, ensuring that students experience the productive struggle necessary for genuine intellectual development. By structuring the curriculum so that technology complements but never replaces foundational work, this stage directly addresses the fears of skill erosion and the lossofacademicintegritysoprominentinfacultydiscourse.Thedeliberateexclusionorcareful management of generative tools at this stage is not reactionary but principled: it preserves the authenticity of the educational experience while laying the groundwork for ethical, discerning technology use later on. Only when students have met explicit proficiency thresholds, as demonstrated byrubric-based assessments or instructor evaluation, do they become eligible for the conditional integration permitted in Tier 2.

4.2 Tier 2: Knowledge Acquisition and Synthesis (Conditional AI Use)

The second tier marks a deliberate transition from independent mastery to augmented synthesis, where algorithmic resources are introduced as scaffolds for research, data analysis, and knowledge construction. The key principle here is that students must first demonstrate foundational competence—evidenced through independent outlines, summaries, and critical evaluations—before being allowed to use generative technologies as supportive aids. The structure of assignments is intentionally sequenced: the initial phase requires students to complete core tasks unaided, while a subsequent phase allows for the integration of digital systems to expand, organize, or challenge their preliminary work. For example, in a research project, a student might independently gather and annotate sources, then use a custom generative platform to help synthesize themes, identify gaps, or structure arguments, provided that both the original and augmented outputs are submitted together for comparison and evaluation.

Transparency is paramount in this tier. Students are required to maintain detailed process logs—documenting every prompt, tool interaction, editorial decision, and revision made in the transition from initial draft to final submission. These transparency logs not only serve as a record of engagement but also provide instructors with critical insight into the sequence and substance of cognitive moves. Assignments in Tier 2 frequently incorporate critical engagement tasks, where students are asked to critique or improve upon flawed algorithmic outputs, reconcile discrepancies between machine-generated analyses and their own, or verify the accuracy of automatically produced content. These tasks teach learners to approach generative outputs with skepticism and intellectual rigor, reinforcing habits of source evaluation, error detection, and analytical reasoning.

Assessment in this phase emphasizes both the quality of the final product and the ethical, critical,
and reflective processes underlying its construction. Rubrics are adapted to reward discernment in tool usage, accuracy in attribution, and depth of self-analysis. Reflective assignments require students to discuss how generative resources influenced their thinking, identify strengths and limitations in algorithmic assistance, and articulate the decision-making process behind accepting or rejecting certain outputs. This dual focus—on product and process—ensures that technology is framed as a means to cognitive enhancement, not a shortcut to completion. Moreover, by introducing conditional use only after demonstrable proficiency, Tier 2 addresses the core pedagogical concern of faculty: it prevents technology from eroding independent skill while fostering the digital literacy necessary for the contemporary workforce. Where feasible, custom or course-specific generative tools may be employed to guide students through these scaffolded phases. For example, a proprietary writing platform might generate automated feedback reports or prompt suggestions for revision, ensuring alignment with course objectives and maintaining instructor oversight. In all cases, the emphasis is on transparency, accountability, and iterative learning. This phase models the kinds of workflows students are likely to encounter in real-world professional or research settings, preparing them to engage with automation responsibly and reflectively.

4.3 Tier3:Communicationof Ideas (FullAI Integration)

The final tier is reserved for assignments whose primary focus is the communication of ideas, professional presentation, or the simulation of authentic workplace practice. In this environment,
generative technologies are fully integrated, permitting students to leverage their capacities for drafting, editing, formatting, and organizing complex deliverables. Activities in this tier might include business proposals, policy briefs, research reports, multimedia presentations, or technical
documentation, all of which benefit from the clarity, efficiency, and adaptability that digital systems provide. The critical distinction, however, is that full integration is contingent upon prior
demonstration of foundational skill and responsible, reflective tool use in earlier phases. Assignments at this level are designed to mimic real-world scenarios, requiring students to manage collaborative workflows, respond to dynamic client briefs, or integrate feedback from multiple stakeholders. Rubrics in Tier 3 are revised to evaluate not only the professionalism and communicative effectiveness of the final product but also the ethical and critical engagement demonstrated throughout its production. Process documentation is mandatory: students must submit a comprehensive log detailing every step of their workflow, including the prompts used, key revisions, decisions made, and justifications for tool selection. Attribution of algorithmic contributions is required for every deliverable, ensuring transparency and honoring academic integrity.

Ethical considerations occupy a central place in Tier 3. Students are expected to verify the accuracy of generative outputs, identify and correct any biases, and reflect on the broader social or professional implications of their tool use. Metacognitive reflection remains integral, with students required to discuss how their decisions were shaped by the interplay between independent judgment and algorithmic assistance, as well as to propose improvements for future application. These reflective practices foster self-regulation, deepen digital literacy, and prepare students to navigate the ambiguous boundaries between human and machine intelligence in professional life. The ultimate goal of this approach is not merely to produce polished outputs but to cultivate adaptive, reflective, and ethically responsible communicators. Students exit this tier with experience in documenting, critiquing, and justifying their use of advanced digital resources, skills increasingly indispensable in an automated workforce. By anchoring full integration in a foundation of skill mastery and ethical discernment, the framework ensures that generative media augment rather than supplant the rigor, creativity, and critical capacity essential to higher learning and professional success.

What distinguishes this tiered framework is its commitment to phased skill development, iterative assessment, and authentic verification. Across all levels, students are required to submit scaffolded artifacts—annotated sources, early drafts, transparency logs, and process documentation—that allow instructors to trace intellectual growth and distinguish between independent work and algorithmic augmentation. Assignments build iteratively, requiring students to reflect on changes, compare outputs, and engage in peer or oral review. Rubrics explicitly address both the quality of the final product and the transparency, creativity, and ethical considerations surrounding tool use. By foregrounding process over product and outcome-driven design, the framework maintains the centrality of human cognition while harnessing the efficiency and dynamism of emerging technologies. In this way, it models a future-oriented, inclusive pedagogy—one in which rigor and flexibility, tradition and innovation, are held in generative tension, preparing learners for the complexities of life and work in the era of ubiquitous automation.

5. Strategies for Maintaining Authenticity and Demonstrating Proficiency

A process-over-product approach to assessment is foundational to maintaining academic authenticity in AI-mediated learning environments (Table 2). Emphasizing the steps that lead to a final submission—drafts, annotated outlines, brainstorming artifacts, and reflective notes—not only reveals the learner's cognitive trajectory but also offers safeguards against passive automation. By requiring students to submit intermediary learning artifacts, educators are better equipped to distinguish between superficial output and genuine understanding. The iterative nature of these assignments reinforces conceptual depth, enabling students to revise based on formative feedback and gradually refine their skills. Yoon et al. (2025) demonstrated the power of electronic portfolios in clinical education, highlighting how structured submission of layered artifacts supports both competency mapping and timely feedback loops. When students reflect on their revisions and decisions throughout the learning process, they engage in metacognitive work that deepens retention and promotes transferability. These learning records serve not only as evaluative instruments but also as dialogic spaces between instructors and students—spaces where intellectual process takes precedence over polished results. Such transparency is particularly essential in AI-supported settings, where the final artifact may conceal the student's original contributions unless the process is fully documented.

Table 2. Strategies and Assessment Models for Maintaining Authenticity and Demonstrating Proficiency in AI-Integrated Learning

Strategy	Practical Approach	Assessment Model	Targeted Outcomes	References
Process-over-Product	Require submission of drafts, outlines, annotated notes, and revisions.	Formative, process-based assessment	Transparent demonstration of cognitive steps; metacognitive development.	Yoonetal.,2025;Morgan ,1999
Portfolio and Iterative Assessment	Students curate portfolios documenting initial, revised, and final work, including reflections on decisions, prompt histories, and ethical tool use.	Longitudinal, portfolio-based assessment	Holistic view of growth; evidence of both independent and AI-augmented effort; reflective learning.	Ariyani,2013;Ediger, 2000
Interactive and Oral Assessments	Implement live or recorded oral exams, presentations, or interviews, including explanation of methodology and tool use.	Real-time, interactive assessment	Verifiable, spontaneous demonstration of understanding; communicative and adaptive competence.	Ally,2024;Akhteretal.,2024
Rubric Adaptation	Use rubrics with criteria for independent work, AI integration, critical reflection, prompt design, and ethical decision-making.	Criterion-referenced, transparent grading g	Consistent, fair evaluation; clear communication of expectations; accountability for all forms of contribution..	Sanavi & Mohammadi,2020;Pérez-Higueraset al., 2025
Metacognitive and Ethical Reflection	Require written or oral self-assessments on tool usage, decision-making, and ethical considerations..	Embedded in process/product assessment	Enhanced self-regulation, digital literacy, and ethical practice.	Yoonetal.,2025;Ediger, 2000

The portfolio model, long valued in teacher education and professional disciplines, aligns seamlessly with this emphasis on iterative and authentic learning. Portfolios afford learners the opportunity to curate a narrative of their development over time, linking discrete assignments to larger themes of growth, challenge, and transformation. Morgan (1999) traced the evolution of performance assessment portfolios in a preservice teacher program, underscoring their capacity to render visible higher-order thinking when accompanied by reflective commentary. In AI-enabled classrooms, portfolios take on new relevance as both protective and pedagogical tools. Students can be asked to submit early-stage drafts alongside algorithmically enhanced revisions, including reflective annotations explaining the purpose and ethical considerations of tool use. This dual-submission practice helps educators assess not just the end product but also the judgment behind augmentation, thus supporting academic integrity. Ariyani (2013) demonstrated the importance of detailed, rubric-aligned portfolio criteria in capturing intratextual quality, student voice, and the progression of ideas. When developed with clear performance descriptors and integrated reflection points, portfolios become verifiable indicators of student agency and critical engagement—resisting the flattening effects of generative automation by foregrounding narrative, context, and intentionality.

Oral and interactive assessments have also re-emerged as powerful tools for authenticating learning and verifying student proficiency in the age of generative systems. Unlike written assignments, which may be surreptitiously augmented, oral evaluations require students to think aloud, respond spontaneously, and demonstrate their grasp of material in real time. These formats reinforce comprehension, synthesis, and communication—essential skills that cannot be easily outsourced. Ally (2024) proposed an iterative scheduling system for online oral exams that ensures both scalability and security, enabling institutions to validate student understanding while preserving accessibility. In addition to verifying authorship, oral assessments cultivate discourse skills and professional fluency, preparing students for roles where clarity, adaptability, and verbal persuasion are critical. In AI-integrated classrooms, educators may use oral exams to triangulate learning: a student who submits a research report must also explain its methodology and conclusions in a follow-up interview, ensuring alignment between product and professed understanding. This layered design fosters coherence between declarative and procedural knowledge while reaffirming the role of instructors as evaluators of live intellectual performance.

Furthermore, oral and recorded assessments facilitate nuanced engagement with students' decision-making in using generative tools. In a large-scale business course implementation, Akhter et al. (2024) developed the Live Recorded Video Exam (LRVE), a scalable model where students recorded asynchronous oral responses while screen-sharing their process. This allowed instructors to not only assess communicative competence but also audit the technological path taken to complete the task. Such innovations merge verbal articulation with digital transparency, enabling real-time verification without logistical burdens. For disciplines that rely on case-based reasoning, diagnostic thinking, or applied knowledge, oral assessments offer irreplaceable insights into the learner's capacity to transfer and apply concepts across contexts. Moreover, they foster student confidence, as learners are invited to claim ownership of their ideas and publicly reason through complex material. In an academic culture increasingly mediated by automation, these performances re-center human agency and authentic cognition.

Finally, rubrics must be reconceived to accommodate both independent and AI-augmented work while preserving clarity, consistency, and fairness. Traditional rubrics focus on outcomes alone—coherence, grammar, argumentation—but fall short in capturing the ethical and strategic dimensions of tool use. A revised rubric must include explicit criteria for evaluating the quality of integration: prompt construction, evaluation of outputs, editing for accuracy, and metacognitive reflection. Sanavi and Mohammadi (2020) argue that rubric design is an iterative, multi-phase process that must account for construct validity, content alignment, and scoring transparency. In the context of AI, this means embedding criteria that reward students not simply for polished work but for thoughtful tool engagement, originality of perspective, and ethical restraint. Pérez-Higueras et al. (2025) demonstrated that rubrics, when introduced early and aligned with learning outcomes, help students internalize expectations and self-assess with greater precision. Moreover, rubrics demystify grading for all stakeholders—students, instructors, administrators—by operationalizing complex judgments in accessible terms. When shared prior to assignments, they serve as learning tools; when used consistently across tasks, they become anchors of academic trust.

Such rubrics must be capable of accommodating hybrid products that contain both human-authored and AI-generated components. For instance, a rubric may evaluate a student's critical use of algorithmic suggestions, their ability to revise flawed outputs, or their awareness of bias and misinformation in generative responses. These categories require linguistic precision, calibrated scoring scales, and exemplars to guide both students and assessors. Ediger (2000) emphasizes that rubrics help structure evaluation across diverse student outputs—written, oral, visual—by providing consistent lenses for interpreting quality. As Moothedath (2024) found in clinical oral assessments, rubrics also yield more reliable and valid judgments than traditional unstructured assessments, especially when combined with performance observation. In technology-rich learning environments, this dual function—as evaluative schema and instructionalscaffold—becomesvital.Rubricsmustnolongerbemereinstrumentsofsummative judgment; they are pedagogical contracts that promote transparency, guide ethical practice, and enable authentic demonstration of knowledge in an increasingly automated academic landscape.

6. Implementation Guidance for Instructors

Effective implementation of scaffolded AI integration hinges on thoughtful, staged assessment design. Instructors must align formative and summative assessments with each tier of the framework to maintain both academic rigor and developmental progression. At Tier 1, formative assessments should isolate and evaluate foundational competencies such as critical reading, independent writing, or problem decomposition. These assessments—e.g., timed essays, coding challenges, or source-based textual analyses—intentionally exclude AI use to establish baseline proficiency and discourage premature automation. As students progress, summative evaluations may include oral defenses, in-class prompts, and reflection-based tasks designed to verify authentic learning outcomes while building learner confidence in independent skill application.

As students advance to Tier 2, assessments evolve to accommodate conditional AI usage. Assignments are structured in sequenced phases: students first produce independently generated work, then use generative tools to revise, expand, or critique their original output. This scaffolded structure supports knowledge synthesis while preserving a trail of process evidence. Page et al. (2024) recommend combining Bloom's Taxonomy with Knowledge Dimensions to ensure that AI integration supports, rather than supplants, cognitive complexity. For example, in a history course, students might independently draft an annotated bibliography before using a generative tool to identify emergent themes and develop a thesis. Summative assessments in Tier 2 should include comparison tasks—evaluating discrepancies between human and machine interpretations—or reflective analyses on the reliability, bias, and utility of AI contributions.

In Tier 3, instructors design assessments for professional communication and polished output, where full AI integration is permitted with clear parameters. These assessments should emulate authentic workplace or domain-specific deliverables—such as policy briefs, pitch decks, or design portfolios—and be judged on quality, clarity, and ethical tool usage. To preserve academic integrity, instructors should require submission of process logs, screen captures, prompt histories, and reflective essays detailing AI contributions and human decision-making. Khlaif et al. (2025) propose a "Four-A" framework—Against, Avoid, Adopt, and Explore—that can guide instructors in classifying and aligning assessments with appropriate AI engagement levels. Embedding this kind of framework into assignment design allows for transparent and accountable use while encouraging critical examination of the tool's role within the student's workflow.

Transparency begins with syllabus design. Faculty should clearly communicate when, where, and how AI use is permitted across the course. Syllabus language should mirror the scaffolded framework: Tier 1 tasks prohibit AI use, Tier 2 allows conditional integration with documentation, and Tier 3 supports full integration with attribution and reflection. A sample clause might read: "This course employs a three-tiered model of AI integration. Assignments will indicate the permitted level of tool use. Unauthorized or undocumented use of AI technologies will be considered a violation of the academic integrity policy." Such clarity ensures students know the expectations up front and understand the pedagogical rationale behind AI restrictions or freedoms. Assignment instructions should reinforce this clarity. For Tier 1, instructors might write: "AI tools may not be used for this in-class essay. You must complete the assignment using only your own knowledge, and you may be asked to orally defend your response." For Tier 2, a research project might include: "After independently generating your annotated bibliography, you may use an AI tool to organize your notes into thematic clusters. Include a reflection (300 words) detailing your evaluation of the AI's suggestions and any edits you made." In Tier 3, a business proposal prompt could read: "You may use AI to refine the formatting and visual design of your report. Your submission must include a usage log (prompts and outputs), a final product, and a reflection explaining your design choices and how the technology enhanced your message." Such detailed task framing aligns with ethical best practices and helps learners distinguish between augmentation and substitution.

Furthermore, institutions should provide standardized language banks and assignment templates to reduce the cognitive and administrative load on instructors. As Gonsalves (2025) notes, contextual clarity is paramount when integrating AI into instructional design; otherwise, students and faculty alike may default to confusion or inconsistency. Departments could also host cross-disciplinary repositories of AI-integrated assignments, showcasing successful examples and encouraging shared policy coherence. Verbiage should also include a consistent approach to AI attribution—e.g., "AI-assisted content must be labeled as such in the final submission and fully documented in the process log." Over time, these policies will cultivate shared norms around responsible, transparent AI use in academic work.

While pedagogical frameworks are vital, their success depends on faculty readiness. Unfortunately, instructors vary significantly in their familiarity, comfort, and willingness to engage with generative technologies. According to Mathew and Stefaniak (2024), a major obstacle to AI integration in higher education is faculty's lack of training, not resistance. Needs assessments show that instructors require structured opportunities to explore the pedagogical, ethical, and technical dimensions of generative tools. A tiered professional development model, akin to the scaffolded AI usage framework itself, can help guide faculty through exploration, experimentation, and implementation. Foundational workshops should cover AI tool functionality, educational implications, and basic prompt engineering. These sessions help

faculty recognize the boundaries and affordances of generative tools and identify discipline-specific use cases. Miller (2024) emphasizes the role of assessment professionals in helping instructors reimagine assessment rather than merely retrofit old models. Therefore, sessions should emphasize design thinking—how to reconstruct assignments, integrate reflective tasks, and establish verification protocols without defaulting to suspicion or surveillance. Cordie and Adelino (2020) found that faculty development models rooted in transformative learning—dialogue, peer modeling, and iterative redesign—yielded significant gains in instructor confidence and willingness to innovate.

In addition to training on AI use, faculty need time and support to develop aligned materials: revised rubrics, assignment prompts, grading workflows, and usage documentation protocols. Marshall et al. (2017) demonstrated that involvement in structured assessment institutes not only improved scoring consistency but also elevated confidence in both instruction and evaluation. Institutions might establish interdisciplinary “AI Teaching Labs,” where faculty can workshop materials, test assignments in sandboxed environments, and receive feedback from peers and instructional designers. These labs should include exemplars, shared repositories of vetted assignments, and real-time analytics for evaluating student engagement with AI tools. To ensure long-term sustainability, institutions should recognize and reward faculty efforts to design, pilot, and assess AI-integrated pedagogies. This might include grant programs, course release time, or formal credit toward promotion and tenure. As Willkomm (2024) argues, gaining faculty buy-in requires demonstrating how AI integration benefits not just compliance but also innovation, equity, and instructional quality. Faculty must be seen not merely as end users but as co-designers of the educational response to a generative future. Professional development, then, becomes both the bridge and the incubator—connecting vision with action and cultivating the conditions in which responsible, student-centered AI integration can flourish.

7. Conclusion: Evolving Educational Principles for an AI-Augmented Era

The accelerating diffusion of generative technologies in educational contexts presents both unprecedented opportunities and existential challenges. At the heart of these developments remains the non-negotiable imperative to reaffirm the centrality of human cognition, judgment, and creativity. Despite the remarkable capabilities of large language models and automated media engines, authentic learning continues to rely on the slow work of reflection, synthesis, and disciplined inquiry—processes that cannot be fully replicated, much less replaced, by algorithmic systems. Educational institutions thus stand at a pivotal juncture: the task is not to retreat from digital innovation, nor to accept uncritical automation, but to construct new frameworks that recognize the enduring significance of human-centered learning within computationally saturated environments. As recent scholarship contends, only by foregrounding the irreducible role of the learner as interpreter, critic, and ethical agent can education retain its transformative potential in an era increasingly shaped by machine intelligence (Gonsalves, 2025;

Miller, 2024).

The scaffolded, tiered framework advanced here provides a principled and pragmatic response to these demands, ensuring that technological augmentation is not permitted to erode foundational skills or academic honesty. By insisting that students demonstrate independent mastery before advancing to conditional or fully integrated use of generative tools, the model preserves the integrity of assessment and the authenticity of learning. This developmental sequencing, rooted in constructivist pedagogy, revised Bloom’s taxonomy, and Universal Design for Learning, supports the gradual release of responsibility while accommodating the diversity of learner needs and modalities. The framework's requirement for process documentation, transparency logs, and reflective practices ensures that the journey of learning remains visible, accountable, and ethically anchored. As a result, academic rigor and creativity are not casualties of technological advance, but are rather recalibrated and renewed in dialogue with new media. This approach, tested in a variety of educational settings and affirmed by contemporary research, offers not a compromise but an evolution—one that balances tradition with innovation, and autonomy with augmentation (Khlaif et al., 2025; Cordie & Adelino, 2020).
Looking ahead, future research should interrogate the efficacy of tiered frameworks across disciplines, student populations, and educational levels, seeking both empirical validation and refinement. Longitudinal studies will be necessary to trace the development of metacognitive, ethical, and collaborative competencies in students exposed to structured AI integration. Institutional adoption, meanwhile, will require robust faculty development, iterative policy revision, and ongoing dialogue between technologists, educators, and learners themselves. As Willkomm (2024) and Mathew & Stefaniak (2024) emphasize, the cultivation of AI literacy and ethical discernment must be recognized as a shared institutional responsibility, not simply an individual faculty burden. Ultimately, enduring educational relevance in the age of AI will depend on the willingness of schools, colleges, and universities to engage in principled adaptation—embracing the creative affordances of new tools while defending the epistemic and ethical standards upon which meaningful learning rests. The scaffolded model offered here is a step toward such an evolution, but it will be through collective inquiry, institutional experimentation, and empirical study that education’s next paradigm will be fully realized.

Data Availability

Data available upon request.

Conflicts of Interest

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