International Journal of Modern Education
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.gaexcellence.com/ijmoe

GLOBAL ACADEMIC EXCELLENCE

# TEACHING INNOVATION IN THE ERA OF GENERATIVE ARTIFICIAL INTELLIGENCE: A CONCEPTUAL FRAMEWORK FOR FUTURE-READY PEDAGOGY

Khairul Adilah Ahmad[1]*, Anis Faradella Abdul Malik[2], Ab Razak Mansor[3], Puguh Jayadi[4]

[1]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Cawangan Kedah, Kampus Sungai Petani, Malaysia
adilah475@uitm.edu.my https://orcid.org/0009-0003-1217-5107
[2]Faculty of Information Sciences, Universiti Teknologi MARA, Cawangan Kedah, Kampus Sungai Petani, Malaysia
anisfaradella@uitm.edu.my https://orcid.org/0009-0009-2723-3756
[3]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Cawangan Kedah, Kampus Sungai Petani, Malaysia
arazman@uitm.edu.my https://orcid.org/0009-0003-4258-4825
[4]Universitas PGRI Madiun, Indonesia & Universitas Negeri Malang, Indonesia
puguh.jayadi@unipma.ac.id https://orcid.org/0000-0003-0422-9630
*Corresponding Author

**Article Info:**

**Article history:**
Received date: 25.01.2026
Revised date: 19.02.2026
Accepted date: 04.03.2026
Published date: 26.03.2026

**To cite this document:**

Ahmad, K. A., Abdul Malik, A. F., Mansor, A. R., & Jayadi, P. (2026). Teaching Innovation in The Era of Generative Artificial Intelligence: A Conceptual Framework for Future-Ready Pedagogy. *International Journal of Modern Education, 8*(29), 1013-1027.

**Abstract:**

The rapid integration of Generative Artificial Intelligence in higher education is reshaping assumptions about authorship, assessment validity, and cognitive mastery. While existing research highlights both opportunities and risks, discussions remain divided across concerns about academic integrity, student reliance on AI, assessment design, and AI literacy. Much of the response has focused on controlling misuse rather than redesigning pedagogy for AI-supported learning. This paper proposes the AI-Resilient Teaching Innovation Framework (ARTIF), an integrative and vaue-grounded model that positions GenAI as a bounded collaborative learning partner rather than a substitute for human reasoning. ARTIF synthesizes Constructivism, Self-Regulated Learning, Technological Pedagogical Content Knowledge, and Substitution, Augmentation, Modification, Redefinition within a structured framework that prioritizes Cognitive Autonomy as the central learning outcome. The framework outlines five interrelated dimensions: dialogic human–AI engagement, authentic process-oriented assessment, metacognitive scaffolding, ethical AI literacy, and educator role transformation. An illustrative Object-Oriented Programming case demonstrates how these principles translate into practice. ARTIF contributes a coherent blueprint for preserving intellectual agency while enabling responsible and transformative AI integration in future-ready higher education systems.

International Journal of Modern Education
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027
**DOI:** 10.35631/IJMOE.829059

**Keywords:**

AI Literacy, Authentic Assessment, Cognitive Autonomy, Educational Philosophy, Generative Artificial Intelligence, Pedagogy, Teaching Innovation,



## Introduction

The rapid normalization of Generative Artificial Intelligence (GenAI) in higher education, challenging is transforming long-standing assumptions about knowledge production, authorship, and evidence of learning (Garzón et al., 2025; Ryzheva et al., 2024). Unlike earlier forms of narrow artificial intelligence (AI) that supported pattern recognition and rule-based automation, contemporary large language models such as ChatGPT, Claude, and Gemini can generate essays, code, structured arguments, and analytical responses that resemble human work. (Aldreabi et al., 2025). As a result, tasks traditionally used to measure intellectual competence, including essay writing, design prototyping, code development, and critical synthesis, can now be partially or fully automated (Zhou & Peng, 2025). This shift compels institutions to reconsider not only the tools used in teaching, but also the meaning and validation of learning itself (Lakhe Shrestha et al., 2025).

Beyond concerns of misuse, a deeper challenge lies in the changing nature of academic evidence. When AI systems can produce coherent outputs on demand, product-based assessments no longer reliably reflect independent reasoning (Ateeq et al., 2024; Barua & Lockee, 2025). The issue, therefore, is not simply whether students use AI, but how learning can be designed and evaluated in environments where generative tools are readily accessible. This situation raises a central pedagogical question: how can higher education preserve intellectual rigor while responsibly integrating AI technologies (Izquierdo-Condoy et al., 2025)?

Although existing research highlights both opportunities and risks, discussions remain divided across concerns about academic integrity, student reliance on AI, assessment redesign, AI literacy, and institutional regulation (Shi et al., 2025; Shukla & Pandey, 2025; Younas et al., 2025). Many institutional responses have focused on detection mechanisms, policy restrictions, or tool governance (Atif et al., 2024). While necessary, such responses remain largely reactive. What remains underdeveloped is a coherent pedagogical framework that systematically redesigns teaching to strengthen independent reasoning within AI-supported learning environments. Existing models offer partial but incomplete insights. Technology integration frameworks such as Technological Pedagogical Content Knowledge (TPACK) explain the alignment of technological, pedagogical, and content knowledge (Mishra et al., 2023), while the substitution, augmentation, modification, redefinition (SAMR) model categorizes levels of technological incorporation (Gonsalves, 2025). Self-Regulated Learning (SRL) theory emphasizes metacognitive control and learner agency (Karaoglan Yilmaz & Yilmaz, 2025; Xu et al., 2025), However, these models operate in parallel rather than within a unified framework centered on independent reasoning in generative AI contexts. They explain adoption, alignment, and regulation, but do not explicitly reposition independent thinking as the defining objective of AI-integrated pedagogy.

The theoretical contribution of this study lies in repositioning Cognitive Autonomy as the organizing principle of AI-integrated pedagogy. The ARTIF places Cognitive Autonomy at the core of pedagogical design. Cognitive Autonomy refers to the learner's ability to reason independently and critically evaluate AI-generated outputs before accepting or refining them. Rather than treating AI as an external instructional enhancement, the ARTIF conceptualizes it as a bounded collaborative learning partner whose outputs require human interrogation, validation, and refinement. This reframing draws upon constructivist principles of active knowledge construction, Self-Regulated Learning's emphasis on metacognitive control, and technology integration models, but reorganizes them within a structured framework that prioritizes human judgment over algorithmic authority.

The novelty of ARTIF lies not merely in combining established frameworks, but in reorganizing them around a single organizing principle: Cognitive Autonomy. While TPACK explains alignment between technology, pedagogy, and content, and SAMR categorizes levels of technological integration, neither framework explicitly prioritizes independent reasoning as the central outcome in generative AI contexts. Similarly, SRL emphasizes metacognitive regulation, yet does not fully address how learners should supervise AI-generated contributions in co-creative environments. ARTIF advances these models by reframing AI integration as a question of cognitive authority rather than technological adoption. In doing so, it positions Cognitive Autonomy, not tool proficiency, as the defining goal of AI-integrated education.

Methodologically, this study adopts a conceptual model development approach grounded in integrative theoretical synthesis. Drawing upon interdisciplinary research in educational technology, learning sciences, and AI ethics, the paper advances a structured pedagogical framework rather than an empirical evaluation. An illustrative Object-Oriented Programming case is presented to demonstrate how the model may be operationalized in practice. The case serves as an explanatory example rather than empirical validation, highlighting the practical implications of centering Cognitive Autonomy within AI-augmented learning design.

By advancing an integrated and value-grounded framework, this study shifts the discourse from reactive control toward principled pedagogical redesign. ARTIF offers a structured blueprint for institutions seeking to balance technological innovation with the preservation of independent reasoning in the era of generative AI.

## Literature Review

This literature review synthesizes recent research to map the transformative impact of GenAI on higher education practices. The analysis is organized around four essential dimensions: the conceptualization of teaching innovation in AI-mediated environments, the interactive nature of GenAI in knowledge production, the critical challenges regarding academic integrity and cognitive dependency, and the affordances for deep personalization and instructional efficiency. These synthesized insights provide the theoretical foundation for reclaiming Cognitive Autonomy through a structured pedagogical redesign.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

***Teaching Innovation in Education***

Teaching innovation is commonly defined as the adoption of novel pedagogical strategies, assessment approaches, and instructional technologies to enhance learning quality (Zhou & Peng, 2025). In the digital era, innovation has evolved from the content digitization toward student-centered and adaptive learning environments (Younas et al., 2025). It is increasingly understood as an organizational transformation involving changes in professional roles, institutional culture, and instructional design (Sarun et al., 2026).

Recent research emphasizes human-machine collaboration, where educator function as learning designer and facilitator rather than content transmitters (Kumar, 2024). Effective innovation depends on digital literacy and the ability to design tasks that promote higher-order thinking (Mengmeng et al., 2025). However, much of this literature does not fully address how generative AI reshapes the balance between human reasoning and automated content generation.

In many contexts, innovation is guided by institutional value systems that emphasize holistic human development. For example, the educational philosophy of Universiti Teknologi MARA (UiTM) highlights the nurturing of individual potential within knowledge generation process (Universiti Teknologi MARA, 2026). While referenced here as a contextual illustration, such as value orientations broadly reinforce the importance of safeguarding independent reasoning in AI-supported education.

***Generative AI in Teaching and Learning***

The literature on GenAI in education presents a dual landscape of pedagogical affordances and systemic risks. On one hand, AI systems function as powerful instructional tools capable of generating explanations, feedback, and customized learning materials in real (Garzón et al., 2025; Ryzheva et al., 2024). These capabilities enable personalized support, scalable feedback, and increased instructional efficiency, potentially reducing administrative burdens and enhancing student engagement.

On the other hand, scholars raise concerns regarding academic integrity, overreliance on automated outputs, and the erosion of independent reasoning (Ateeq et al., 2024; Ryzheva et al., 2024). The capacity of large language models to produce essays, code, and structured arguments challenges traditional product-based assessment models and blurs the boundary between human and machine contribution. Additionally, issues related to bias, misinformation, and data ethics further complicate implementation. (Shukla & Pandey, 2025).

Although the literature documents these opportunities and risks extensively, much of the discourse remains focused on tool adoption or misuse prevention. Less attention has been given to how pedagogical design should evolve to preserve independent reasoning in environments where AI actively contributes to knowledge production. This gap highlights the need for a framework that redefines the role of AI relative to human cognition.

***Limitations of Existing Technology Integration Frameworks***

Several established frameworks provide important foundations for understanding technology integration. The TPACK framework explains the alignment between technological, pedagogical, and content knowledge (Mishra et al., 2023). The SAMR model categorizes levels of technological incorporation from substitution to redefinition (Gonsalves, 2025). The SRL theory emphasizes metacognitive monitoring, goal setting, and learner agency (Dhivya et al., 2024; Karaoglan Yilmaz & Yilmaz, 2025).

While these models offer valuable insights, they primarily address alignment, levels of integration, or individual regulation processes. They do not explicitly account for the transformation in knowledge production introduced by generative AI, where algorithmic systems can independently produce content that resembles higher-order reasoning. In such contexts, the challenge is not merely how technology is integrated, but how cognitive authority is maintained.

As generative AI increasingly participates in knowledge production, existing frameworks require reorganization around a central principle that safeguards independent reasoning. The literature thus reveals a conceptual gap: the absence of a unified pedagogical architecture that systematically centers Cognitive Autonomy in AI-supported learning environments.

### *Synthesis and Conceptual Gap*

The literature consistently recognizes the transformative potential of GenAI while acknowledging risks to academic integrity and learner independence. However, these discussions are often treated separately, focusing on innovation, regulation, or learner control independently. What remains lacking is a clear and integrated framework that places independent reasoning at the center of AI-supported pedagogy.

This identified gap provides the basis for proposing the ARTIF, which reorganizes existing theoretical insights around the preservation and cultivation of Cognitive Autonomy in generative AI environments.

## Theoretical Integration and Philosophical Grounding

The development of the ARTIF model integrates five core educational theories:

### *Constructivism*

Constructivism maintains that learning is an active, iterative process where students construct new knowledge based on prior experiences and social interactions(Xu et al., 2025). In an AI-augmented environment, GenAI acts as a "cognitive partner" that facilitates this construction by providing a safe, scaffolded space for experimentation (Karaoglan Yilmaz & Yilmaz, 2025).

### *Technological Pedagogical Content Knowledge (TPACK)- Contextual Knowledge (XK)*

Expanding teacher knowledge to include the societal and institutional context. The TPACK framework provides a structure for understanding the interplay between technological (TK), pedagogical (PK), and content knowledge (CK) (Lakhe Shrestha et al., 2025). However, scholars argue that GenAI requires an expansion of this model to include "Contextual Knowledge" (XK) (Gonsalves, 2025). This encompasses an understanding of how AI is fundamentally changing the content of the disciplines themselves, for instance, how GenAI's ability to write code transforms the "content knowledge" required for a programmer. TPACK

Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

in the AI age is not a checklist but a "critical lens" that ensures technology aligns with pedagogical goals rather than becoming a distraction.

***SAMR Model: Moving from Substitution to Redefinition of tasks.***

The SAMR model evaluates the depth of technology integration (Gonsalves, 2025).

- Substitution: AI performs a task with no functional change (e.g., using AI to summarize a reading).
- Augmentation: AI improves task functionality (e.g., using AI for instant feedback on a draft).
- Modification: AI allows for significant task redesign (e.g., using AI to simulate a professional marketing scenario).
- Redefinition: AI enables new tasks previously impossible (e.g., real-time collaborative knowledge co-creation with a customized AI agent).

***Self-Regulated Learning (SRL)***

SRL is the cyclical process of planning, monitoring, and reflecting on learning (Karaoglan Yilmaz & Yilmaz, 2025). The Winne and Hadwin model of SRL is particularly relevant, identifying four phases: task definition, goal setting, enactment, and metacognitive adaptation(Shi et al., 2025). In AI environments, the "enactment" phase can be automated by the tool, potentially leading to "metacognitive laziness". AI-resilient pedagogy must implement "metacognitive support", such as reflection prompts and Socratic questioning, to ensure the student remains in control of the cognitive process (Izquierdo-Condoy et al., 2025; Karaoglan Yilmaz & Yilmaz, 2025; Shi et al., 2025).

***Value Foundation: Contextual Philosophical Anchoring***

ARTIF adopts a value-based orientation that grounds technological integration in the belief that human potential remains the primary driver of educational transformation. This perspective aligns with institutional philosophies such as that of UiTM, which emphasize the nurturing of individual talents and ethical responsibility within knowledge development processes (Universiti Teknologi MARA, 2026).

Within this orientation, Cognitive Autonomy is understood as the practical expression of nurtured intellectual potential. The framework links principles of SRL with value-based educational goals by emphasizing that independent reasoning is not an automatic outcome of technology use, but a capability that must be intentionally cultivated. Students must be guided to engage AI as a collaborative learning partner rather than a substitute for cognitive effort.

By framing SRL within this value-oriented perspective, ARTIF ensures that technological proficiency remains secondary to the development of independent judgment and responsible knowledge construction. The structural relationship between these dimensions is represented in the multi-layered concentric model shown in Figure 1, where Cognitive Autonomy occupies the central position.

International Journal of Modern Education IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

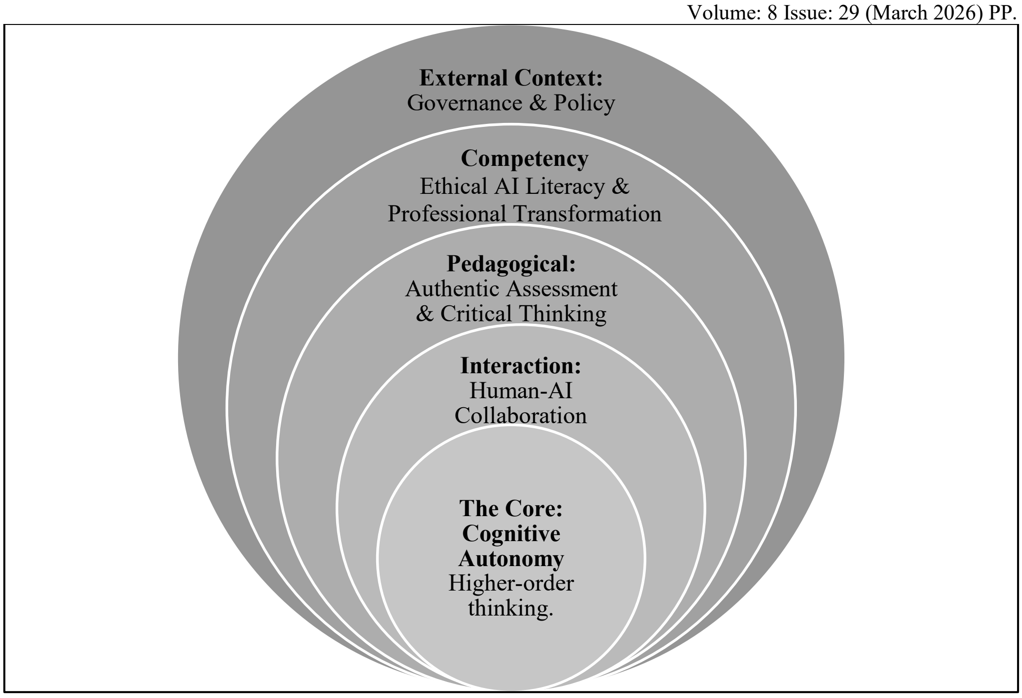


**Figure 1: The AI-Resilient Teaching Innovation Framework (ARTIF) - A Multi-Layered Concentric Model**

**Proposed AI-Resilient Teaching Innovation Framework (ARTIF)**

The ARTIF model provides a multi-layered approach to future-ready pedagogy.

***The Core: Cognitive Autonomy***

At the center of the ARTIF framework is Cognitive Autonomy. This refers to the learner's capacity for independent reasoning, critical analysis, and evaluative judgment in AI-supported learning environments. It emphasizes the ability to question, validate, and refine AI-generated outputs rather than accept them uncritically.

Aligned with value-based educational principles that prioritize human development, this core layer focuses on cultivating higher-order thinking skills—such as analysis, evaluation, and reflective decision-making—that remain fundamentally human responsibilities. In this model, AI serves as a collaborative tool, but the authority to interpret, justify, and make final judgments rests with the learner.

***Interaction Layer: Dialogue-Reflection-Enhancement***

This layer operationalizes the relationship between the learner and AI through a cyclical process:

- Dialogue: Iterative engagement in which AI supports the learner through ongoing dialogue and feedback.
- Reflection: Critical evaluation of AI outputs to detect bias or inaccuracies.
- Enhancement: Human-led refinement where the student revises and enhances the AI output with independent reasoning.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

***Pedagogical Layer: Authentic Assessment & Critical Thinking***

Innovation here focuses on process over product.

- Authentic assessment redesign: Shifting to tasks that demand contextual understanding and independent decision-making beyond automated AI assistance.
- Critical thinking scaffolding: Using structured questioning strategies to prompt analysis and reflection instead of supplying immediate solutions.

***Competency Layer: Ethical AI Literacy & Professional Transformation***

Both learners and educators must develop the technical and ethical competencies needed to critically manage AI-generated outputs. This includes ethical AI literacy, such as understanding data privacy, bias, and responsible use—as well as professional development that supports teachers in evolving into learning designers rather than content transmitters.

***External Context: Governance and Policy***

The outer boundary represents institutional and regulatory structures that establish governance standards, accountability mechanisms, and ethical safeguards for AI-supported learning environments.

**Case Study: Applying ARTIF to Introduction to Object-Oriented Programming (OOP)**

Each layer of the ARTIF framework transforms a standard Object-Oriented Programming lesson into a future-ready, AI-resilient learning experience. This example emphasizes that in the GenAI era, the teacher's role shifts from "Syntax Instructor" to "Architectural Critic."

***Module Overview***

**Topic:** Introduction to Classes, Encapsulation, and Inheritance. Traditional Challenge: Students use GenAI to generate entire class structures, missing the conceptual why behind access modifiers and hierarchical logic.

***The Core: Cognitive Autonomy***

Prior to using any Integrated Development Environment (IDE) or GenAI tool, students are required to engage in independent conceptual modeling.

- Activity: Sketching. Students are given a real-world system (e.g., a Library Management System). They must draw the class diagrams and identify private vs. public members using pen and paper.
- Goal: To ensure the mental model of abstraction and encapsulation is formed by human cognition before automation begins.

***Interaction Layer: Human-AI Collaboration***

Students are required to use AI as a "Pair Programmer".

- Dialogue: Students prompt the AI: *"Generate a Java class for a 'Book' with attributes for ISBN and Title. Include a constructor."*

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

- Reflection: Students must document three "critiques" of the AI output. *Example: "The AI made the ISBN field public, which violates our encapsulation rules for data integrity."*
- Enhancement: Students manually rewrite the code to include proper getters/setters and custom logic that the AI missed (e.g., ISBN validation logic).

***Pedagogical Layer: Authentic Assessment and Critical Thinking***

The final grade is shifted away from the working code to the logic verification."

- The AI-audit Assignment: Students are given an AI-generated code snippet containing a subtle logical hallucination (e.g., an inheritance loop or a memory leak). They are graded on their ability to find, explain, and fix the error.
- Viva Voce (Oral Defense): Students must attend a 5-minute session to explain their code. If they cannot explain why they chose *Composition* over *Inheritance*, they fail the component, regardless of whether the code runs.

***Competency Layer: Ethical AI Literacy & Debugging***

The module explicitly teaches the limitations of LLM-generated code.

- Activity: "The Bias Check." Students prompt AI to create a "User" class for a hiring system. They then analyze if the AI-generated attributes or default values reflect societal biases or security vulnerabilities (e.g., storing passwords in plain text).
- Competency: Students learn that the human programmer is the "Legal and Ethical Lead," while the AI is merely the "Junior Assistant."

***External Context: Governance & Policy***

- Classroom Policy: The Traffic Light System.
    - Red Light: (No AI) During mid-term in-class exams.
    - Yellow Light: (AI for Syntax only) During weekly labs to help find semi-colon errors.
    - Green Light: (Full AI) During the final project refactoring phase.
- Attribution: All AI-assisted code blocks must be wrapped in comments: // Generated by Gemini; Modified by Student for Encapsulation compliance.

The practical application of this framework is most effectively demonstrated through the fundamental transformation of instructional design in technical disciplines. To illustrate the operationalization of this transition, Table 1 provides a comparative summary of the shift within an Introduction to Object-Oriented Programming (OOP) module.

**Table 1: Summary of the Shift**

| | **Traditional OOP Teaching** | **ARTIF-Augmented OOP Teaching** |
|---|---|---|
| Focus: | Writing code that compiles. | Evaluating code that was generated. |
| Assessment: | Final .java file submission. | Documentation of the logic-validation process. |

International Journal of Modern Education IJMOE EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

| | | |
|---|---|---|
| AI Role: | Forbidden tool / Hidden cheating aid. | A flawed collaborator that requires human oversight. |
| Outcome: | Student learns syntax. | Student learns Architectural Judgment. |

**Discussion and Implications**

The AI-Resilient Teaching Innovation Framework (ARTIF) advances current scholarship on GenAI in higher education by repositioning the discourse from technological reaction to pedagogical framework. Rather than treating GenAI as either a disciplinary threat or a productivity enhancer, the framework conceptualizes it as a bounded collaborative learning partner operating within a value-centered learning system. The analytical emphasis therefore shifts from tool adoption to learning outcomes, with Cognitive Autonomy established as the primary educational objective in AI-mediated environments. Unlike existing AI-in-education models that primarily extend technology integration frameworks or focus on adoption behaviour, ARTIF advances an integrated, value-grounded framework that places Cognitive Autonomy at the center of AI-integrated learning. Cognitive Autonomy is defined as the learner's capacity to independently construct, evaluate, and justify knowledge claims while exercising metacognitive control over AI-assisted processes. It encompasses the ability to interrogate algorithmic outputs, detect inaccuracies or biases, and make reasoned decisions grounded in disciplinary understanding rather than automated suggestion. Operationally, Cognitive Autonomy may be evidenced through reflective articulation of reasoning pathways, evaluative critique of AI-generated content, and the demonstrated capacity to defend conceptual or architectural choices in assessment contexts.

Whereas TPACK and SAMR articulate levels of technological incorporation, and SRL emphasizes individual regulation processes, ARTIF synthesizes these perspectives within a concentric, value-driven model that redefines the human-AI relationship as dialogic rather than instrumental. The framework therefore shifts the evaluative lens from technological efficiency and user acceptance toward the preservation of intellectual agency in generative environments. This integrated positioning distinguishes ARTIF as a developmental and philosophical redefine of AI pedagogy rather than a procedural extension of existing models.

Conceptually, ARTIF differentiates itself from prevailing adoption-based models. Frameworks such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) focus on behavioural intention and usage determinants; they do not address the preservation of cognitive rigor once AI integration becomes normalized. Similarly, while TPACK articulates the interplay between technological, pedagogical, and content knowledge, it does not sufficiently account for the generative agency of contemporary AI systems or the ethical recalibration required in co-creative environments. By integrating Constructivism and Self-Regulated Learning within a philosophy-grounded orientation, ARTIF extends these models into a coherent structure that safeguards metacognitive regulation, evaluative reasoning, and reflective judgment.

Pedagogically, the framework reframes assessment as a process-verification mechanism rather than a product-validation endpoint. The emphasis on architectural reasoning, reflective critique, oral defence, and AI-audit activities re-centers evidence of learning within the learner's decision-making logic. This redistribution of cognitive responsibility mitigates

Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

automation risks without prohibiting technological participation. AI use is neither concealed nor eliminated; it is structured, documented, and subordinated to human interpretive authority. At the institutional level, ARTIF supports a transition from enforcement-centric policies toward integrity ecosystems grounded in guided transparency. Differentiated AI permissions across instructional phases, attribution protocols, and formalized ethical AI literacy establish governance mechanisms that reinforce developmental aims. Regulatory safeguards thus operate as pedagogical enablers rather than reactive controls.

The framework adopts a value-based orientation that emphasizes the development of human potential within AI-integrated education. While aligned with institutional philosophies such as that of UiTM, this orientation is not institution specific. Cognitive Autonomy is framed not merely as a technical skill, but as the practical expression of cultivated independent reasoning and responsible judgment. This value-based perspective distinguishes ARTIF from purely technocentric approaches and ensures that technological advancement remains aligned with broader educational goals at the individual and societal levels.

To translate conceptual framework into actionable guidance, structured implementation phases are proposed to assist educators in embedding Cognitive Autonomy within AI-augmented instructional design. These phases, ranging from assessment auditing to ethical AI reflection, operationalize the theoretical principles of ARTIF while preserving flexibility across disciplinary contexts. The alignment between philosophical grounding and pedagogical execution is summarized in Table 2.

Future research should empirically examine ARTIF through design-based and quasi-experimental methodologies to evaluate its impact on metacognitive regulation, architectural reasoning, and long-term intellectual independence. The development of measurable indicators for Cognitive Autonomy will be essential in determining the scalability and contextual adaptability of the framework across diverse higher education settings.

**Table 2: Practical Implementation Guidelines for Educators**

| Phase | Strategic Action | Goal / Rationale |
|---|---|---|
| Audit | Analyze assessments for "AI-vulnerability." | Identify tasks where AI bypasses human cognition. |
| Grounded Redesign | Shift to "Process-Oriented" tasks | Ensure validity by evaluating the how of learning. |
| Cognitive Forcing | Require "AI-Free" outlines before tool use. | Preserve Cognitive Autonomy and initial human thought. |
| Metacognitive Scaffolding | Use Socratic prompting | Guide students toward solutions without giving direct answers. |
| Ethical Reflection | Assignments to critique AI bias and hallucinations. | Foster ethical AI literacy and evaluative judgment. |

### *Implications for Teaching Practice*

At the instructional level, educators are encouraged to embed the Dialogue–Reflection–Enhancement cycle within task design. Rather than evaluating AI-generated outputs, assessment should prioritize the learner’s capacity for architectural reasoning, reflective critique, and justified decision-making.

### *Implications for Institutional Policy*

At the institutional level, policy frameworks should transition from detection-oriented enforcement toward integrity ecosystems that normalize guided AI use while safeguarding intellectual independence. Governance mechanisms must align regulatory safeguards with developmental objectives, ensuring that technological integration strengthens rather than substitutes human independent thinking.

## Conclusion

Generative AI calls for a decisive shift from product-based evaluation toward process-oriented pedagogy. The ARTIF framework adopts a value-based orientation centered on Cognitive Autonomy, ensuring that higher education leverages the efficiency of AI while preserving independent reasoning, ethical judgment, and intellectual depth. By positioning AI as a bounded collaborative learning partner rather than a substitute for cognitive effort, ARTIF safeguards intellectual integrity within AI-supported learning environments. In doing so, the framework supports institutions in fulfilling their broader educational mission: cultivating learners who can think critically, act responsibly, and engage technology with informed judgment.

| | |
|---|---|
| **Acknowledgements:** | The authors would like to express their sincere gratitude to Universiti Teknologi MARA for providing the necessary resources and support throughout the course of this research. Special appreciation is extended to colleagues and peers who contributed valuable insights and constructive feedback, which greatly enhanced the quality of this paper. |
| **Funding Statement:** | No Funding. |
| **Conflict of Interest Statement:** | The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the International Journal of Modern Education (IJMOE). |
| **Ethics Statement:** | This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards. |

| | |
|---|---|
| **Author Contribution Statement:** | All authors contributed substantially to the development of this manuscript. Khairul Adilah Ahmad led the conceptualization of the framework, methodological positioning, and overall supervision of the study. Anis Faradella Abdul Malik contributed to the theoretical synthesis and development of the illustrative application. Ab Razak Mansor was responsible for the literature review, drafting, and critical revision of the manuscript. All authors reviewed and approved the final version prior to submission. |

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume: 8 Issue: 29 (March 2026) PP. 1013-1027

**References**

Adarkwah, M. A. (2025). GenAI-infused adult learning in the digital era: A conceptual framework for higher education. *Adult Learning*, *36*(3), 149–161.

Aldreabi, H., Dahdoul, N. K. S., Alhur, M., Alzboun, N., & Alsalhi, N. R. (2025). Determinants of student adoption of generative AI in higher education. *Electronic Journal of E-Learning*, *23*(1), 15–33.

Al-Razgan, M., Almoaiqel, S., Alrajhi, N., Alhumegani, A., Alshehri, A., Alnefaie, B., AlKhamiss, R., & Rushdi, S. (2021). A systematic literature review on the usability of mobile applications for visually impaired users. *PeerJ Computer Science*, *7*, e771.

Ateeq, A., Alzoraiki, M., Milhem, M., & Ateeq, R. A. (2024). Artificial intelligence in education: implications for academic integrity and the shift toward holistic assessment. *Frontiers in Education*, *9*, 1470979.

Atif, A., Jha, M., & Richards, D. (2024). Evaluating the Integration of Generative AI in ICT Higher Education: Aligning University Practices with TEQSA Principles for Effective and Ethical Assessment. *ACDICT L&T Research Grant*, 1–13.

Barua, L., & Lockee, B. (2025). Flexible assessment in higher education: A comprehensive review of strategies and implications. *TechTrends*, *69*(2), 301–309.

Garzón, J., Patiño, E., & Marulanda, C. (2025). Systematic review of artificial intelligence in education: Trends, benefits, and challenges. *Multimodal Technologies and Interaction*, *9*(8), 84.

Gonsalves, C. (2025). Contextual Assessment Design in the Age of Generative AI. *Journal of Learning Development in Higher Education*.

Karaoglan Yilmaz, F. G., & Yilmaz, R. (2025). Exploring the role of self-regulated learnings skills, cognitive flexibility, and metacognitive awareness on generative artificial intelligence attitude. *Innovations in Education and Teaching International*, *62*(5), 1682–1695.

Kumar, V. (2024). Future trends in collective intelligence for education. *Collective Intelligence: A Resource for Teachers, Parents & Policymakers*, 255.

Lakhe Shrestha, B. L., Dahal, N., Hasan, M. K., Paudel, S., & Kapar, H. (2025). Generative AI on professional development: a narrative inquiry using TPACK framework. *Frontiers in Education*, *10*, 1550773.

Luckin, R. (2025). Nurturing human intelligence in the age of AI: rethinking education for the future. *Development and Learning in Organizations: An International Journal*, *39*(1), 1–4.

Mengmeng, Z., Ishar, M. I. M., & Saud, M. S. (2025). Empowering Higher-Order Thinking through Generative AI: The Mediating Roles of Teachers' Digital Literacy and Pedagogical Innovation in Vocational Education. *International Journal of Academic Research in Progressive Education And Development*, *14*(3), 524–537. https://doi.org/10.6007/IJARPED/v14-i3/25996

Mishra, P., Warr, M., & Islam, R. (2023). TPACK in the age of ChatGPT and Generative AI. *Journal of Digital Learning in Teacher Education*, *39*(4), 235–251.

Onuean, K., Chinnasarn, K., Somphongphueng, W., Nooyen, P., Onuean, A., & Chompoo, W. (2025). Human-Centric Software Co-Designed Framework for Competency Evaluations. *2025 IEEE/ACIS 29th International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNPD)*, 442–447.

Ryzheva, N., Nefodov, D., Romanyuk, S., Marynchenko, H., & Kudla, M. (2024). Artificial Intelligence in higher education: opportunities and challenges. *Revista Amazonia Investiga*, *13*(73), 284–296.

Sarun, H., Nara, I., & Saroeung, M. (2026). Artificial Intelligence as a Driver of Innovation and Digital Transformation in Higher Education: Nano Review. *Journal of Agriculture and Environment*, *3*(2), 35–37.

Shi, J., Liu, W., & Hu, K. (2025). Exploring how AI literacy and self-regulated learning relate to student writing performance and well-being in generative AI-supported higher education. *Behavioral Sciences*, *15*(5), 705.

Shukla, H., & Pandey, K. (2025). Human-AI Collaboration in Teaching and Learning. *Available at SSRN 5198554*.

Universiti Teknologi MARA. (2026). *Falsafah UiTM.* https://www.uitm.edu.my

Xu, X., Qiao, L., Cheng, N., Liu, H., & Zhao, W. (2025). Enhancing self-regulated learning and learning experience in generative AI environments: The critical role of metacognitive support. *British Journal of Educational Technology*, *56*(5), 1842–1863.

Younas, M., El-Dakhs, D. A. S., & Noor, U. (2025). The impact of artificial intelligence-based learning tools in academic innovation: a review of Deep seek, GPT, and Gemini (2020–2025). *Frontiers in Education*, *10*, 1689205.

Zhou, M., & Peng, S. (2025). The usage of AI in teaching and students' creativity: The mediating role of learning engagement and the moderating role of AI literacy. *Behavioral Sciences*, *15*(5), 587.