

Synergistic Designs: Developing a Sustainable Digital Literacy Framework for College Faculty in the Age of Generative AI

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ABSTRACT

The rapid integration of generative artificial intelligence (GenAI) into higher education has transformed faculty roles, requiring educators to evaluate AI outputs, redesign assessments, manage ethical risks, and guide students in AI-mediated environments. Existing digital competence frameworks (e.g., TPACK and DigCompEdu) predate large-scale public GenAI systems and therefore fall short in addressing prompt literacy, multimodal generation, retrieval-augmented systems, and institutional governance needs. This conceptual paper proposes the Synergistic Digital Literacy (SDL) Model as a sustainable, internationally adaptable framework for college faculty. The model integrates four interlocking dimensions—AI Fluency, Pedagogical Intelligence, Ethical Vigilance, and Digital Citizenship—connected by an AI Literacy Helix (a continuous cycle of diagnosis, design, enactment, and renewal). Drawing on UNESCO (2024), OECD (2026), NIST (2024), and recent higher education reviews, the framework reconceptualizes digital literacy as a dynamic, institutionally embedded capability rather than a static skill set. Practical implementation pathways include an institutional readiness audit, differentiated faculty development routes, localized co-design of AI pedagogy playbooks, and ongoing renewal mechanisms. The SDL Model offers higher education leaders a human-centered, ethically grounded blueprint for building faculty capability that adapts to rapid technological change.

Keywords: Generative AI, Digital literacy, Faculty development, AI ethics, Sustainable framework.

1. INTRODUCTION

Generative AI has moved from an experimental tool to an increasingly central infrastructure in higher education. The United Nations Educational, Scientific and Cultural Organization (UNESCO, 2024) emphasizes that GenAI requires long-term policy development and human-capacity building, shifting education from a traditional teacher–student relationship toward a teacher–AI–student dynamic. The Organisation for Economic Co-operation and Development (OECD, 2026) likewise notes that GenAI is accessible and intuitive, and that its use often extends beyond formal institutional control, with students and faculty independently adopting consumer-grade tools. The 2025 EDUCAUSE Horizon Report identifies AI as a major force reshaping teaching, learning, assessment, and institutional strategy, and projects

broader multimodal integration by 2027 (Robert et al., 2025).

These changes extend beyond scale to more fundamental shifts in capability. Multimodal GenAI can now generate and transform text, images, speech, code, and video in integrated ways, enabling new forms of explanation, simulation, and accessibility support. Retrieval-augmented generation (RAG) systems extend this further by grounding outputs in external, trusted knowledge bases such as library holdings or institutional repositories, thereby reducing hallucination risks while enabling dynamic, context-specific responses (Li et al., 2025). The opportunities are substantial: personalized formative feedback, rapid material generation, multilingual support, and administrative efficiency. Yet these benefits coexist with intensified concerns, including hallucination, bias amplification, plagiarism facilitation,

misinformation, epistemic opacity, and cognitive outsourcing that may weaken deep learning (Qian, 2025; Tillmanns et al., 2025).

The OECD (2026) draws a critical distinction: GenAI can improve task performance without necessarily producing genuine learning gains when cognitive effort is offloaded without pedagogical scaffolding. Faculty therefore face a dual mandate: to harness GenAI for more effective teaching while preserving human judgment, critical thinking, and ethical stewardship.

Existing frameworks provide strong foundations, but they require extension for the GenAI context. Mishra and Koehler's (2006) TPACK clarified that effective technology integration depends on the interplay of technological, pedagogical, and content knowledge rather than on isolated skills. Redecker's (2017) DigCompEdu organized 22 educator competencies across six areas, including professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and the facilitation of digital competence. Both remain influential; however, neither explicitly addresses prompt literacy, cross-modal output evaluation, RAG-grounded systems, synthetic-content risks, or faculty's expanded roles in institution-wide AI governance and policy stewardship.

AI literacy scholarship helps bridge part of this gap. Long and Magerko (2020) defined core competencies for understanding and interacting with AI systems. Ng et al. (2021, 2023) organized literacy around knowing and understanding AI, using and applying it, evaluating and creating with it, and addressing ethical issues, while Chiu et al. (2024) emphasized confidence, self-reflection, and practical judgment as integral components. Higher education studies further reinforce the need for faculty-specific frameworks amid privacy concerns, ethical dilemmas, plagiarism risks, and the need for pedagogical adaptation (Zhou & Schofield, 2024; Qian, 2025).

Governance adds an important institutional layer. Lelescu et al. (2025) found that faculty trust in GenAI is shaped by training quality, institutional support, and perceived risks. The National Institute of Standards and Technology (NIST, 2024) treats GenAI as a risk-governed technology that requires organizations to map, measure, and manage novel or amplified risks across the lifecycle. Faculty digital literacy therefore emerges as both an individual capability and an institutional capacity.

This conceptual paper addresses that gap by asking: How can a sustainable digital literacy framework be designed for college faculty in the GenAI era? The proposed Synergistic Digital Literacy (SDL) Model reframes literacy as a dynamic, institutionally embedded capability that combines AI fluency, pedagogical intelligence, ethical vigilance, and digital citizenship. Here, sustainability refers to intelligent, iterative adaptability to technological evolution rather than to static competence.

2. FROM DIGITAL LITERACY TO AI-MEDIATED FACULTY CAPABILITY

Digital literacy in higher education has evolved through several phases: an early emphasis on access and operational skills, followed by a stronger focus on critical use, participation, and the social shaping of technology (Selwyn, 2009). Selwyn's critique of the "digital native" myth warned that routine exposure does not produce meaningful critical competence—a warning that becomes even more relevant in the GenAI era. Familiarity with chatbots does not equip faculty to detect epistemic errors in outputs, redesign assessments to resist shallow automation, enforce transparent use norms, or steward ethical AI practices within academic communities.

TPACK (Mishra & Koehler, 2006) remains foundational in arguing that meaningful integration arises from the interaction of technological, pedagogical, and content knowledge. DigCompEdu (Redecker, 2017) extends this logic by detailing competencies such as professional engagement and learner empowerment. However, both frameworks predate the public GenAI surge after 2022 and therefore omit prompt-based interaction, multimodal synthesis, RAG architectures for factual grounding, model opacity challenges, and faculty's growing stewardship role in institutional AI policy.

AI literacy scholarship addresses several of these gaps. Long and Magerko (2020) outlined competencies for critical evaluation and effective collaboration with AI. Ng et al. (2021) proposed four dimensions—knowing, using, evaluating and creating, and ethical addressing—which were later extended to intersect with 21st-century skills such as reflection and autonomy (Ng et al., 2023). Chiu et al. (2024) further distinguished literacy from narrow competency by arguing that confidence and contextual judgment are essential. These insights

align closely with faculty roles as curriculum designers, assessors, mentors, and policy actors.

Recent higher education literature confirms this shift. Zhou and Schofield (2024) called for explicit frameworks to support AI integration amid gaps in curriculum, pedagogy, and critical understanding. Qian’s (2025) systematic review traced early GenAI research toward prompt literacy, autonomy, creativity, and critical thinking, while warning that efficiency gains often coexist with overreliance. Tillmanns et al. (2025) similarly mapped a growing consensus that GenAI integration requires human-centered design and robust ethical structures.

Trust and governance further deepen the imperative. Lelescu et al. (2025) showed that adoption is constrained by trust issues tied to leadership, training, and risk perception. NIST (2024) provides an operational risk logic for GenAI and urges lifecycle governance. In higher education, this means that faculty literacy cannot be separated from policy clarity, procurement choices, assessment culture, and shared institutional norms.

Stanford’s 2025 AI Index reports rapid capability gains—including advances in multimodal and video generation, as well as declining costs—making GenAI a form of general infrastructure rather than a specialist tool. Faculty therefore must navigate fast-evolving multimodal systems, the distinction between open and grounded tools, pedagogical redesign in response to AI availability, and institutional risk management—precisely the gap the SDL Model seeks to address.

3. THE SYNERGISTIC DIGITAL LITERACY (SDL) MODEL

The SDL Model argues that faculty literacy in the GenAI era must be technically informed, pedagogically directed, ethically governed, and socially enacted. It comprises four mutually reinforcing dimensions (see “Table 1”), linked by the AI Literacy Helix—a non-linear, deepening cycle of diagnosis, design, enactment, and renewal.

Table 1. The Synergistic Digital Literacy (SDL) model for college faculty

Dimension	Core Question	Faculty Practices	Institutional Enablers
AI Fluency	Can faculty understand and critically use contemporary AI systems?	Prompt design, output comparison, verification, multimodal task design, RAG-aware use	Sandbox tools, secure access, model capability training
Pedagogical Intelligence	Can faculty align AI use with disciplinary goals and learning design?	AI-supported feedback, assessment redesign, scaffolded inquiry, transparency rules	Instructional design support, micro-credentials, policy revision
Ethical Vigilance	Can faculty identify and manage bias, privacy, integrity, and accountability risks?	Source critique, bias checking, disclosure, data minimization, human review	Governance boards, ethics rubrics, procurement review
Digital Citizenship	Can faculty model responsible participation in AI-mediated academic communities?	Peer mentoring, student guidance on attribution, inclusive practices	Recognition in promotion, open repositories, communities of practice

a Note. Synthesized from UNESCO (2024), OECD (2026), and NIST (2024).

AI Fluency serves as the entry-point foundation—not because it is primary, but because it is necessary. Faculty need a working understanding of model behavior, including probabilistic generation, context windows, prompt sensitivity, hallucination patterns, multimodal affordances (e.g., text-to-image, text-to-video, and code generation), and the value of RAG for grounding outputs in trusted sources (Li et al., 2025; Stanford Institute for Human-Centered Artificial Intelligence, 2025). Fluency means distinguishing open consumer tools, which may be riskier in sensitive domains, from bounded institutional systems; comparing outputs; verifying claims; and designing multimodal tasks safely. It emphasizes

prompt literacy and output critique rather than narrow “engineering.” For example, a history instructor might use RAG-linked tools to ground discussion in primary sources and reduce fabricated citations.

Pedagogical Intelligence differentiates the model and functions as its core. Faculty must align AI use with disciplinary epistemologies and learning goals, deciding whether AI should serve as a tutor for scaffolding, a brainstorming partner, a feedback aid, a simulation tool, a drafting support, or, in some cases, be excluded altogether. OECD (2026) stresses that guided use preserves learning, whereas unguided outsourcing may raise performance without producing durable gains. This

dimension therefore includes redesigning assessment toward process evidence—such as oral defenses, annotated drafts, reflective commentary, staged submissions, and in-class synthesis—that is less vulnerable to automation. In STEM fields, AI might simulate lab experiments through multimodal outputs; in the humanities, it might generate draft critiques for iterative refinement. Recent reviews note efficiency benefits alongside risks of metacognitive erosion when scaffolding is absent (Qian, 2025).

Ethical Vigilance embeds risk management as an ongoing competency. UNESCO (2024) foregrounds human agency, inclusion, and sustainability, while NIST (2024) urges systematic risk mapping. Faculty must routinely ask whether an output is evidenced, whether input data raise privacy concerns, whether bias is being reproduced, whether disclosure is needed, whether high-stakes feedback is appropriate, and whether reliance on AI erodes authorship norms. Relevant practices include source critique, data minimization, bias checks, and human review. Vigilance also extends to equity by addressing access gaps in devices, paid tools, and prior familiarity so that AI adoption does not widen existing divides.

Digital Citizenship prevents the framework from collapsing into mere compliance. Faculty model responsible participation in AI-mediated publics through attribution norms, disclosure transparency, inclusive access, peer mentoring, and student guidance on intellectual responsibility. Aligned with Ribble (2015) and higher education AI ethics discussions, this dimension positions faculty as stewards who help define fair collaboration in synthetic-media environments—for example, by sharing effective prompts in open repositories or debating AI's role in academic integrity policy.

The AI Literacy Helix is operationalized through repeated cycles:

- **Diagnose:** Assess readiness, risks, disciplinary priorities, and assessment vulnerabilities (e.g., through surveys or audits).
- **Design:** Align AI uses with learning outcomes, disciplinary epistemologies, and academic integrity rules (e.g., through co-created rubrics).
- **Enact:** Implement bounded practices with clear oversight and rules (e.g., piloting AI use in a single course).

- **Renew:** Review failures, document cases, and update guidance (e.g., through semesterly reflections).

The helix metaphor is preferable to that of a ladder because GenAI capability deepens through repeated re-entry into the cycle rather than through one-time, linear mastery. The model operates across multiple levels—individual (e.g., building judgment and confidence), course/program (e.g., assessment redesign and student guidance), and institutional (e.g., governance, procurement, and recognition)—to support overall coherence (Lelescu et al., 2025).

4. DESIGN AND IMPLEMENTATION PATHWAYS

Implementation requires a phased, realistic strategy.

First, an institutional readiness audit (adapted from EDUCAUSE; Robert et al., 2025) can provide an initial baseline. Cross-functional teams composed of faculty, IT staff, librarians, and administrators can address ten guiding questions: What tools are currently in use? What data-protection rules apply? Where are the main faculty uncertainties? Which assessments are most vulnerable? What support exists for instructional redesign? How are procurement and risk review handled? Are student rules transparent? How are updates managed? Is inclusion monitored? Is faculty effort recognized? This process helps identify priorities and gaps.

Second, differentiated faculty pathways should respect motivational diversity:

- **Novice to Prompt-Aware Practitioner:** Focus on safe experimentation, verification basics, and low-risk instructional uses (e.g., generating quiz questions with human review).
- **Skeptic to Critical Integrator:** Prioritize ethics and academic integrity, clarify disciplinary limits, and support controlled adoption (e.g., initially restricting AI in high-stakes exams).
- **Innovator to Institutional Change Agent:** Encourage peer mentoring, RAG pilots, and local policy or exemplar building (e.g., leading workshops on multimodal AI).

Third, localized co-design is essential. Faculty, instructional designers, librarians, IT staff, and students can jointly develop disciplinary AI pedagogy playbooks that specify permitted and

prohibited uses, disclosure templates, assessment redesigns, source-verification routines, and the prioritization of RAG in precision-critical fields (Li et al., 2025). Grounded tools can reduce hallucinations and context errors, although human oversight remains indispensable. In practice, law faculties may emphasize RAG for case-law work, whereas arts programs may use multimodal tools for creative ideation under clear attribution rules.

Fourth, governance and renewal should follow the risk-management logic outlined by NIST (2024). Institutions can establish semesterly reviews, collect anonymized cases of both success and failure, and support “AI Literacy Circles” in which small groups discuss authentic classroom uses. Recognition in workload allocation and promotion can help counter underinvestment, aligning with UNESCO’s (2024) progression from acquire to deepen to create.

5. DISCUSSION

The SDL Model advances the conversation by reframing literacy as a renewable capability—a necessary move in a context defined by rapid change, including multimodality, RAG, and workflow integration. It brings together domains that are often treated separately—technical, pedagogical, ethical, and civic—and connects faculty practice to institutional ecology, including policy, procurement, and professional culture. The model is broadly aligned with UNESCO (2024), OECD (2026), and NIST (2024), and can be adapted across contexts, from low-resource environments that rely on mobile or open tools to well-resourced institutions that emphasize private RAG systems and stronger governance. In this sense, it offers a flexible framework rather than a one-size-fits-all solution.

Limitations remain. The paper is conceptual and therefore requires empirical validation across disciplines and institutions, including comparisons between contexts such as STEM and the humanities. It also assumes a level of institutional investment that is not universally available. Moreover, rapid technological change means that the helix itself must remain open to revision. Its main strength lies in its iterative logic, which is more durable than fixed standards. Future research could test the model through mixed-methods studies in diverse educational settings.

6. CONCLUSION

Generative AI has elevated faculty digital literacy to a strategic institutional priority. The challenge is no longer simply access to tools, but the exercise of informed judgment in synthetic and increasingly automated environments. Existing frameworks remain indispensable, but they require extension. The SDL Model responds by organizing sustainable capability around four interlocking dimensions connected by the AI Literacy Helix. Universities that navigate this transition well will align human agency, pedagogy, governance, and technological change while preserving academic judgment in AI-shaped futures. In that regard, the framework offers a practical and human-centered point of reference for responsible integration.

ACKNOWLEDGMENTS

This study was supported by the Research Programs of Beijing Institute of Graphic Communication (BIGC, Grant No.22150225011), the University-Industry Collaborative Education Program of the Ministry of Education (Grant Nos. 231101339132335, 240901339250432) and Beijing Municipal Education Reform and Innovation Project (Grant No.202510015004).

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