Arki-Nexus AI: A Framework for Integrating Artificial Intelligence Competencies Into NEUST College of Architecture

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***Abstract*—The rapid expansion of Artificial Intelligence (AI) is reshaping architectural education and practice, yet its systematic curricular integration remains limited in many higher education settings. This study developed the proposed Arki-Nexus AI Framework to guide the structured integration of AI competencies into the curriculum of the NEUST College of Architecture. Employing a descriptive-comparative quantitative research design, the study involved 31 faculty members selected through purposive sampling and 200 architecture students selected through stratified random sampling with equal allocation by year level. Data were gathered using a researcher-developed survey instrument that underwent expert content validation by seven experts (I-CVI = 1.00) and pilot reliability testing (Cronbach's α = .85–.92). Faculty members reported a high overall level of AI competency (M = 4.11), while students also reported a high overall level (M = 3.63), although student ratings were moderate in AI-assisted design, AI-supported collaboration, and AI-driven innovation. The perceived extent of AI integration was moderately evident for both faculty (M = 3.18) and students (M = 2.96). Significant faculty-student differences were found in applied AI competencies, but not in AI literacy or ethical AI use. These findings informed a proposed framework linking human competencies, pedagogical drivers, and institutional enablers. Because the findings were based on self-reported data from one college, the framework requires future expert review, pilot implementation, and feasibility and impact evaluation.**

Keywords*—Artificial intelligence; architecture education; self-reported AI competency; curriculum integration; curriculum framework; digital transformation; future-ready architects

I. Introduction

Artificial Intelligence (AI) and related digital technologies are changing design generation, visualization, simulation, information modeling, environmental analysis, and decision support across the architecture, engineering, and construction industry. Recent architectural education studies show that AI can support architectural programming, design exploration, iterative visualization, and studio learning when it is integrated through deliberate pedagogical design rather than treated as a stand-alone tool [1]–[3]. Architecture programs must therefore prepare students to use AI critically and competently while preserving architectural judgment, creativity, and accountability.

International competency frameworks also emphasize that AI readiness includes more than operational tool use. UNESCO's frameworks for students and teachers identify human-centered values, ethical AI use, foundational knowledge, practical application, pedagogy, and continuous professional learning as central dimensions of AI competency [4], [5]. These dimensions provide an appropriate basis for examining how architecture students and faculty understand and use AI in educational contexts.

Within architecture education, AI has been used in programming, concept development, design alternatives, image generation, environmental analysis, and critique. Empirical studies nevertheless report uneven and fragmented use, including difficulties in connecting AI outputs to coherent architectural workflows and in maintaining human oversight of design decisions [1]–[3], [6]. These findings indicate that access to AI tools alone does not guarantee meaningful curricular integration.

At the institutional level, AI adoption requires alignment among curriculum outcomes, teaching strategies, learning activities, assessment practices, digital infrastructure, faculty development, and governance. Higher education research shows that digital transformation remains limited when technology is added without coordinated changes to pedagogy, assessment, policy, and organizational support [7]–[10]. A structured curriculum framework is therefore necessary to move from isolated tool use toward progressive competency development.

This concern is relevant to the NEUST College of Architecture, which seeks to prepare graduates for digitally enabled professional practice. The College needs empirical evidence on the self-reported AI competencies of its faculty members and students and on the extent to which AI is presently reflected in its curriculum, instruction, learning activities, assessment practices, and resources.

The integration of AI into architectural education must remain human-centered. AI should augment, rather than replace, design reasoning, contextual sensitivity, professional judgment, authorship, and social responsibility. International ethical guidance emphasizes transparency, accountability, privacy, fairness, and human oversight in the development and use of AI systems [11]–[13]. These principles are especially important in architecture because design decisions affect people, communities, and the built environment.

In response, this study developed the proposed Arki-Nexus AI Framework as a curriculum enhancement model for the NEUST College of Architecture. The framework organizes AI competency development across human, pedagogical, and institutional dimensions and links identified competency and integration gaps with possible curricular interventions.

The framework is intended for the specific context examined in this study. It was developed from the findings but was not independently validated through expert review, pilot implementation, or feasibility testing during this research phase. Its use beyond the NEUST College of Architecture therefore requires further evaluation and contextual adaptation.

A. *Artificial Intelligence Competencies in Architecture Education*

AI competency refers to the knowledge, skills, values, and judgment required to understand, evaluate, apply, and communicate with AI systems responsibly. It includes conceptual understanding, practical application, critical evaluation, ethical awareness, and the capacity to use AI in problem-solving and creative work [4], [5], [14], [15]. In architectural education, these competencies must be connected to design processes, technical workflows, collaboration, and professional responsibility.

The present study examined five competency dimensions: AI literacy and foundational knowledge; AI-assisted design and technical skills; ethical and responsible AI use; AI-supported collaboration and communication; and AI-driven innovation and problem-solving. These dimensions were adapted to the architecture education context from established AI literacy and competency frameworks [4], [5], [14], [15].

Assessing these dimensions can identify where faculty members and students perceive themselves as prepared and where additional learning opportunities are needed. Because the instrument used self-rated Likert-scale responses, the resulting scores indicate perceived competency rather than directly demonstrated performance.

B. *AI Integration in Architecture Programs*

Program-level AI integration involves embedding AI concepts and applications across formal curriculum content, instructional strategies, student learning experiences, assessment systems, and institutional resources. Effective integration is systematic, progressive, aligned with program outcomes, and supported by appropriate governance and infrastructure.

Curriculum content establishes where AI competencies are introduced, reinforced, and applied. Architecture education studies recommend integrating AI into programming, studio work, computational design, visualization, performance analysis, and design critique while preserving critical and human-centered approaches [1], [2], [6].

Teaching strategies determine how faculty members mediate AI use. AI-assisted studio demonstrations, guided experimentation, project-based learning, critique, collaborative inquiry, and reflective discussion can help students connect AI outputs with architectural reasoning and design decisions.

Institutional adoption is more likely to produce educational value when faculty preparation, instructional design, and student access are coordinated. Research on AI and digital transformation in higher education emphasizes that technology adoption without pedagogical alignment and sustained institutional support often remains superficial [7]–[9].

Learning activities provide opportunities to translate conceptual knowledge into performance. Studio projects, iterative prompt-and-critique exercises, AI-assisted programming, visualization, simulation, and collaborative design tasks can support authentic practice when activities are scaffolded and connected to course outcomes [1], [2], [6].

Assessment practices must evaluate not only final AI-assisted outputs but also process documentation, critical judgment, ethical use, attribution, and human decision-making. Assessment standards should protect academic integrity and maintain transparency, fairness, and human oversight [9], [12], [13].

C. *Research Questions*

This study aimed to develop a proposed Arki-Nexus AI Framework for integrating Artificial Intelligence competencies into the curriculum of the NEUST College of Architecture. Specifically, it sought to answer the following questions:

- What is the level of self-reported Artificial Intelligence competency among architecture students and faculty members of the NEUST College of Architecture in terms of:
  - AI literacy and foundational knowledge;
  - AI-assisted design and technical skills;
  - ethical and responsible AI use;
  - AI-supported collaboration and communication; and
  - AI-driven innovation and problem-solving?
- What is the perceived extent of AI integration in the NEUST College of Architecture with respect to:
  - Curriculum content;
  - Teaching strategies;
  - Learning activities;
  - Assessment practices; and
  - Digital infrastructure and AI-related resources?
- Based on the findings, what Arki-Nexus AI Framework may be proposed to support the systematic integration of Artificial Intelligence competencies into the curriculum of the NEUST College of Architecture?
- Is there a significant difference between the self-reported AI competency levels of faculty members and architecture students across the five competency dimensions?

II. Methodology

A. Research Design

The study employed a descriptive-comparative quantitative research design. The descriptive component measured respondents' self-reported AI competency and their perceptions of the extent of AI integration in the College. The comparative component examined differences between faculty and student self-ratings across the five AI competency dimensions. The findings were used as an empirical basis for developing the proposed Arki-Nexus AI Framework; the research design did not include a separate validation phase for the framework.

B. Locale, Respondents, and Sampling Technique

The study was conducted at the College of Architecture of Nueva Ecija University of Science and Technology in the Philippines. Respondents comprised 31 faculty members and 200 architecture students. Faculty members were selected purposively because of their direct involvement in architecture courses and design studios. Students were selected through stratified random sampling with equal allocation of 40 respondents from each year level. This equal allocation ensured representation from all year levels but was not proportional unless year-level populations were equal. Because the study involved respondents from one college in one institution, the results are context-specific and should not be generalized to Philippine architecture education as a whole.

C. Research Instrument

The researcher-developed survey instrument consisted of two main sections.

The first section measured self-reported AI competency across five dimensions: AI literacy and foundational knowledge; AI-assisted design and technical skills; ethical and responsible AI use; AI-supported collaboration and communication; and AI-driven innovation and problem-solving. Responses used a five-point scale interpreted as follows: 4.21–5.00, Very High; 3.41–4.20, High; 2.61–3.40, Moderate; 1.81–2.60, Low; and 1.00–1.80, Very Low. Because the items were self-rated, the scores represented perceived competency rather than objectively demonstrated performance.

The second section assessed the perceived extent of AI integration across curriculum content, teaching strategies, learning activities, assessment practices, and digital infrastructure and AI-related resources. Responses used a five-point scale interpreted as follows: 4.21–5.00, Very Evident; 3.41–4.20, Evident; 2.61–3.40, Moderately Evident; 1.81–2.60, Somewhat Evident; and 1.00–1.80, Not Evident.

D. Validity and Reliability of the Instrument

Content validity was evaluated by seven experts in architecture education, curriculum development, and educational technology. All items across the ten subscales attained an Item-Level Content Validity Index (I-CVI) of 1.00, indicating unanimous expert agreement on item relevance and clarity [16]. Reliability was examined through a pilot test involving 42 students who were excluded from the main study. Cronbach's alpha coefficients ranged from .85 to .92 across the subscales, indicating good to excellent internal consistency [17]. These findings supported the quality of the survey instrument only; they did not constitute validation of the proposed Arki-Nexus AI Framework.

E. Data-Gathering Procedure

Data collection was conducted after approval from the relevant academic and institutional authorities. The researcher coordinated with subject teachers, distributed the validated questionnaires with informed-consent forms, and provided standardized instructions. Respondents completed the instrument in approximately 15 to 25 minutes. Completed questionnaires were retrieved, checked for completeness, encoded, and organized for statistical analysis. Participation remained voluntary throughout the process.

F. Data Analysis

Descriptive and inferential statistics were used. Means were computed to summarize self-reported AI competency and the perceived extent of AI integration. An independent-samples t-test examined differences between faculty and student self-ratings across the five AI competency dimensions. Statistical decisions were evaluated at the .05 level of significance. The analysis did not test the validity, feasibility, or effectiveness of the proposed framework.

G. Ethical Considerations

The study observed established ethical principles for educational research. Informed consent was obtained before participation, and respondents were informed that participation was voluntary. Anonymity and confidentiality were maintained; no identifying information was linked to individual responses, and the data were used only for academic purposes and stored securely.

III. Results and Discussion

A. AI Literacy and Foundational Knowledge

Faculty members reported a Very High level of AI literacy and foundational knowledge ($M = 4.21$), while students reported a High level ($M = 4.03$). The results indicate strong perceived awareness of AI concepts in both groups, although faculty ratings were slightly higher. These findings are consistent with AI literacy frameworks that distinguish foundational understanding from deeper application and critical evaluation [4], [5], [14], [15].

For both groups, awareness of the limitations and risks of AI in architecture received the highest rating (faculty: $M = 4.55$; students: $M = 4.43$), both interpreted as Very High. Regular updating of knowledge on emerging AI technologies received the lowest rating (faculty: $M = 3.95$; students: $M = 3.84$), although both remained High. Faculty members also rated their understanding of how data and algorithms influence AI-generated outputs higher ($M = 4.40$) than students did ($M = 3.92$). These patterns support continuous updating and deeper instruction on data, algorithms, limitations, and critical evaluation.

B. AI-Assisted Design and Technical Skills

Faculty members reported a High level of AI-assisted design and technical skills ($M = 3.94$), whereas students reported a Moderate level ($M = 3.34$). The difference indicates that students perceived less consistent ability to apply AI across architectural workflows. Architecture education studies similarly show that learners may use generative tools for isolated tasks without yet integrating them into a coherent programming, design, and technical process [1], [2].

Faculty members rated the use of AI to improve design efficiency and productivity highest (M = 4.20). Students reported their lowest ratings for integrating AI with CAD/BIM platforms (M = 3.02) and generating design alternatives using AI (M = 3.32). Both groups rated critical evaluation of AI-generated outputs more strongly (faculty: M = 4.11; students: M = 3.65) than technical workflow integration. The findings support curriculum enhancement in AI-CAD/BIM integration, generative design, and studio-based application [1], [2], [6].

C. Ethical and Responsible AI Use

Faculty members reported a Very High level of ethical and responsible AI use (M = 4.38), while students reported a High level (M = 4.07). The difference should not be interpreted as proof of actual ethical behavior because the ratings were self-reported. However, the pattern suggests that both groups perceived themselves as aware of accountability, transparency, attribution, and responsible use. Kolb's experiential learning perspective indicates that ethical judgment can be strengthened through repeated application and reflection in authentic tasks [18], while UNESCO's competency frameworks place ethics and human-centered values at the core of AI readiness [4], [5].

Faculty ratings were Very High for understanding ethical issues related to AI use (M = 4.50) and for responsible use and attribution of AI-generated outputs (M = 4.45). Students rated recognition of bias and misinformation highest (M = 4.18), but proper attribution of AI-generated outputs was lower (M = 3.92). The results support explicit instruction on authorship, intellectual property, data privacy, bias, transparency, and human oversight, consistent with international ethical guidance [11]–[13].

D. AI-Supported Collaboration and Communication

Faculty members reported a High level of AI-supported collaboration and communication (M = 4.06), whereas students reported a Moderate level (M = 3.34). This difference indicates that students perceived fewer or less consistent opportunities to use AI in collaborative architectural work. Vygotsky's social constructivist perspective emphasizes learning through guided and socially mediated activity [19], while UNESCO's frameworks recognize communication, collaboration, and pedagogy as important elements of responsible AI use [4], [5].

Faculty members rated AI-supported communication in group tasks (M = 4.15) and coordination of design collaboration (M = 4.10) most strongly. Students reported lower ratings for clearly sharing AI-generated outputs (M = 3.20) and using AI-supported platforms (M = 3.37). Connectivism explains learning as participation in networks of people, information, and digital tools [20]. Accordingly, shared BIM environments, collaborative generative platforms, and structured group critique may help students use AI outputs more effectively in team-based design [12], [15].

E. AI-Driven Innovation and Problem-Solving

Faculty members reported a High level of AI-driven innovation and problem-solving (M = 3.95), while students reported a Moderate level (M = 3.34). The results indicate a gap in perceived ability to use AI for complex design reasoning, scenario analysis, and evidence-informed decisions. The higher-order cognitive processes of analyzing, evaluating, and creating in Bloom's revised taxonomy provide an appropriate basis for designing progressively challenging AI-assisted tasks [21].

Faculty members rated exploration of innovative architectural solutions (M = 4.15) and critical evaluation of AI-generated outputs (M = 4.10) most strongly. Students reported Moderate ratings in complex problem-solving (M = 3.28), scenario analysis (M = 3.35), and evidence-based decision-making (M = 3.28). Their relatively higher ratings in innovation exploration (M = 3.44) and critical evaluation (M = 3.48) indicate emerging readiness that can be strengthened through scaffolded studio tasks aligned with AI literacy and higher-order learning outcomes [14], [15], [21].

F. Summary of Self-Reported AI Competency

Table I summarizes the self-reported AI competency results. Faculty members obtained a High grand mean (M = 4.11), and students also obtained a High grand mean (M = 3.63). Faculty ratings were strongest in ethical and responsible AI use and AI literacy. Student ratings were High in these foundational domains but Moderate in AI-assisted design, collaboration, and innovation. The pattern suggests that conceptual and ethical awareness is more developed than applied and workflow-based competency [4], [5], [9], [14], [15].

The applied-domain differences indicate a need to connect AI knowledge with repeated studio practice. Students should encounter progressively complex tasks involving architectural programming, generative exploration, CAD/BIM integration, collaborative design, technical analysis, and critical evaluation of outputs. Such integration is consistent with current research on AI-assisted architectural education and design pedagogy [1], [2], [6].

TABLE I. SUMMARY OF SELF-REPORTED AI COMPETENCY LEVELS OF FACULTY MEMBERS AND STUDENTS

Artificial Intelligence Competency	Faculty		Students	
	Mean	Verbal Description	Mean	Verbal Description
AI Literacy and Foundational Knowledge	4.21	Very High	4.03	High
AI-Assisted Design and Technical Skills	3.94	High	3.34	Moderate
Ethical and Responsible AI Use	4.38	Very High	4.07	High
AI-Supported Collaboration and Communication	4.06	High	3.34	Moderate
AI-Driven Innovation and Problem-Solving	3.95	High	3.34	Moderate
Grand Mean	**4.11**	**High**	**3.63**	**High**

G. Curriculum Content

Faculty (M = 2.82) and students (M = 2.95) both perceived AI integration in curriculum content as Moderately Evident. These results indicate that AI-related concepts were present but not consistently embedded in formal course outcomes, vertical curriculum mapping, or studio requirements. The pattern reflects a broader distinction between isolated technology adoption and system-level digital transformation [7]–[10].

Faculty members rated curriculum updates reflecting emerging AI technologies lowest (M = 2.55, Somewhat Evident), while vertical integration across year levels was also limited (M = 2.70, Moderately Evident). Students rated curriculum updates (M = 2.92) and integration into learning outcomes (M = 2.98) as Moderately Evident. The findings support competency mapping across year levels, explicit inclusion in course outcomes, and regular syllabus review informed by developments in architectural AI [1], [2], [6].

H. Teaching Strategies

Faculty members perceived AI integration in teaching strategies as Evident (M = 3.51), whereas students perceived it as Moderately Evident (M = 2.90). This difference suggests that faculty members recognized their instructional intentions and demonstrations more strongly than students experienced consistent AI-supported teaching. Research on technology integration similarly shows that instructional adoption may not translate into meaningful learner experience without coherent pedagogical design [7]–[9].

Faculty members rated promotion of critical evaluation of AI outputs highest (M = 3.75) and reported using AI in instructional demonstrations and design activities (M = 3.45–3.50). Students rated encouragement to use AI tools (M = 2.83) and AI-supported design exploration (M = 2.87) lower. Bloom's revised taxonomy supports instructional tasks that move from understanding and application toward analysis, evaluation, and creation [21], while experiential learning emphasizes active practice and reflection [18]. Faculty development should therefore focus on structured, visible, and repeatable AI-mediated studio pedagogy.

I. Learning Activities

Faculty members perceived AI integration in learning activities as Evident (M = 3.41), while students perceived it as Moderately Evident (M = 2.98). The difference suggests that AI was used in selected tasks but was not consistently experienced across subjects and studios. This pattern is consistent with higher education research showing that digital activities remain fragmented when implementation is not aligned across curriculum and instruction [7]–[9].

Faculty ratings were higher for encouraging AI use in architectural research tasks (M = 3.65) and experimentation with AI technologies (M = 3.50). Students reported limited participation in AI-assisted design projects (M = 2.89) and use of generative AI tools (M = 2.88). Repeated, scaffolded, and authentic activities are needed to develop competence through experience [18]. Studio projects that connect research, programming, visualization, critique, and revision can provide this progression [1], [2].

J. Assessment Practices

Faculty (M = 3.13) and students (M = 2.96) both perceived AI integration in assessment practices as Moderately Evident. The results indicate that AI was only partially reflected in grading, feedback, criteria, and assessment design. Concerns related to validity, fairness, transparency, and academic integrity often cause assessment reform to lag behind instructional adoption [9], [12], [13].

The assessment of ethical AI use received relatively higher ratings (faculty: M = 3.35; students: M = 3.08), as did evaluation of both process and AI-supported outputs (faculty: M = 3.30; students: M = 3.04). Faculty ratings were lower for using AI to evaluate outputs, provide feedback, and operationalize AI-integrated criteria (M = 2.95 for each). These findings support process-based rubrics, documentation of human and AI contributions, reflective justification of design decisions, and clear ethical standards [9], [12].

Assessment was among the least developed dimensions of integration. Redesign should focus on authentic tasks that evaluate architectural reasoning, design process, critical appraisal of AI outputs, attribution, and ethical decision-making rather than rewarding AI-generated products alone.

K. Digital Infrastructure and AI-Related Resources

Faculty (M = 3.01) and students (M = 3.03) both perceived digital infrastructure and AI-related resources as Moderately Evident. The nearly identical ratings indicate shared recognition that basic resources were available but were not yet sufficient for advanced AI-assisted design, computational modeling, and cloud-based collaboration. Digital transformation requires coordinated infrastructure, governance, access, and human capability [9], [10].

Faculty members rated access to AI design software (M = 2.75) and infrastructure upgrading (M = 2.80) lowest. Both groups also rated internet connectivity and laboratory adequacy at moderate levels. These constraints may limit repeated use of AI in studio courses and create unequal learning opportunities. The College should therefore assess hardware, software licensing, cloud access, connectivity, technical support, and responsible-use policies as part of an AI-readiness plan [9].

Infrastructure should be developed alongside curriculum and pedagogy. Investment in tools without faculty development, assessment standards, and implementation governance would be unlikely to produce sustained curricular transformation [9], [10].

L. Summary of the Perceived Extent of AI Integration

Table II shows that faculty (M = 3.18) and students (M = 2.96) both perceived the overall extent of AI integration as Moderately Evident. AI was therefore present across curriculum, teaching, activities, assessment, and resources, but it had not yet become fully institutionalized. The results describe the NEUST College of Architecture only and should not be generalized to other architecture programs without additional evidence [9], [10].

TABLE III. SUMMARY OF THE PERCEIVED EXTENT OF AI INTEGRATION IN THE NEUST COLLEGE OF ARCHITECTURE

AI Integration in NEUST College Of Architecture	Faculty		Students	
	Mean	Verbal Description	Mean	Verbal Description
Curriculum Content	2.82	Moderately Evident	2.95	Moderately Evident
Teaching Strategies	3.51	Moderately Evident	2.90	Moderately Evident
Learning Activities	3.41	Moderately Evident	2.98	Moderately Evident
Assessment Practices	3.13	Moderately Evident	2.96	Moderately Evident
Digital Infrastructure	3.01	Moderately Evident	3.03	Moderately Evident
Grand Mean	3.18	Moderately Evident	2.96	Moderately Evident

Faculty ratings were highest for teaching strategies (M = 3.51, Evident), while curriculum content received its lowest rating (M = 2.82, Moderately Evident). Students rated all domains as Moderately Evident, and digital infrastructure was the only domain in which the student mean slightly exceeded the faculty mean. These results indicate that current AI adoption is primarily instruction-led and requires stronger alignment among formal curriculum, learning activities, assessment, and institutional support [7], [9].

M. Differences in Self-Reported AI Competency Between Faculty Members and Students

Table III presents the comparison of faculty and student self-reported AI competency. No significant differences were found in AI literacy and foundational knowledge (p = .345) or ethical and responsible AI use (p = .135). Significant differences were found in AI-assisted design and technical skills (p = .006), AI-supported collaboration and communication (p = .002), and AI-driven innovation and problem-solving (p = .011), with faculty members reporting higher means in each applied domain.

TABLE IV. DIFFERENCES IN SELF-REPORTED AI COMPETENCY BETWEEN FACULTY MEMBERS AND STUDENTS

Competency Dimension	Faculty M	Student M	p	Decision
AI Literacy and Foundational Knowledge	4.21	4.03	.345	NS
AI-Assisted Design and Technical Skills	3.94	3.34	.006	Sig.
Ethical and Responsible AI Use	4.38	4.07	.135	NS
AI-Supported Collaboration and Communication	4.06	3.34	.002	Sig.
AI-Driven Innovation and Problem-Solving	3.95	3.34	.011	Sig.

Note. NS = not significant; Sig. = significant at p < .05.

The results indicate stronger alignment in foundational awareness and ethical understanding than in applied competency. The higher faculty ratings should not be interpreted as objective evidence of superior performance because both groups completed self-report measures. They do, however, identify areas in which students perceived a need for more structured practice, feedback, collaboration, and technical integration.

For the NEUST College of Architecture, the findings support a progression from foundational AI literacy and ethics toward applied design, collaboration, and problem-solving. This progression should be implemented through curriculum mapping, faculty-student co-learning, studio projects, and performance-based assessment. International frameworks similarly emphasize progressive development from understanding to application and creation within an enabling digital ecosystem [4], [5], [9], [14], [15].

N. Proposed Arki-Nexus AI Framework

Fig. 1 presents the proposed Arki-Nexus AI Framework developed from the study findings. The Arki-Nexus AI Framework was developed as an evidence-based curriculum model derived from the quantitative findings of this study. Rather than serving as a purely conceptual representation, the framework synthesized the empirical results obtained from the assessment of Artificial Intelligence (AI) competencies among architecture faculty members and students, the extent of AI integration within the curriculum, and the comparative analysis of faculty and student perceptions regarding AI implementation. Consequently, the framework addressed research problems by translating the identified strengths, gaps, and statistically significant differences into a structured model for curriculum innovation.

The findings revealed that both faculty members and students generally demonstrated satisfactory levels of AI competency, particularly in AI literacy and foundational knowledge and ethical and responsible AI use, indicating a positive institutional readiness for AI-enhanced architectural education. However, comparatively lower ratings in AI-assisted design and technical skills, AI-supported collaboration, AI-driven innovation, and several dimensions of curriculum integration suggest that AI competencies remain inconsistently embedded across instructional practices. Moreover, the significant differences between faculty and student assessments indicate varying perceptions regarding the actual implementation of AI within teaching, learning, and assessment processes. These findings highlight the necessity of a comprehensive framework capable of aligning competency development with curriculum design, instructional delivery, institutional resources, and professional expectations.

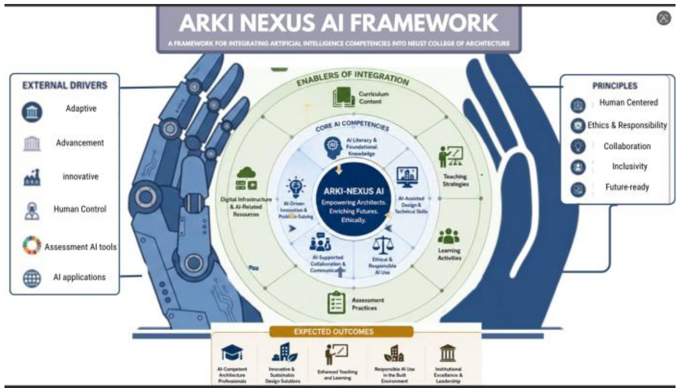

Fig. 1. Proposed Arki-Nexus AI framework developed from the study findings.

Accordingly, the Arki-Nexus AI Framework was formulated as a systematic response to these empirical findings. It provides a coherent mechanism through which AI competencies may be progressively developed and intentionally integrated across the architecture curriculum while ensuring alignment with educational objectives and the evolving demands of architectural practice.

1) Interpretation of the framework in relation to the research findings: The framework consists of five interconnected components: the External Drivers, Core AI Competencies, Enablers of Integration, Guiding Principles, and Expected Outcomes, which collectively demonstrate the dynamic process of AI integration in the architecture curriculum.

The External Drivers represent the contextual forces influencing curriculum transformation, including technological advancement, innovation, adaptability, AI applications, AI-assisted assessment tools, and continued human oversight. These drivers acknowledge that architectural education operates within a rapidly evolving technological environment where emerging AI technologies continuously reshape professional practice. Their inclusion reflects the study's findings that curriculum development must remain responsive to technological change while preserving the human-centered nature of architectural design.

At the core of the framework are the five AI competency domains, which directly correspond to the competency dimensions investigated in Research Problem 1. These include AI Literacy and Foundational Knowledge, AI-Assisted Design and Technical Skills, Ethical and Responsible AI Use, AI-Supported Collaboration and Communication, and AI-Driven Innovation and Problem-Solving. Positioning these competencies at the center of the framework signifies that AI competency development constitutes the primary objective of curriculum integration. The quantitative findings indicate that while respondents possess adequate foundational knowledge of AI, further curricular enhancement is necessary to strengthen students' ability to apply AI within authentic architectural design processes, interdisciplinary collaboration, and innovation-driven problem-solving. Consequently, the framework conceptualizes competency development as a continuous progression rather than a static outcome.

Surrounding these competencies are the Enablers of Integration, comprising curriculum content, teaching strategies, learning activities, assessment practices, and digital infrastructure and AI-related resources. These elements correspond directly to the dimensions examined in Research Problem 2 and emphasize that AI competency development cannot occur independently of institutional and pedagogical support. The findings revealed varying levels of AI integration across these curricular dimensions, suggesting that AI adoption remains uneven despite generally positive competency levels. Therefore, the framework advocates deliberate alignment between learning outcomes, instructional approaches, authentic learning experiences, assessment strategies, and institutional technological capacity to facilitate meaningful and sustainable AI integration throughout the curriculum.

The implementation of these curriculum enablers is governed by five Guiding Principles: Human-Centeredness, Ethics and Responsibility, Collaboration, Inclusivity, and Future-Readiness. These principles ensure that AI functions as an educational enabler rather than a substitute for architectural creativity and professional judgment. Their inclusion reflects the study's findings that ethical AI use received among the highest competency ratings, reinforcing the importance of embedding responsible AI practices alongside technical proficiency. The interaction among these framework components ultimately contributes to the Expected Outcomes, namely the development of AI-competent architecture graduates, enhanced teaching and learning experiences, responsible AI utilization, strengthened innovation and sustainability, and institutional leadership in AI-enabled architectural education. Collectively, these outcomes represent the desired impact of systematic AI integration and provide a strategic direction for curriculum enhancement within the architecture curriculum.

2) Theoretical foundation and alignment with existing literature: The Arki-Nexus AI Framework is theoretically anchored in Vygotsky's Social Constructivist Theory and the UNESCO AI Competency Framework for Teachers, each of which provides complementary perspectives on AI integration in higher education.

Vygotsky's Social Constructivist Theory emphasizes that knowledge is constructed through interaction, collaboration, and authentic learning experiences. This theoretical perspective supports the framework's emphasis on AI-supported collaboration, project-based learning, and collaborative design processes, where AI functions as a cognitive tool that enhances rather than replaces human learning. By promoting collaborative inquiry and reflective practice, the framework reinforces the social nature of architectural education while integrating intelligent technologies into studio-based learning environments.

Furthermore, the framework reflects the principles articulated in the UNESCO AI Competency Framework, particularly its emphasis on responsible AI use, ethical governance, human-centered implementation, and lifelong learning. The inclusion of ethical AI use, inclusivity, and future-readiness acknowledges that AI integration must promote not only technological competence but also critical thinking, professional accountability, and equitable access to emerging technologies.

3) Contribution of the framework to architecture curriculum: The principal contribution of the Arki-Nexus AI Framework lies in its presentation of a comprehensive, empirically grounded model for integrating AI competencies into architecture curriculum. Unlike existing AI competency models that primarily emphasize technological literacy or digital skills, the proposed framework adopts a systems perspective by integrating competency development, curriculum implementation, instructional practice, ethical governance, institutional readiness, and graduate outcomes within a single architecture-specific model. This contribution is particularly significant because architecture curriculum requires the integration of creativity, technical competence, sustainability, collaborative practice, and ethical decision-making. Rather than positioning AI as a replacement for architectural expertise, the framework conceptualizes AI as an enabling technology that augments design thinking, evidence-based decision-making, and innovative problem solving while preserving the architect's central role as a creative and ethical professional.

From a curricular perspective, the framework provides academic leaders and curriculum developers with a structured roadmap for embedding AI competencies throughout architectural education. Its emphasis on alignment among curriculum content, pedagogy, assessment, and institutional infrastructure promotes a holistic approach to curriculum innovation that extends beyond isolated course revisions. Consequently, the framework contributes not only to the advancement of AI integration within the NEUST College of Architecture but also offers a transferable reference model for architecture schools and higher education institutions seeking systematic AI implementation within design-oriented programs.

4) Expert validation of the framework: The evaluation indicated a high level of content validity, demonstrating strong agreement that the framework presents a logically organized, empirically supported, and educationally relevant model for integrating AI competencies into architecture curricula. The experts affirmed that the framework effectively synthesizes the quantitative findings into an implementable curriculum model while maintaining consistency with contemporary theories of technology integration and higher education innovation. The validators further recommended strengthening provisions for continuous curriculum review, expanding faculty capability-building initiatives in AI pedagogy, fostering stronger partnerships with industry to support authentic AI applications, and establishing mechanisms for periodically updating digital infrastructure in response to rapidly evolving AI technologies.

Overall, the expert validation provides evidence that the Arki-Nexus AI Framework possesses strong conceptual coherence, empirical grounding, and practical applicability. As an evidence-informed curriculum model, it offers a robust foundation for systematically integrating AI competencies into architecture curriculum while ensuring that technological innovation remains aligned with creativity, ethical responsibility, sustainability, and the evolving competencies required of future architects.

IV. Conclusion and Recommendations

A. Conclusion

Among the 31 faculty members and 200 architecture students who participated in this single-institution study, both groups reported High overall AI competency, with faculty members obtaining a higher grand mean (M = 4.11) than students (M = 3.63). Faculty and student ratings were strongest in AI literacy and ethical AI use, while student ratings were Moderate in AI-assisted design, AI-supported collaboration, and AI-driven innovation. These findings indicate that perceived foundational readiness was stronger than perceived applied competency within the NEUST College of Architecture.

The overall perceived extent of AI integration was Moderately Evident for faculty (M = 3.18) and students (M = 2.96). Teaching strategies were the most visible domain in faculty ratings, but curriculum content, assessment, and infrastructure remained only moderately integrated. The evidence therefore suggests that AI adoption in the College was emerging and primarily instruction-led rather than fully embedded across formal curriculum and institutional systems.

Significant faculty-student differences were found in the three applied competency domains, while differences in AI literacy and ethical AI use were not significant. These findings informed the proposed Arki-Nexus AI Framework. The study did not validate the framework, and the conclusions apply only to the respondents and institutional context examined.

B. Recommendations

The College should map AI competencies across program and course outcomes and integrate them progressively into architectural programming, design studios, CAD/BIM workflows, visualization, simulation, research, and technical subjects. Curriculum revision should move beyond theoretical exposure toward performance-based and project-driven learning.

Faculty development and faculty-student co-learning should be institutionalized. Workshops, mentoring, collaborative studio projects, and communities of practice should focus on responsible AI use, generative and computational design, collaborative platforms, critical evaluation, attribution, and human oversight.

Assessment should be redesigned using process-based rubrics, design documentation, oral defense, reflective justification, and transparent declaration of AI assistance. The College should also conduct an AI-readiness audit covering hardware, connectivity, software licensing, cloud platforms, technical support, data governance, accessibility, and equitable student access.

Before institutional adoption, the proposed Arki-Nexus AI Framework should undergo structured expert review, feasibility assessment, and pilot implementation. Evaluation should determine whether the framework improves demonstrated competencies, curriculum alignment, student learning, ethical practice, and resource efficiency within the NEUST College of Architecture.

C. Limitations and Directions for Future Research

The findings were based on self-rated Likert-scale responses from 31 faculty members and 200 students in one college and may have been affected by social desirability, recall error, or overestimation of competency. The cross-sectional design did not measure change over time, and the unequal group sizes may have influenced the comparison. Future studies should include performance-based design tasks, portfolios, software demonstrations, interviews, classroom or studio observations, and multi-institution samples. The proposed framework should also undergo expert validation, pilot implementation, feasibility testing, and outcome evaluation before broader use.

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