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ARTIFICIAL INTELLIGENCE AND SPECIFICATION WRITING IN ARCHITECTURAL EDUCATION: A FRAMEWORK FOR RESPONSIBLE AI INTEGRATION

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ABSTRACT
Generative artificial intelligence (AI) is rapidly changing how architectural knowledge is created, communicated, and taught. Yet its role in teaching technical specification writing, one of the most critical forms of professional communication in architecture, has received little attention. Specifications translate design intentions into precise, legally binding instructions governing materials, standards, and construction performance, and so demand accuracy, technical knowledge, and professional responsibility. This paper proposes a conceptual framework, AI-Integrated Specification Writing (AISW), for integrating AI into specification-writing instruction in architectural education. Adapted from an existing AI mentoring model, the framework follows a three-stage design, application, and evaluation structure, modified to the procedural, technical, and regulatory demands of specification pedagogy. It positions AI as a supportive learning tool within instructor-guided, standards-based activities, while addressing concerns around ethics, regulation, and academic integrity. The central argument is that effective AI use in specification-writing education depends less on the sophistication of the technology than on thoughtful instructional design, sound institutional policy, and the development of students' professional judgment. As a conceptual, literature-based framework, its claims are necessarily preliminary; empirical testing of AISW in classroom settings is identified as the paper's central limitation. The paper closes by outlining implications for curriculum development, assessment practices, and future research.
Keywords: artificial intelligence; specification writing; architectural education; responsible AI integration; design pedagogy; construction documentation

1. INTRODUCTION

The rapid growth of generative AI has significantly influenced higher education, changing the ways students learn, conduct research, and engage with academic disciplines (El Samaty & Albadi, 2026). Tools such as ChatGPT, Midjourney, and DALL·E are increasingly used for tasks ranging from text and image generation to coding and translation. Experience has shown, however, that successful AI adoption in higher education requires more than simply making these tools available to students: their use must be guided by sound pedagogical principles that align with institutional goals, student needs, and academic values (El Samaty & Albadi, 2026; Salih *et al.*, 2026). These developments carry particular weight for architectural education. Unlike many other disciplines, architecture is largely studio-based and combines design creativity, critical reflection, and research-oriented inquiry, a distinctive learning environment that makes AI integration both promising and challenging (El Samaty & Albadi, 2026). AI is also becoming embedded in professional practice: students and practitioners now use AI-driven applications to generate design alternatives, assess building performance, and support sustainable decision-making. Tools such as Tally and Sefaira help evaluate the environmental impacts of building materials and energy use, while UrbanSim supports transportation and land-use analysis (Komatina *et al.*, 2024). AI-assisted CAD tools, generative design platforms, and digital twins have further expanded AI's role in the design and management of the built environment (Wang *et al.*, 2026).

Despite these developments, relatively little attention has been paid to AI's application in teaching technical specification writing. Technical specifications are among the most important forms of professional communication in architecture: they translate design intentions into precise instructions governing materials, workmanship, construction quality, and contractual obligations. Preparing them requires technical knowledge, familiarity with standards and regulations, and a high degree of professional responsibility, requirements that differ considerably from the exploratory, idea-generation tasks that dominate current discussions of AI in architectural education (Tan, Cheng, & Ling, 2025).

Nevertheless, existing studies on AI-assisted academic writing suggest that AI may have value in supporting specification-writing instruction. For example, architecture students have used AI-based writing assistants to support referencing, text organization, and summarization within structured and instructor-guided learning environments (Deep & Chen, 2025; El Samaty & Albadi, 2026). This experience indicates that AI could also support specification writing if its use is carefully designed, appropriately supervised, and accompanied by clear ethical and professional guidelines.

The increasing emphasis on responsible AI use in higher education strengthens the case for such an approach. In Saudi Arabia, the digital transformation agenda under Vision 2030 has encouraged universities to develop policies promoting the responsible integration of AI into teaching and research (Al-Motrif, 2026; El Samaty & Albadi, 2026). Regulation (EU) 2024/1689 (the Artificial Intelligence Act) similarly seeks to encourage trustworthy, human-centred AI while safeguarding public interests such as health, safety, and environmental protection (European Parliament & Council of the European Union, 2024). Together, these developments suggest that integrating AI into educational practice is becoming both an institutional expectation and a regulatory concern, one that matters particularly for specification writing, where errors can carry significant legal, financial, and safety implications.

Interest in AI within architectural education continues to grow, yet practical frameworks that translate policy principles into classroom applications remain scarce, particularly for specification-writing instruction. Existing scholarship has concentrated almost entirely on design studio and research-writing contexts, leaving the professional conventions that govern specification writing itself, chiefly the standardized, industry-wide formats through which specifications are structured and communicated, largely unexamined. This paper addresses that gap by proposing a framework for the responsible integration of AI into the teaching of technical specifications, grounded both in the emerging literature on responsible AI pedagogy and in the established professional conventions of specification writing. It draws on evidence from recent studies of AI adoption in architectural education to show how AI can be incorporated into specification-writing pedagogy while preserving academic integrity, professional accountability, and the development of sound professional judgement.

To address this gap, this study adopts an integrative conceptual approach to synthesise existing evidence and develop a framework for the responsible integration of AI into specification-writing instruction in architectural education.

2. METHODOLOGICAL APPROACH

This study adopts a conceptual research design and an integrative review approach, following the methodological guidance of Whittemore and Knafl (2005), to develop a framework for the responsible integration of AI into specification-writing instruction in architectural education. An integrative review is appropriate because research on AI applications in architectural specification writing remains limited; consequently, evidence must be synthesised from related but non-identical fields, including AI pedagogy in architectural design education, AI ethics in higher education, and the professional literature on specification writing and construction documentation, to build a preliminary conceptual framework.

The framework was developed in three stages. First, relevant literature on AI in higher education, architectural education, ethical AI, and professional guidance on AI adoption in architecture was reviewed to identify key concepts and emerging issues. Second, this literature was analysed through thematic synthesis to identify recurring themes: governance, transparency, human oversight, instructor mediation, academic integrity, and professional responsibility. Finally, these themes were integrated into the proposed AI-Integrated Specification Writing (AISW) framework, which adapts the design-application-evaluation structure of previous AI mentoring studies to the specific requirements of specification-writing pedagogy.

As a conceptual study, this research does not generate primary empirical data. It instead offers a theoretically informed, practice-oriented framework intended to guide future empirical studies and support the responsible integration of AI into architectural specification-writing education. The evidence base for this synthesis is concentrated in a small number of closely relevant primary studies, principally El Samaty and Albadi (2026) and Komatina *et al.* (2024), supplemented by broader policy and regulatory sources. This concentration reflects the current scarcity of research on AI-assisted specification writing specifically, but it is also a limitation: the resulting framework should be read as a synthesis anchored in a narrow evidentiary base rather than a comprehensive survey of a mature field, pending broader empirical study.

3. LITERATURE REVIEW

3.1 Specification Writing as a Professional and Pedagogical Genre

Before considering how artificial intelligence might be integrated into specification-writing instruction, it is important to understand what specification writing entails as a professional and educational practice. This is particularly necessary because most of the literature reviewed in this paper examines AI in architectural education more broadly and pays little attention to specification writing specifically. Unlike conventional prose, technical specifications are usually prepared according to established professional conventions and standardised formats. One of the most widely recognised systems internationally is MasterFormat, a numbered classification system developed by the Construction Specifications Institute (CSI) in collaboration with Construction Specifications Canada for organising construction specifications. Within this system, individual specification sections are commonly arranged using SectionFormat, which structures content into three parts—General, Products, and Execution—an arrangement widely known as the "three-part specification" (Construction Specifications Institute, 2026). Although specification practices and documentation standards differ across countries and professional settings, these frameworks provide a useful illustration of the structured and standards-based nature of specification writing. The purpose of this study is therefore not to advocate any particular national specification standard, but rather to explore how artificial intelligence can be integrated responsibly into the teaching of technical specification writing as a professional and pedagogical activity..

Existing pedagogy in specification writing has historically emphasized close reading of standards documentation, precise and unambiguous technical language, and instructor-supervised drafting exercises against established section formats. This baseline matters for the present paper because it clarifies exactly what AI integration would change: not the underlying professional format or its legal significance, but the process by which students research, draft, and verify content within that format. The remainder of this literature review addresses AI in architectural education more broadly, given the current scarcity of research specifically on AI-assisted specification writing, before returning to this professional baseline in Section 3.7.

3.2 Institutional and Policy Frameworks for Responsible AI Integration

Recent literature increasingly suggests that successful AI integration in higher education is not simply a matter of adopting new technologies, but equally a question of policy and governance. Rather than prohibiting or freely permitting generative AI, many universities are developing balanced frameworks that encourage innovation while maintaining accountability and ethical standards (El Samaty & Albadi, 2026). These frameworks generally promote transparency, academic integrity, inclusiveness, and the use of AI to support rather than replace human teaching and learning (Chan, 2023, as cited in El Samaty & Albadi, 2026).

One example is the Artificial Intelligence Guide and Policies for Education and Scientific Research developed by King Abdulaziz University (KAU). The guide outlines principles that include aligning AI use with intended learning outcomes, promoting student-centred learning, empowering academic staff, ensuring transparency and academic integrity, supporting equitable access, encouraging higher-order thinking, and developing AI literacy and responsible use among students and educators (El Samaty & Albadi, 2026; Slavov *et al.*, 2025). Similar ideas

Recent systematic reviews further indicate that successful AI integration in higher education depends on institutional readiness, teacher professional development, AI literacy, and governance structures that support responsible implementation (Tan, Cheng, & Ling, 2025). Community-wide ethical frameworks similarly emphasise transparency, accountability, fairness, and human agency as core principles for educational AI systems (Holmes *et al.*, 2022). Read together, these studies support the view that AI integration in architectural education is not merely a technological innovation but a socio-technical and pedagogical transformation requiring institutional support and ethical oversight.

Despite this growing attention, the literature points to a persistent gap between policy statements and classroom practice. Institutional guidelines frequently set out broad principles but offer limited direction on how those principles translate into everyday teaching and learning activities, particularly in architecture programmes (El Samaty & Albadi, 2026). This disconnect points to the need for practical, evidence-based approaches showing how policy principles can be implemented in specific educational contexts rather than left as aspirational goals.

3.3 The Instructor as Mediator of AI-Supported Learning

A consistent finding in the literature is that instructors play a critical role in shaping how students understand, use, and learn from artificial intelligence. Although AI tools can meaningfully support learning activities, students still place considerable value on the human qualities instructors bring to the educational process, including mentorship, critical guidance, and emotional support (Chan & Tsi, 2024, as cited in El Samaty & Albadi, 2026). Many scholars therefore argue that AI should be integrated into teaching in ways that strengthen, rather than diminish, the role of the educator: effective AI-supported learning depends not only on the technology itself but on how instructors guide students to use it responsibly and critically (Moorhouse *et al.*, 2023, as cited in El Samaty & Albadi, 2026).

Evidence of this can be seen in a case study in which the same "AI Mentoring Method" was implemented over two consecutive semesters by two different instructors and two separate student cohorts, each comprising approximately 15–20 architecture students (El Samaty & Albadi, 2026). Although both instructors followed the same seven-phase framework, notable differences emerged in the ways students used AI tools, the types of prompts they developed, and the extent of their critical engagement with AI-generated outputs. These differences were also reflected in student achievement across the Knowledge, Skills, and Values domains of the Intended Learning Outcomes (ILOs) (El Samaty & Albadi, 2026). Under one instructor, average ILO achievement increased only slightly, from 81.8% to 82.1%, whereas under the second instructor it rose substantially to 87.4% (El Samaty & Albadi, 2026). Given the relatively small cohort sizes and the absence of reported statistical significance testing in the original study, these differences should be interpreted cautiously. Nevertheless, the findings suggest that variations in instructor implementation can meaningfully influence students' engagement with AI-supported learning and their achievement of intended learning outcomes. A structured AI integration method therefore appears necessary but not sufficient on its own; the instructor's ability to scaffold learning, contextualise AI-generated information, and encourage critical reflection appears equally important in shaping educational outcomes.

The literature further shows that effective instructor mediation works through established pedagogical approaches rather than through unrestricted access to AI tools. Guided inquiry, formative feedback, reflective practice, mentorship-based learning, constructivist approaches, and studio-based critique have all been identified as useful ways of structuring students' interactions with AI in research and design courses (El Samaty & Albadi, 2026). Importantly, these strategies were not applied uniformly across all learning activities but were selected according to the specific learning objectives and cognitive demands of different course components (El Samaty & Albadi, 2026), suggesting that responsible AI integration requires careful alignment between pedagogical strategy and the nature of the task at hand, rather than a single standardised approach.

3.4 AI Tools and Applications in Architectural Design and Practice

Beyond teaching and learning, artificial intelligence tools are increasingly applied across architectural design and planning. Recent studies show that students and practitioners use AI-powered technologies to generate design alternatives, conduct zoning and energy analyses, and optimise material selection. Tally and Sefaira are commonly used to assess the life-cycle impacts of building materials and evaluate energy consumption and carbon emissions, while UrbanSim supports transportation and land-use analysis aimed at improving urban sustainability (Komatina *et al.*, 2024).

The range of AI applications in architecture continues to expand. AI-enhanced CAD platforms can generate detailed plans more efficiently, while conversational tools such as ChatGPT and modelling software such as SketchUp offer conceptual guidance and design suggestions. Collaborative platforms such as Miro and Figma further support teamwork on complex design projects (Komatina *et al.*, 2024), and AI-enhanced virtual and augmented reality tools such as Enscape and Unreal Engine are being used to create more realistic digital environments, while research platforms such as Iris.ai help students identify and summarise relevant literature (Komatina *et al.*, 2024).

Another notable development is the emergence of digital twin technologies. By combining sensor data with Building Information Modelling (BIM), digital twins let architects and engineers monitor and simulate building performance in real time, supporting more informed decisions about energy use, structural performance, and maintenance needs before problems occur (Komatina *et al.*, 2024).

At the course level, a more focused set of generative AI tools has also been integrated into architectural education, including ChatGPT-4, the writing and citation assistant Aithor, the image-generation platform Midjourney, and the AI-assisted design and analysis platform Autodesk Forma. These tools have supported problem identification, academic writing, visual exploration, and spatial analysis within architectural research courses (El Samaty & Albadi, 2026).

These examples, taken together, show that AI applications in architecture are highly diverse and serve different educational and professional purposes: some tools are intended primarily to stimulate creativity and generate ideas, while others support analysis, research, and technical documentation.

Emerging evidence also suggests that large language models can support specification development itself. Li *et al.* (2024), for example, demonstrate that LLMs can assist in generating and reviewing technical specifications and in identifying inconsistencies within them, although human verification remains essential because errors and omissions can still occur. This evidence is particularly relevant to architectural specification writing, since it suggests AI has potential beyond conceptual design activities and may support technical documentation processes when implemented within appropriate governance and review mechanisms.

This distinction matters for specification writing in particular. The educational and ethical issues raised by an image-generation tool such as Midjourney differ fundamentally from those raised by a writing assistant such as Aithor, especially when the final product is a standards-based technical document rather than a conceptual design representation.

3.5 Student Perceptions, Sustainability, and Ethical Concerns

Another area of research examines how architecture students perceive the opportunities and challenges of artificial intelligence, and whether these perceptions relate to their understanding of sustainability. A comparative study of final-year architecture students in Serbia and Montenegro found that students placed high value on key sustainability principles, including reducing carbon emissions, improving water efficiency, promoting occupant health and well-being, adopting life-cycle approaches, and integrating smart building technologies into design practice. Across these indicators, between 66% and 79% of respondents considered them important or highly important (N = 100 final-year architecture students: 51 from Serbia and 49 from Montenegro; Komatina *et al.*, 2024). Despite this strong awareness of sustainability issues, actual AI use in students' project work remained relatively limited. Fewer than half the respondents reported using AI frequently for activities such as performance-based design, form generation, spatial planning, multi-objective optimisation, restoration, and the development of design tools (Komatina *et al.*, 2024). The study found no statistically significant relationship between the level of AI use and students' sustainability ratings, suggesting that greater AI use does not necessarily translate into stronger sustainability awareness. Students' acceptance of AI was, however, significantly influenced by both perceived benefits and perceived risks: respondents recognised benefits such as increased efficiency, innovative design solutions, and improved sustainability outcomes, while also raising concerns about ethical issues, legal implications, reliability, and possible job displacement (Komatina *et al.*, 2024).

Among these concerns, job displacement emerged as the most frequently cited issue, reported by 51% of participants; ethical concerns were identified by 43% of respondents, and legal issues and reliability concerns were each reported by 42% (Komatina *et al.*, 2024). Serbian and Montenegrin students held broadly similar views on sustainability and on the potential benefits and risks of AI, but differed in how much they actually used AI tools, with Serbian students reporting higher levels of use (Komatina *et al.*, 2024).

Professional guidance from the Royal Institute of British Architects (RIBA) raises further concerns about hallucinations, confidentiality, copyright, liability, and the reliability of AI-generated outputs in architectural practice. The RIBA AI Report argues that the central question is no longer whether AI should be adopted, but how it should be adopted and under whose terms, and it emphasises the continued importance of professional judgment and human responsibility in all AI-assisted work (Royal Institute of British Architects, 2025).

These findings carry particular weight for specification writing. Technical specifications are legally referenced, standards-based documents that form part of construction contracts, so concerns about reliability, legal responsibility, and professional accountability become still more significant in this context: errors or inaccuracies in AI-generated specification content can have direct contractual and professional consequences. At the same time, evidence from instructor-mediated AI integration suggests that careful, structured AI use can strengthen students' ethical awareness and sense of responsibility. Improvements in the Values domain of learning outcomes, in particular, have been consistently observed following structured AI interventions (El Samaty & Albadi, 2026).

These findings, together, suggest that unrestricted or uncritical AI use may raise unresolved concerns about reliability and accountability, whereas AI integrated within a structured, instructor-guided learning environment can strengthen the very qualities specification writing depends on: ethical awareness, professional responsibility, and academic integrity.

3.6 Toward a Gap-Specific Framework

A review of the existing literature reveals two important and closely related conclusions. First, the effective and responsible integration of artificial intelligence into architectural education relies largely on the role of instructors, well-designed pedagogical support, and clear institutional policies rather than on unrestricted student access to AI tools alone (El Samaty & Albadi, 2026). Simply making AI available to students does not necessarily lead to meaningful or responsible use.

Second, students' willingness to adopt and use AI is influenced by both the advantages they perceive and the concerns they hold about the technology. These concerns often centre on ethical issues, legal implications, and the reliability of AI-generated outputs, and they tend to become more pronounced when AI is applied to tasks that carry direct professional responsibilities and consequences (Komatina *et al.*, 2024). Exposure to AI technologies, therefore, does not automatically eliminate these reservations.

Despite these valuable insights, neither study specifically examines specification writing. El Samaty and Albadi (2026) focus primarily on research-based design courses, while Komatina *et al.* (2024) concentrate on AI applications in design, planning, and sustainability contexts. This is an important gap, because specification writing occupies a unique position within architectural education: it requires both the research and writing competencies highlighted by the first study and the professional accountability and standards compliance emphasised by the second, layered on top of the standardized professional conventions, MasterFormat and SectionFormat, described in Section 3.1, which have no direct counterpart in design studio or research-writing instruction.

The framework proposed in the following section seeks to address this gap. It adapts the instructor-guided and policy-oriented approach identified by El Samaty and Albadi (2026) and applies it to specification writing, while also incorporating the ethical, legal, and reliability considerations associated with technically consequential applications of AI, as identified by Komatina et al. (2024), and the professional documentation conventions established in Section 3.1.

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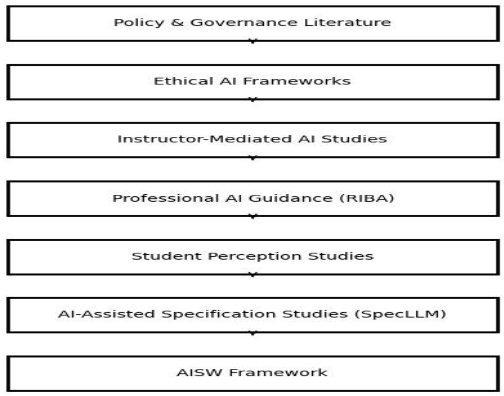

Figure 1. Evidence pillars underpinning the development of the AISW framework

3.7 A Framework for Responsible AI Integration in Specification-Writing Instruction

Drawing on evidence from studies on responsible AI governance in education, ethical AI frameworks, instructor-mediated AI integration, professional guidance on AI adoption in architecture, and emerging evidence on AI-assisted specification development, this study proposes the AI-Integrated Specification Writing (AISW) framework. The framework adopts the design-application-evaluation structure of the AI Mentoring Method while extending it through additional principles of governance, transparency, accountability, and human oversight. It keeps the same sequential structure but modifies its content and activities to reflect the procedural, technical, and regulatory nature of specification writing within architectural education.

Table 1: Correspondence Between the AI Mentoring Method and the AISW Framework

AISW Stage	Corresponding AI Mentoring Method Phase(s)	What Changes for Specification Writing
Design	Design Stage (supported by the phases of Consultation, Self-Development, Exchanging Experiences, Subscription, Guest Speakers, Regular Orientation and Follow-up, and Feedback and Assessment)	Adds explicit classification of which specification tasks may use AI vs. must remain human-only (see below), tied to standards compliance and liability rather than only learning outcomes.
Application	Application Stage	Adds cross-referencing against codes, standards, and manufacturer documentation as a core AI-supported activity, extending

AISW Stage	Corresponding AI Mentoring Method Phase(s)	What Changes for Specification Writing
		beyond design-studio and research-writing applications.
Evaluation	Evaluation Stage	Places greater emphasis on the Values domain, particularly disclosure, verification, and acceptance of professional responsibility for AI-assisted content, reflecting the contractual and legal significance of specifications.

Design Stage: Policy Alignment and Instructor Preparation. Similar to the original mentoring approach, the design stage provides the ethical and procedural foundation for AI use before students engage with the technology. Its primary purpose is to ensure that AI integration aligns with institutional policies on learning outcomes, transparency, authenticity, and academic integrity (El Samaty & Albadi, 2026). Within specification writing, this stage requires instructors to determine which parts of the specification-development process can benefit from AI support and which should remain entirely under human control. AI may be useful, for example, for summarising manufacturers' information, reviewing standards documentation, drafting preliminary boilerplate sections, or checking internal consistency within a document. Decisions involving final material selection, code-compliance determinations, and contractual or liability-related statements, however, should remain the responsibility of the instructor and the student. This stage also requires instructors to develop adequate competence in AI technologies and prompt engineering techniques, reflecting the instructor self-development component identified by El Samaty and Albadi (2026). Clear guidelines should likewise be established for disclosing AI use, so that any AI-assisted sections of a specification document are openly acknowledged, in keeping with institutional expectations of transparency and responsible practice.

Application Stage: Instructor-Mediated and Task-Specific AI Use

The application stage introduces AI into specific specification-writing activities under continuous instructor guidance. Instructors are expected to interpret, verify, and contextualise AI-generated outputs at this stage, ensuring students remain active participants in the learning process rather than passive users of technology (El Samaty & Albadi, 2026).

AI tools designed for writing support, reference management, and text organisation may be particularly useful during the early stages of specification development, helping students structure specification sections according to accepted professional standards and documentation conventions (for instance, the MasterFormat/SectionFormat system discussed in Section 3.1 where applicable), synthesise information from manufacturers' literature, and organise technical documentation. Analytical AI tools similar to those applied in parametric design and site analysis may likewise assist students in cross-referencing specification requirements against material properties, site conditions, and performance criteria (El Samaty & Albadi, 2026).

The literature suggests that guided inquiry and continuous formative feedback are especially effective for supporting research- and writing-intensive tasks (El Samaty & Albadi, 2026), and these approaches accordingly form the core pedagogical strategies of the application stage. Reflective activities should also be built in, encouraging students to critically examine AI-generated specification content, compare it against relevant codes and standards, and assess its appropriateness before it is incorporated into final documents.

Evaluation Stage: Outcome-Based and Perception-Based Assessment

The evaluation stage combines two complementary approaches to assessment that have been highlighted in previous studies. The first involves structured surveys that capture students' perceptions before, during, and after their experience with AI-supported learning (El Samaty & Albadi, 2026). The second consists of outcome-based assessments that evaluate performance across the domains of Knowledge, Skills, and Values, in line with national qualification frameworks (El Samaty & Albadi, 2026).

Because students often express concerns about the ethical, legal, and reliability implications of AI in professionally significant tasks (Komatina *et al.*, 2024), the evaluation of specification-writing instruction should place particular emphasis on the Values domain. Assessment should therefore examine whether students can recognise situations in which AI-generated content requires human verification, disclose the use of AI appropriately, and accept responsibility for the accuracy and quality of the final specification document.

This focus is supported by evidence indicating that structured and instructor-mediated approaches to AI integration produce more consistent improvements in ethical awareness and academic responsibility, even when gains in knowledge and technical skills differ among learners and instructional contexts (El Samaty & Albadi, 2026). Table 2 consolidates the three stages of the AISW framework described above into a single reference summary.

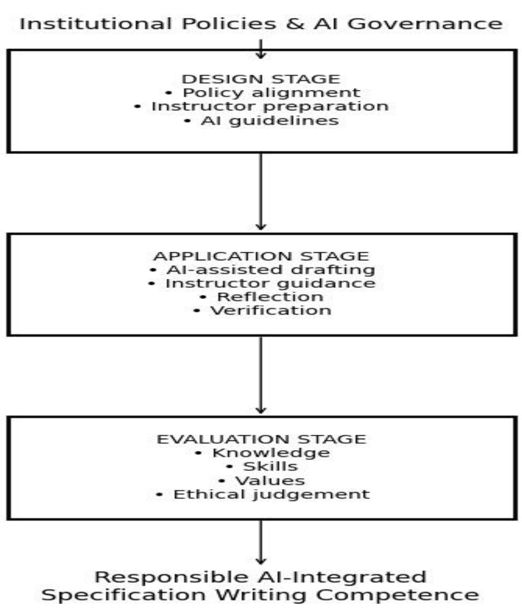

Figure 2. Proposed AI-Integrated Specification Writing (AISW) Framework for Responsible AI Integration in Architectural Education.

Table 2: The AI-Integrated Specification Writing (AISW) Framework

Stage	Purpose	Instructor Role	Permitted AI Uses	Human-Only Tasks	Assessment Focus
Design	Establish ethical and procedural foundation before AI use begins	Set institutional-policy alignment; classify permitted vs. prohibited AI uses; disclose expectations; develop own AI competence	Not yet applicable — this stage precedes student AI use	Defining scope of AI use; setting disclosure requirements	Not assessed at this stage
Application	Introduce AI into specific, bounded specification-writing tasks	Interpret, verify, and contextualise AI outputs; deliver guided inquiry and formative feedback	Summarising manufacturer information; reviewing standards documentation; drafting boilerplate sections; checking internal consistency; cross-referencing requirements against material properties and site conditions	Final material selection; code-compliance determinations; contractual/liability statements	Formative — quality and criticality of student engagement with AI outputs
Evaluation	Assess learning outcomes and student perceptions of AI-assisted work	Administer perception surveys; assess Knowledge, Skills, and Values domains	N/A — assessment activity	N/A — assessment activity	Emphasis on the Values domain: verification behaviour, disclosure, and acceptance of professional responsibility

4. DISCUSSION

The proposed framework rests on a key idea emerging from both studies: the educational value of artificial intelligence in architectural education depends less on the sophistication of the technology itself than on how its use is guided and managed by instructors. El Samaty and Albadi (2026) found that the same AI integration approach produced noticeably different learning outcomes when implemented by different instructors. This finding raises a question the AISW framework, as currently formulated, does not resolve: if the same three-stage AI Mentoring Method, underpinned by seven design phases, could still produce an ILO gap of 81.8%–82.1% versus 87.4% between two instructors (El Samaty & Albadi, 2026), what would prevent a similar gap under AISW, and what instructor-training or institutional-support mechanisms would close it? The framework's Design stage assumes instructors “develop adequate competence in AI technologies and prompt engineering techniques,” but does not specify how, by whom, or to what standard this competence should be assessed before an instructor is considered ready to deliver the Application stage. This gap deserves direct attention, since it is precisely the mechanism the underlying evidence identifies as most consequential.

A second unresolved tension concerns institutional capacity. The framework's Design stage presupposes that instructors have the time and institutional support to review AI-generated content against codes and standards, develop disclosure policies, and build AI literacy before teaching begins. In under-resourced programmes, a condition not unusual in many architecture schools, including within the Nigerian context in which this paper is situated, these preconditions may not hold. The paper does not yet address what a minimum-viable version of AISW would look like where dedicated instructor-training time or institutional policy infrastructure is unavailable, which limits the framework's practical applicability outside well-resourced settings.

Similarly, the relatively low level of AI adoption among architecture students, despite their recognition of its potential benefits (Komatina *et al.*, 2024), suggests that awareness alone is not enough to encourage meaningful use of the technology. Students may need structured learning experiences that help them understand not just how AI tools function, but how to apply them responsibly in professional practice, a need that becomes still more important in specification writing, where decisions often carry significant procedural, contractual, and legal implications.

The concerns students continue to express about job displacement, ethical issues, legal responsibility, and the reliability of AI-generated outputs (Komatina *et al.*, 2024) should not be viewed merely as barriers to AI adoption. They should instead be treated as important learning topics within specification-writing education: future professionals will need to make informed judgments about liability, code compliance, and the limitations of AI-generated technical information, and developing these competencies is essential if graduates are to use AI responsibly in practice.

A third tension worth naming explicitly is that the Evaluation stage's emphasis on the Values domain assumes that ethical awareness and disclosure behaviour, once demonstrated in a classroom exercise, will transfer into professional practice under commercial pressure, a transfer this paper's conceptual evidence base cannot itself confirm, since neither underlying study examines post-graduation professional behaviour.

The framework also aligns with the broader policy direction identified in both studies.

Institutional guidelines emphasise transparency, academic integrity, and alignment with learning outcomes (El Samaty & Albadi, 2026), while broader regulatory initiatives call for trustworthy, human-centred applications of AI (Komatina *et al.*, 2024). Together, these developments suggest that integrating AI into specification-writing instruction should occur within clear, documented, and accountable pedagogical structures rather than through informal or unregulated use of technological tools. Seen this way, the AISW framework is more than a teaching strategy: it offers a structured approach through which architecture programmes can demonstrate responsible, policy-compliant AI integration, provided the instructor-capacity and resourcing questions raised above are addressed in future work.

5. CONCLUSION AND FUTURE RESEARCH

This paper has highlighted specification writing as an important yet largely overlooked area for the integration of artificial intelligence in architectural education. Drawing on evidence from responsible AI governance literature, ethical AI frameworks, instructor-mediated AI mentoring, professional guidance on AI adoption in architecture, studies of students' perceptions of the benefits and risks of AI use, and the established professional conventions that govern specification writing itself, this study proposed the AI-Integrated Specification Writing (AISW) framework. The framework adapts the established design-application-evaluation model to the specific demands of specification writing, where standards compliance, professional accountability, and ethical responsibility carry particular weight.

The framework presented here, however, remains conceptual and is based on evidence drawn from related, rather than identical, educational contexts, concentrated in a small number of primary studies. Its effectiveness within specification-writing instruction has therefore not yet been empirically established, and it should be regarded as a preliminary conceptual model requiring validation through pilot implementation studies, expert review, and longitudinal assessment. Future studies should test the AISW framework in actual specification-writing courses and across different institutional settings, including settings with varying levels of instructor training and institutional resourcing, given the capacity concerns raised in Section 4. Such studies could adopt comparative approaches, examining how variations in instructor implementation influence learning outcomes.

Further research should also employ quantitative, hypothesis-driven methods to investigate students' experiences and perceptions of AI-assisted specification writing, making it possible to determine whether structured, instructor-guided AI integration leads to measurable improvements in the quality, accuracy, code compliance, and professional defensibility of student-produced specifications, compared with traditional instructional approaches or unregulated AI use. Finally, studies drawing on larger, more diverse samples from multiple institutions, supported by appropriate statistical analyses, would provide stronger evidence of the framework's wider applicability. Such work would meaningfully advance understanding of how AI can be integrated responsibly into specification-writing education and would help refine the framework beyond the limited contexts from which it was originally developed.

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