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When machines create, who takes responsibility? An ethical competence framework for graphic design education in the age of generative AI

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Abstract. When generative AI produces a racially stereotyped image, who is responsible – the developer, the platform, or the designer who delivers it to a client? This question, unanswerable within existing competency models, reveals an ethical rupture that generative AI has introduced into design practice. Unlike general AI literacy or digital ethics frameworks, which treat ethical competence as one component among several, the Ethical Information-Communicative Competence (EICC) model proposed in this paper positions ethical competence as a cross-cutting dimension that permeates all aspects of professional design activity – from information evaluation through communication to technology use and reflection. The paper maps the ethical challenge landscape of AI-driven design, develops EICC around five cross-cutting ethical challenges (bias, provenance, disclosure, intellectual property, and environmental impact) that manifest differently across professional domains, and defines proficiency in terms of ethical reasoning levels (compliance, deliberative, transformative) rather than skill acquisition stages. It further proposes TPACK-Ethical as a pedagogical architecture that integrates ethical knowledge into studio-based instruction, and reveals through gap analysis of the Ukrainian B2 Design standard that ethical competence is systematically absent from current standards. An integrative framework links EICC, TPACK-Ethical, and constructive alignment into a cyclical model for curriculum transformation.

Keywords: ethical competence, cross-cutting dimension, EICC model, TPACK-Ethical, design education, generative AI, ethical reasoning, competency standards

1. Introduction

When a generative AI system produces a photorealistic image that perpetuates racial stereotypes, who bears ethical responsibility – the developer who curated the training data, the platform that hosted the model, or the designer who accepted the output and delivered it to a client? This question – unanswerable within existing competency models for design education – reveals a fundamental problem: current approaches to professional competence treat ethics as a module to be added, not a dimension that permeates every aspect of practice.

The transformation driven by generative AI is both rapid and ethically consequential. Tools such as Midjourney, DALL-E, Stable Diffusion, and Adobe Firefly have compressed ideation cycles from hours to minutes, enabling designers to generate, evaluate, and curate dozens of visual alternatives through natural language prompts [15, 35]. This shift from "maker" to "curator" [25] carries substantial ethical weight: each curatorial decision – which prompt to formulate, which output to accept, whether to disclose AI involvement – involves moral judgment that designers are currently unprepared to exercise systematically.

The ethical stakes are uniquely high in visual communication. Unlike text-based AI outputs that can be fact-checked against verifiable sources, AI-generated images encode bias visually – through skin tone distributions, body representations, cultural signifiers, and aesthetic defaults that reflect training data imbalances [34]. The consequences are tangible: Google's Gemini image

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generator faced widespread criticism for historically inaccurate diversity corrections [37]; deepfake technology enabled a $25.6 million fraud against the design firm Arup through AI-generated video impersonation [20]; and non-consensual AI-generated imagery has prompted legislative action across multiple jurisdictions. These are not edge cases but structural features of a technology whose ethical implications are inseparable from its creative utility.

Existing responses to this ethical challenge remain fragmented. Universal digital competence frameworks (DigComp 2.2; [36]) include ethical provisions in their safety dimension but lack professional specificity for designers. Emerging AI literacy models [9, 10, 27] address comprehension of AI systems but treat ethics as one component among several rather than a cross-cutting concern. Professional design codes of ethics [2, 3, 30] articulate normative principles but lack the pedagogical structure needed for systematic competence development. The "Ethical Touchpoints" framework [14] offers tool-based teaching activities but not a comprehensive competence model. Musiienko [26] has proposed an information-communicative competence (ICC) model for AI-era designers that positions ethical awareness within the reflective component; however, this paper argues that ethical competence cannot be confined to a single component – it permeates information analysis, communication, technology use, and reflection alike.

This paper addresses the gap by proposing a theoretical model – Ethical Information-Communicative Competence (EICC) – that positions ethical competence not as an add-on module or a subcomponent of reflection but as a dimension woven through all four aspects of professional design activity. The model is organised around three research questions:

RQ1: How should ethical competence be conceptualised for graphic designers in the generative AI era, given that ethical challenges cut across all professional domains rather than residing in any single one?

RQ2: What criteria, indicators, and ethical reasoning levels constitute EICC, and how do cross-cutting ethical challenges manifest differently across professional domains?

RQ3: What gaps exist when mapping national design competency standards to EICC, and what patterns of ethical omission emerge?

The paper advances the field through three interconnected contributions. It maps the ethical challenge landscape of AI-driven design and proposes EICC as a cross-cutting dimension model, operationalised through five ethical challenges that manifest differently across professional domains, with defined criteria and three ethical reasoning levels (RQ1, RQ2). It develops TPACK-Ethical as a pedagogical architecture that integrates ethical knowledge into studio-based instruction. And it reveals through gap analysis of the Ukrainian B2 Design standard that ethical competence is systematically absent – not merely incomplete, but architecturally missing – providing concrete recommendations for standards reform (RQ3).

The remainder of the paper is organised as follows: section 2 maps the ethical challenge landscape of AI-driven design; section 3 describes the research methodology; section 4 presents the EICC model with cross-cutting ethical challenges and reasoning levels; section 5 defines the ethical reasoning progression; section 6 develops TPACK-Ethical and its integration with studio pedagogy; section 7 maps national design standards to EICC; section 9 discusses implications and limitations; and section 10 concludes with future research directions.

2. The ethical landscape of AI-driven design

Before developing a competence model, it is necessary to understand the ethical terrain that generative AI has created for design practice. Five ethical challenges – bias, provenance, disclosure, intellectual property, and environmental impact – cut across every aspect of professional design activity. These are not separate domains that map neatly onto individual competencies; they are cross-cutting concerns that manifest differently depending on whether a designer is evaluating information, communicating

with stakeholders, selecting tools, or reflecting on practice. This section maps the challenge landscape; the subsequent EICC model (section 4) shows how each challenge requires ethical competence across all professional domains.

Bias and representational harm. Generative AI models reproduce and amplify biases present in their training data. Studies have documented systematic over-representation of lighter skin tones, younger demographics, and Western aesthetic norms in AI-generated imagery, while individuals with disabilities are virtually absent from "successful person" prompts [34]. The Google Gemini image generator controversy [37] demonstrated that even well-intentioned attempts to correct bias can produce historically inaccurate outputs. Bias is not merely an information problem (detecting skewed outputs) but also a communicative problem (who is represented in AI-generated campaigns), a technological problem (which tools encode which biases), and a reflective problem (how designers evaluate their own curatorial choices).

Provenance and authenticity. The proliferation of AI-generated imagery undermines the reliability of visual information. The Coalition for Content Provenance and Authenticity (C2PA) has established an open technical standard – Content Credentials – for embedding cryptographically signed metadata into digital media [11]. Provenance is an information-analytical challenge (verifying sources), a communicative challenge (disclosing AI involvement), a technological challenge (implementing verification tools), and a reflective challenge (evaluating the implications of mediated authorship).

Disclosure and transparency. Professional codes increasingly mandate disclosure of AI involvement in design work [2, 3]. Yet disclosure is not a simple binary: the level of detail appropriate for different stakeholders, the distinction between AI-assisted and AI-generated elements, and the framing of AI's creative role all require ethical judgment that extends beyond any single professional domain.

Intellectual property and creative attribution. Generative AI's capacity for style mimicry raises fundamental questions about creative ownership. Defensive tools such as Glaze [32] and Nightshade [33] attempt to protect artists' work from unauthorised style extraction, but emerging evidence suggests adversarial countermeasures can reduce their effectiveness [29]. Intellectual property concerns span information evaluation (assessing originality), communication (attribution practices), technology selection (choosing tools with licensed training data), and reflection (professional identity in an age of machine-assisted creation).

Environmental sustainability. Large-scale image generation carries significant environmental costs – training GPT-3-class models produces approximately 552 tonnes of CO_2 equivalent, and a single AI-generated image consumes energy comparable to half a smartphone charge [38]. Environmental responsibility intersects with technology selection (when is AI generation justified versus lower-impact alternatives), information analysis (understanding the hidden costs of computational processes), communication (transparency about environmental impact with clients), and reflection (evaluating the sustainability of one's own practice).

These five challenges share a structural feature: they cannot be addressed by ethical reasoning confined to a single professional domain. Each challenge manifests across information analysis, communication, technology use, and reflection simultaneously. This cross-cutting nature is precisely why ethical competence must be conceptualised as a dimension that permeates all professional activity rather than a component that can be isolated in one domain. Existing competence models, including the ICC framework for AI-era designers [26], position ethics within the reflective component; the analysis above suggests that this placement is insufficient for the ethical landscape that generative AI has created.

3. Methodology

This study employs a conceptual research design grounded in *reflective practice inquiry* [12, 31] and *theory synthesis* [17]. Where theory synthesis integrates existing theoretical perspectives to produce a novel framework, reflective practice inquiry – drawn from Schön's theory of the reflective practitioner and Dorst's frame creation methodology – provides the ethical orientation: it begins from

a problematic situation (the ethical rupture created by generative AI in design) and works iteratively toward a frame that restructures professional understanding. This combination is appropriate because EICC is not merely a synthesis of existing constructs but a reconceptualisation that restructures how ethical competence is understood in design education.

The research proceeded through four phases, each oriented around an ethical inquiry question rather than a terminological exercise (figure 1).

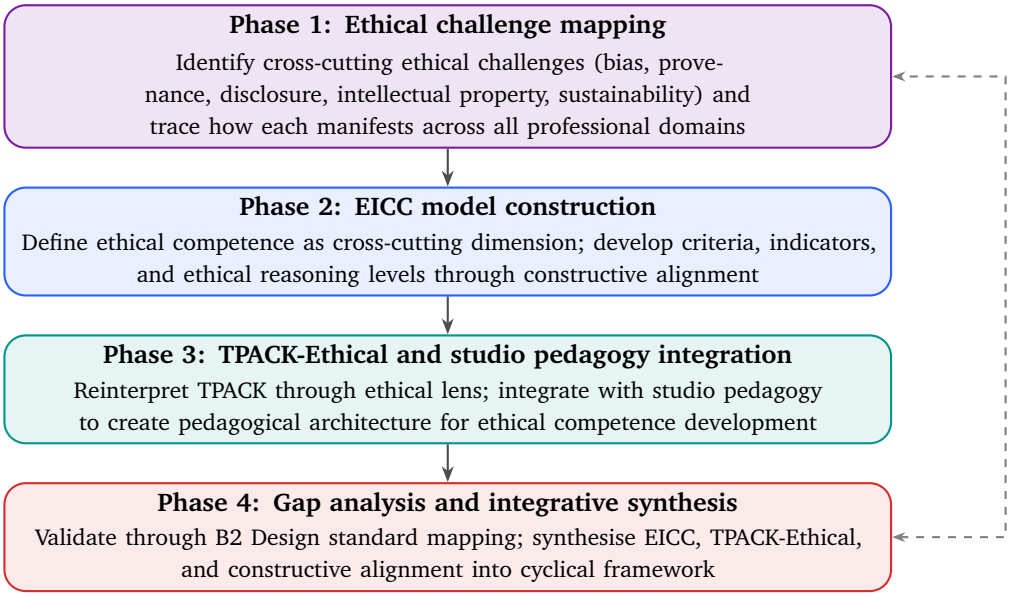

Figure 1: Research methodology: ethical inquiry cycle with four phases and iterative feedback.

Phase 1: Ethical challenge mapping. Rather than comparing adjacent constructs terminologically, this phase identified the ethical challenges that generative AI creates for design practice and traced how each challenge cuts across professional domains. The analysis drew on documented ethical incidents [20, 37], professional codes of ethics [2, 3, 21, 30], AI literacy reviews [4, 10], and the scoping review of generative AI in design higher education [25]. Five cross-cutting challenges were identified: bias and representational harm, provenance and authenticity, disclosure and transparency, intellectual property and creative attribution, and environmental sustainability.

Phase 2: EICC model construction. The challenge mapping was synthesised into the EICC model, defining ethical competence as a cross-cutting dimension that manifests across all professional domains – information analysis, communication, technology use, and reflection. Criteria and indicators were developed using constructive alignment principles [5], and proficiency was defined in terms of ethical reasoning levels (compliance, deliberative, transformative) rather than skill acquisition stages, drawing on developmental ethics theory. Thematic analysis [7] was used to derive criteria from ethical provisions in professional codes, framework documents, and documented incidents.

Phase 3: TPACK-Ethical and studio pedagogy integration. The TPACK framework [23] was reinterpreted through an ethical lens, and the result was integrated with studio pedagogy [31] to produce a pedagogical architecture that embeds ethical knowledge in every aspect of studio instruction. Unlike adaptations that add an ethical overlay to existing knowledge domains, this phase examined how ethical knowledge transforms each TPACK intersection.

Phase 4: Gap analysis and integrative synthesis. The EICC model and TPACK-Ethical were validated through systematic gap analysis: competency descriptors in the Ukrainian B2 Design bachelor's standard [22] were mapped against EICC criteria, following document analysis methodology [6] and building on prior standards analysis [24]. The results were synthesised into a cyclical framework linking ethical awareness, curriculum design, studio practice, and assessment through constructive alignment [5].

4. The EICC model: ethics as a cross-cutting dimension

The EICC model defines ethical competence not as a module to be added to existing curricula nor as a subcomponent of professional reflection, but as a *cross-cutting dimension* that permeates all aspects of professional design activity. The five ethical challenges identified in section 2 – bias, provenance, disclosure, intellectual property, and environmental sustainability – each manifest differently across the four professional domains of design practice: information analysis, communication, technology use, and reflection. This section traces these manifestations and defines assessable criteria for each intersection.

Three design-specific characteristics motivate this structure. First, designers are *producers of visual meaning*: they create images, layouts, and visual systems that encode cultural values, power relations, and identity representations, requiring sensitivity to representational harm – stereotyping, erasure, and cultural appropriation – that has no direct analogue in text-based AI ethics. Second, design practice involves *mediated authorship*: when a designer uses generative AI, the resulting work is neither fully human-authored nor fully machine-generated, creating ethical obligations regarding attribution, disclosure, and intellectual property. Third, designers operate within *client-service relationships* that create ethical tensions between commercial demands and professional responsibility. A client may request outputs that the designer recognises as ethically problematic. Ethical competence must include the capacity to navigate these tensions. These characteristics reinforce the cross-cutting argument: bias manifests in visual meaning production (information analysis + communication), mediated authorship (technology + communication), and client-service tensions (communication + reflection). No single domain can contain the ethical challenge.

4.1. How bias manifests across professional domains

Bias and representational harm are not confined to information evaluation. When a designer detects demographic imbalances in AI-generated imagery, this is an *information-analytical* challenge – applying bias detection tools (REVISE, AI Fairness 360) and articulating bias types. But bias also manifests in *communication*: the formulation of prompts that encode assumptions about who and what should be depicted, and the curatorial choice of which AI-generated representations to accept or reject [13]. It manifests in *technology use*: different AI tools encode different biases based on their training data, and tool selection is itself an ethical act. And it manifests in *reflection*: designers must evaluate their own curatorial biases – the tendency to accept AI outputs that confirm existing assumptions and reject those that challenge them.

Beyond detecting bias in individual outputs, ethical competence includes understanding *how* bias enters AI systems: through dataset curation, model architecture, and prompt design. This structural understanding enables designers to move from reactive bias detection to proactive bias prevention – formulating prompts and selecting tools in ways that minimise representational harm.

4.2. How provenance and disclosure manifest across domains

Provenance verification and transparent disclosure are closely linked ethical challenges that cut across professional domains. The C2PA standard [11] establishes technical infrastructure for Content Credentials, but implementing these standards requires competence across all domains.

In *information analysis*, provenance means verifying Content Credentials in source materials and maintaining a verifiable chain of custody. In *communication*, it means transparent disclosure of AI involvement – the RGD joint code requires designers to inform clients "when and how" AI is used [3]; AIGA positions transparency as foundational to professional trust [2]. Ethical communicative competence involves judgment about *how* to disclose: the level of detail appropriate for different stakeholders, the distinction between AI-assisted and AI-generated elements, and the framing of AI's role in the creative process. In *technology use*, provenance means embedding Content Credentials in deliverables and implementing organisational provenance protocols. In *reflection*, it means evaluating

the implications of mediated authorship – when AI co-creates, who is the author, and what are the obligations that follow?

4.3. How intellectual property and environmental impact manifest across domains

Intellectual property and environmental sustainability present ethical challenges that are particularly consequential because they involve systemic consequences beyond the individual design project.

In *information analysis*, intellectual property competence means assessing the originality and licensing status of AI-generated content, understanding that AI outputs are statistical patterns derived from training data rather than original creations. In *communication*, it means practising proper attribution, communicating intellectual property uncertainty to clients, and navigating the ethics of style mimicry – the risk that generative models "mimic culture without its memory" [21]. In *technology use*, intellectual property competence means selecting tools based on their training data provenance – Adobe Firefly, trained on licensed content, provides clearer intellectual property standing than tools trained on scraped imagery without creator consent [30] – and implementing defensive tools such as Glaze [32] and Nightshade [33] while understanding their limitations [29]. In *reflection*, it means grappling with professional identity: if machines can produce visually competent output, what is the distinctive value of human designers?

Environmental sustainability cuts across domains similarly. In *information analysis*, it means understanding the hidden environmental costs of computational processes. In *communication*, it means transparency about environmental impact with clients. In *technology use*, it means making informed decisions about when AI generation is justified versus when lower-impact alternatives are preferable [38]. In *reflection*, it means evaluating the sustainability of one's own practice.

4.4. The EICC structural model

Figure 2 visualises the EICC structure. Unlike models that position ethical competence as one of four parallel components, EICC places ethical principles – fairness, accountability, transparency, and sustainability – at the centre, with professional domains as the domains through which ethical challenges are addressed. The key design principle is that ethical competence is not a component added alongside professional competencies but a dimension that runs *through* each domain.

Table 1 presents the EICC criteria matrix, organising the 12 criteria by cross-cutting ethical challenge and professional domain. This structure makes visible how each challenge manifests across multiple domains – a feature that would be obscured in a model organised by parallel components alone.

Table 1
EICC criteria matrix: ethical challenges across professional domains.

Challenge	Information analysis	Communication	Technology use	Reflection
Bias	Bias detection in AI outputs	Inclusive representation in prompting	Bias-aware tool selection	Self-assessment of curatorial biases
Provenance	Content Credentials verification	Transparent AI disclosure	Provenance protocol implementation	Evaluation of mediated authorship
Disclosure	Source identification	Ethical AI disclosure practice	Disclosure tool integration	Judgment about disclosure scope
Intellectual property	Originality and licensing assessment	Attribution and style ethics	Ethical tool selection (licensed data)	Professional identity negotiation
Sustainability	Environmental cost awareness	Client transparency about impact	Justified AI use vs. alternatives	Sustainable practice evaluation

All professional domains are connected through the ethical core, reflecting their mutual dependence. Bias detection results inform ethical tool selection; client feedback on disclosure practices prompts

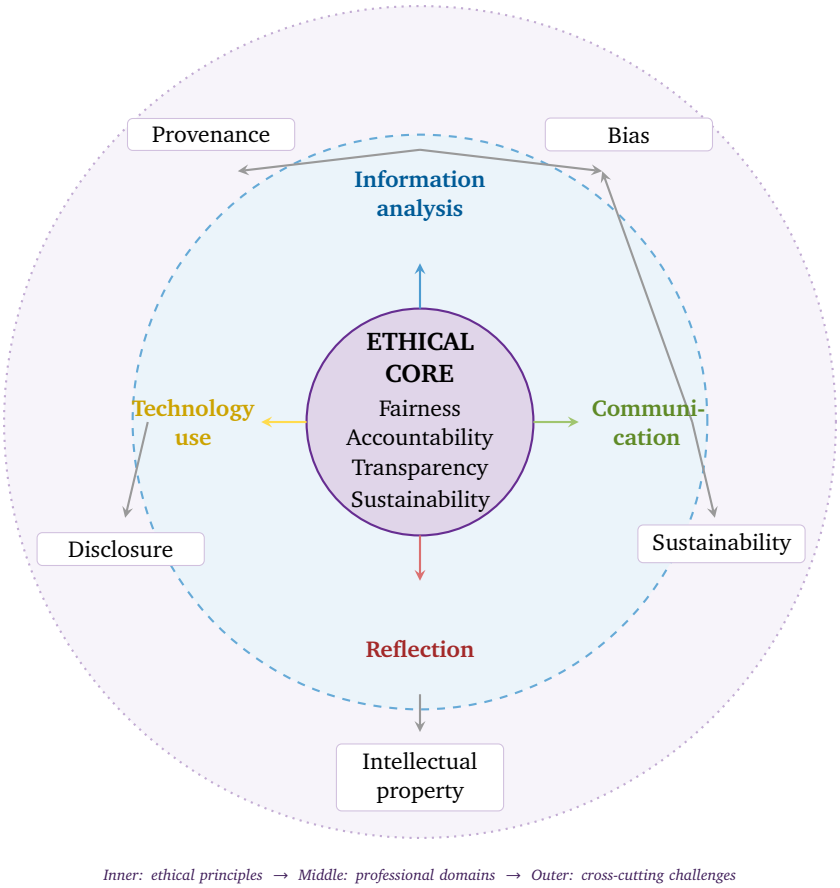

Figure 2: EICC structural model: ethical principles at the core permeate professional domains and manifest as cross-cutting challenges.

professional identity reconsideration; algorithmic understanding facilitates bias detection; and ethical reflection provides the meta-cognitive foundation ensuring that ethical practice is conscious, deliberate, and continuously developing. This cross-cutting structure – where ethical challenges permeate all domains simultaneously – distinguishes EICC from models that treat ethics as one parallel component among several.

5. Ethical reasoning levels and assessment

The EICC criteria in table 1 define *what* ethical competence encompasses across professional domains. This section defines *how* competence develops and is assessed, using a progression of ethical reasoning levels rather than skill acquisition stages. The distinction is substantive: skill-based proficiency levels (beginner, intermediate, advanced) measure increasing technical capability, but ethical competence involves not merely doing more or doing better – it involves reasoning differently about increasingly complex moral situations.

Three ethical reasoning levels are proposed, drawing on developmental ethics theory and the graduated structure of the AI Assessment Scale [28]:

1. *Compliance level.* The designer follows established rules, codes, and guidelines. Ethical competence at this level means recognising obvious ethical violations (e.g., using AI-generated content without disclosure), adhering to professional codes [2, 3], and applying established procedures (e.g., checking for Content Credentials). The compliance level corresponds to rule-based moral reasoning: the designer knows what the rules are and follows them, but may struggle when rules conflict or when novel situations arise that existing codes do not address.

2. *Deliberative level.* The designer can reason about novel ethical situations where established rules are insufficient. At this level, the designer weighs competing ethical principles (e.g., the tension between client confidentiality and public disclosure obligations), applies ethical frameworks to analyse ambiguous cases, and makes justified decisions in the absence of clear guidelines. Deliberative competence includes formulating deliberately inclusive prompts, conducting bias audits that go beyond checklist compliance, evaluating tools across multiple ethical dimensions, and communicating AI limitations proactively rather than reactively. This level corresponds to principled moral reasoning: the designer understands the ethical principles underlying professional codes and can apply them to new situations.

3. *Transformative level.* The designer shapes professional ethical norms rather than merely following or interpreting them. At this level, the designer develops organisational disclosure policies, conducts ethical tool audits, mentors others on transparency practice, contributes to professional discourse on designer-AI collaboration, and advocates for ethical standards reform. Transformative competence includes recognising systemic ethical issues (e.g., the structural absence of ethical competence in national standards) and working to address them at the institutional and professional level. This level corresponds to what might be called constitutive moral reasoning: the designer not only applies ethical principles but participates in shaping the ethical framework of the profession.

These three levels differ from skill-based proficiency frameworks in a fundamental way: they represent not a continuum of capability (doing the same thing better) but a qualitative shift in the kind of ethical reasoning employed. A designer at the compliance level cannot simply "try harder" to reach the deliberative level; they must develop the capacity for principled reasoning in situations of ambiguity, which is a different cognitive and moral skill. Similarly, the shift from deliberative to transformative reasoning requires the capacity to see beyond individual practice to systemic and institutional dimensions of ethical concern.

Table 2 illustrates the progression for three representative criteria.

Table 2
Ethical reasoning levels: progression from compliance to transformative reasoning.

Criterion	Compliance	Deliberative	Transformative
Bias detection	Recognises obvious demographic imbalances; follows bias-checking procedures	Applies bias detection tools; articulates bias type; weighs representational trade-offs	Designs bias mitigation strategies; conducts structured bias audits; shapes team-level guidelines
AI disclosure	Acknowledges AI use when asked; follows disclosure policies	Proactively discloses with appropriate detail; navigates disclosure ambiguity	Develops organisational disclosure policies; mentors others; advocates for standards reform
Tool selection	Distinguishes licensed vs. unlicensed training data; follows procurement rules	Evaluates tools across multiple ethical dimensions; resolves conflicts between functionality and ethics	Advises on ethical tool procurement; conducts ethical tool audits; shapes procurement standards

6. TPACK-Ethical and studio pedagogy

The Technological Pedagogical Content Knowledge (TPACK) framework [23] provides the dominant theoretical model for understanding how teachers integrate technology into instruction. However, TPACK was developed before the generative AI era and does not explicitly address the ethical dimension of technology integration. This section proposes TPACK-Ethical, an adaptation that

introduces an ethical overlay, and integrates it with studio pedagogy – the signature pedagogy of design education – to create a pedagogical architecture for ethical competence development.

6.1. Reinterpreting TPACK through an ethical lens

Ethical Technological Knowledge (Ethical TK) extends TK beyond operational proficiency to include ethical awareness of the technologies used. In the context of AI-era design education, Ethical TK encompasses: awareness of how AI models are trained and the ethical implications of training data sources; understanding the environmental costs of AI computation; knowledge of intellectual property protection tools and their limitations; and the capacity to evaluate AI tools based on ethical criteria (licensing, compensation, transparency) rather than functionality alone. Ethical TK transforms the question "How does this tool work?" into "How does this tool work, and what are the ethical consequences of using it?"

Ethical Pedagogical Knowledge (Ethical PK) extends PK to include pedagogical approaches for developing ethical competence. In design education, the studio critique – the discipline's signature pedagogy [31] – provides a natural site for ethical deliberation. Ethical PK involves: designing critique sessions that foreground ethical evaluation alongside aesthetic and functional assessment; facilitating discussions about representational harm, disclosure obligations, and professional responsibility; modelling ethical decision-making through think-aloud processes during demonstrations; and creating assessment tasks that evaluate ethical reasoning alongside technical execution. The studio, as a space of guided reflection and peer evaluation, is particularly well-suited for developing ethical competence because ethical judgment, like design judgment, is refined through practice, critique, and iteration rather than through lecture-based instruction alone [1, 19].

Ethical Content Knowledge (Ethical CK) extends CK to include the ethical dimensions of design content itself. For graphic designers, this encompasses: understanding how visual elements (colour, composition, framing, representation) encode cultural values and power relations; knowledge of representational ethics specific to visual communication – the distinction between appreciation and appropriation, the politics of visibility and erasure, the ethics of beauty standards; and awareness of how design decisions in areas such as packaging, advertising, and user interface design carry ethical implications for audiences and communities.

6.2. TPACK-Ethical intersections

The original TPACK framework derives its power from the intersections between knowledge domains. TPACK-Ethical introduces ethical considerations into each intersection (figure 3).

Ethical Technological Pedagogical Knowledge (Ethical TPK) involves knowing how to teach ethical technology use – going beyond demonstrating tool operations to guiding students through the ethical decisions embedded in every technological choice. This includes designing assignments that require students to justify their tool selection on ethical grounds, creating scenarios where ethical and functional considerations conflict, and facilitating reflection on how technology choices reflect professional values.

Ethical Technological Content Knowledge (Ethical TCK) involves understanding how AI technologies interact with design content in ethically significant ways – how prompt language influences representational outcomes, how model architecture affects style diversity, and how output curation reflects implicit aesthetic and cultural values.

Ethical Pedagogical Content Knowledge (Ethical PCK) involves knowing how to teach the ethical dimensions of design content – how to facilitate discussions about representational harm in student work, how to help students develop ethical sensitivity to the cultural implications of their visual choices, and how to assess ethical reasoning in design projects.

TPACK-Ethical represents the integration of all three ethical knowledge domains and their intersections: the capacity to teach design content using AI technologies while explicitly addressing the ethical implications of every pedagogical, technological, and content-related decision. TPACK-Ethical

is the knowledge that enables an educator to design a studio project in which students use generative AI to create campaign imagery while simultaneously developing their capacity for bias detection, transparent disclosure, responsible tool selection, and critical reflection on their curatorial role.

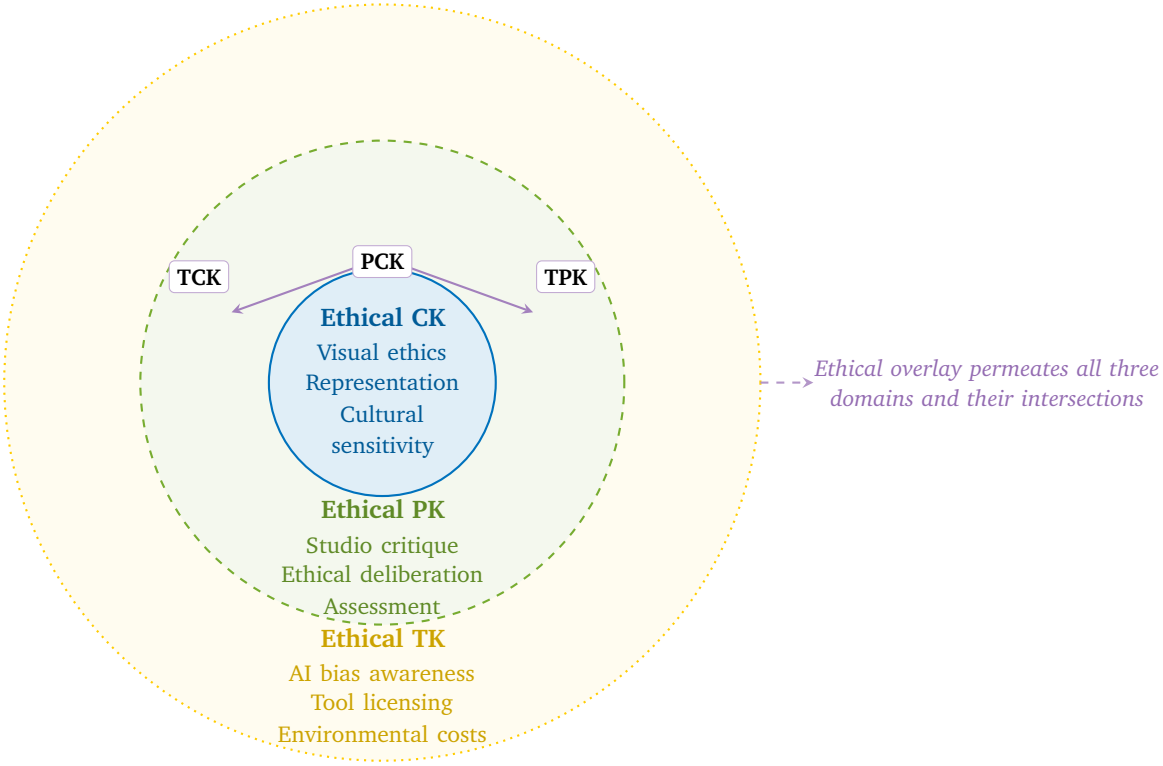

Figure 3: The TPACK-Ethical model: three nested knowledge domains with an ethical overlay. Concentric rings represent CK (inner), PK (middle), and TK (outer), with intersections at their boundaries. The ethical dimension permeates all three domains.

6.3. Studio pedagogy as the site for ethical competence development

TPACK-Ethical identifies the knowledge required for ethical AI-era design education, but knowledge alone does not produce competence. Studio pedagogy – the discipline's signature pedagogy [31] – provides the setting where ethical knowledge becomes ethical competence through practice, critique, and iteration.

The studio critique, as a space of guided reflection and peer evaluation, is particularly well-suited for developing ethical competence because ethical judgment, like design judgment, is refined through practice rather than through lecture-based instruction alone [1, 19]. In an EICC-aligned studio, the critique addresses ethical evaluation alongside aesthetic and functional assessment: students evaluate AI-generated outputs not only for visual quality but also for bias, transparency, cultural sensitivity, and environmental responsibility.

The integration of TPACK-Ethical with studio pedagogy means that every aspect of studio instruction becomes a site for ethical development: technology selection (Ethical TK in practice – students justify their tool choices on ethical grounds), pedagogical approach (Ethical PK – instructors design critique sessions that foreground ethical evaluation), and content evaluation (Ethical CK – students develop ethical sensitivity to the cultural implications of their visual choices). This is a more integrated model than adding an "ethics week" to the studio schedule; it embeds ethical reasoning in the fabric of studio practice.

7. Gap analysis: ethical blind spots in design standards

To assess whether current design education standards address the ethical challenges identified in section 2, this section maps the competency descriptors of the Ukrainian B2 Design bachelor's standard [22] against the EICC criteria matrix (table 1). The analysis reveals not merely isolated omissions but a systematic pattern of ethical absence: even where competencies exist, the ethical dimension is missing.

The Ukrainian standard was selected because prior analysis [24] demonstrated that it provides foundational elements for professional digital practice while systematically omitting AI-related capabilities. This section extends that analysis specifically to the ethical dimension and identifies patterns of ethical absence that suggest structural rather than incidental gaps.

The mapping followed a systematic document analysis approach [6]. Each competency descriptor was coded against EICC criteria and classified by gap type: "absent" (no connection to the ethical criterion), "present but AI-unaware" (elements exist but lack AI-specific elaboration), or "gap" (no connection). This tripartite classification captures the distinction between absent constructs, constructs that exist without ethical awareness, and structural omissions where the architecture to address ethical competence is missing entirely.

Table 3 presents the results of the mapping.

Table 3
Gap analysis: Ukrainian B2 Design standard mapped against EICC criteria with gap type classification.

Challenge	Domain	Status	Gap type	Analysis
Bias	Information analysis	Gap	Absent	No reference to algorithmic bias or representational harm
	Communication	Partial	AI-unaware	General "social responsibility" references without AI specificity
	Technology	Gap	Absent	Software mastery addressed without ethical evaluation criteria
	Reflection	Gap	Absent	Self-assessment present but without AI-specific reflection
Provenance and disclosure	Information analysis	Gap	Absent	No content authenticity or provenance standards
	Communication	Gap	Absent	No provisions for AI transparency in professional communication
	Technology	Gap	Absent	No disclosure tool integration
	Reflection	Partial	AI-unaware	Communication competencies exist without AI ethical dimensions
Intellectual property	Communication	Partial	AI-unaware	Intellectual property mentioned in general terms; no AI-specific issues
	Technology	Gap	Absent	No ethical tool selection criteria
	Reflection	Partial	AI-unaware	Professional identity without AI transformation context
Sustainability	Technology	Gap	Absent	No reference to environmental costs of digital technologies
	Reflection	Gap	Structural	No sustainability evaluation in professional practice

The gap analysis reveals a systematic pattern: of the EICC criteria mapped against the B2 Design standard, the majority represent complete gaps, while the remainder are only partially addressed.

No criterion is fully addressed. Crucially, the gaps follow a pattern that reflects the cross-cutting nature of ethical challenges: the same ethical concern (e.g., bias) is absent across all professional domains, not just in one component. This pattern confirms that the omission is structural rather than incidental – the standard lacks the conceptual architecture to address ethical competence as a cross-cutting concern.

Three categories of gaps emerge:

1. *Absent constructs.* Entire conceptual domains are missing from the standard – algorithmic bias, AI provenance, prompt engineering, environmental costs of computation, and the designer-curator paradigm. These represent foundational omissions that cannot be addressed through minor revisions but require substantive additions to competency descriptors.

2. *Present but AI-unaware constructs.* Several competency areas exist in the standard but lack AI-specific elaboration – inclusive representation, client communication, intellectual property, professional identity, and lifelong learning. These can be addressed through targeted updates that extend existing descriptors to encompass AI-related ethical dimensions.

3. *Structural omissions.* The standard lacks the conceptual architecture to address ethical competence as a cross-cutting concern. Ethics appears only in fragmented references to "social responsibility" and "intellectual property" without a coherent framework for ethical reasoning about technology use. EICC provides the missing architecture.

8. Integrative framework

The preceding sections have developed three interconnected contributions: the EICC model with its cross-cutting ethical challenges and reasoning levels (section 4), the TPACK-Ethical and studio pedagogy integration (section 6), and the gap analysis revealing systematic ethical absence in design standards (section 7). This section synthesises these into a cyclical framework for curriculum transformation, guided by constructive alignment [5].

Rather than a static three-pillar model, the integrative framework operates as a cycle (figure 4) with four interconnected phases:

Phase 1: *Ethical awareness.* The EICC model defines what ethical competence encompasses: five cross-cutting challenges manifesting across four professional domains, assessed through three reasoning levels (compliance, deliberative, transformative). This defines the learning outcomes that curriculum design targets.

Phase 2: *Curriculum design.* Learning outcomes from EICC are translated into course structures through TPACK-Ethical: ethical knowledge across all three domains (TK, PK, CK) informs how courses are designed, which tools are selected, and how content is evaluated. Constructive alignment ensures coherence between outcomes, activities, and assessment.

Phase 3: *Studio practice.* The curriculum is enacted through studio pedagogy, where ethical knowledge becomes competence through practice, critique, and iteration. The studio critique becomes a site for ethical deliberation where students evaluate AI-generated outputs for bias, transparency, cultural sensitivity, and environmental responsibility alongside aesthetic quality.

Phase 4: *Assessment and feedback.* Student ethical competence is assessed against EICC criteria and reasoning levels. Assessment results feed back into ethical awareness (Phase 1), revealing where reasoning levels need recalibration, and into curriculum design (Phase 2), identifying where pedagogical approaches need adjustment. The gap analysis (section 7) connects this cycle to standards reform.

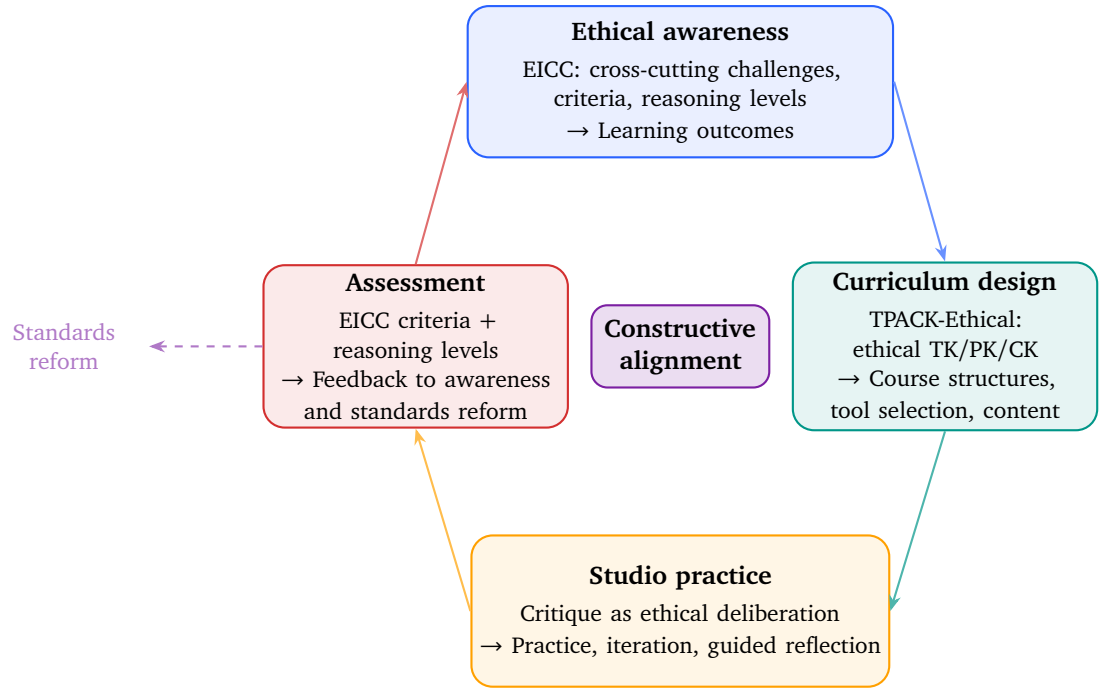

Figure 4: Integrative framework: cyclical model for ethical competence development. Four phases (awareness, design, practice, assessment) form a feedback cycle, with constructive alignment at the centre. The gap analysis connects assessment to standards reform.

For example, the EICC criterion "bias detection" at the deliberative reasoning level specifies that a designer should be able to "apply bias detection tools, articulate the specific type of bias identified, and weigh representational trade-offs". Constructive alignment yields: a learning outcome ("Students will apply bias detection methodologies to evaluate AI-generated imagery for representational harm"), a teaching activity (a studio project in which students use REVISE or equivalent tools to audit AI-generated campaign imagery, followed by peer critique of their findings), and an assessment task (a bias audit report documenting the methodology, findings, and proposed mitigations, evaluated against EICC criteria).

9. Discussion

9.1. Theoretical implications

The theoretical work presented here has three implications for the field of AI ethics in design education.

By positioning ethical competence as a cross-cutting dimension that permeates all professional domains rather than a component that can be isolated in one, EICC implies that curriculum reform cannot be achieved by adding a standalone ethics module. The cross-cutting challenge structure (table 1) shows that the same ethical concern – bias, for instance – manifests across information analysis, communication, technology use, and reflection simultaneously. Embedding ethical learning outcomes in every course that addresses these domains, rather than confining ethics to a single module, is the structural implication of the cross-cutting model.

The TPACK-Ethical adaptation implies that teacher preparation programmes for design educators need restructuring: faculty must develop ethical knowledge across all three TPACK domains, going beyond what current educator training addresses. Ethical considerations cannot be confined to the Content Knowledge domain while Technological and Pedagogical Knowledge remain ethically unmarked.

The gap analysis, revealing a systematic pattern of ethical absence across all cross-cutting chal-

lenges and professional domains, implies that standards reform requires addressing the structural architecture of ethical competence, not merely adding individual competency descriptors. The pattern is not random: ethical challenges are absent across all domains simultaneously, confirming that the omission is architectural rather than incidental.

9.2. Relationship to related frameworks

EICC complements rather than replaces existing approaches. The ICC model for AI-era designers [26] provides a comprehensive four-component architecture for professional competence; however, EICC differs from ICC in a fundamental structural respect. ICC positions ethical competence within the reflective component, whereas EICC argues that ethical challenges – bias, provenance, disclosure, intellectual property, sustainability – are cross-cutting concerns that permeate all professional domains. This is a substantive theoretical disagreement, not merely a terminological one: treating ethics as cross-cutting rather than component-based implies different curriculum designs, different assessment strategies, and different standards reform priorities. The two frameworks address different aspects of the same phenomenon – ICC the full scope of professional competence, EICC the ethical dimension specifically – and can be used complementarily. The "Ethical Touchpoints" framework [14] offers tool-based teaching activities that can be mapped onto EICC criteria as specific pedagogical implementations – for example, Hu and Wang's ethical touchpoint for "data sourcing" maps directly onto EICC's ethical information-analytical criterion of provenance verification. The AI literacy models [9, 10, 18, 27] provide the broader context of AI competence within which ethical competence operates; Knoth et al.'s [18] three-layer matrix (generic, domain-specific, ethical) is architecturally compatible with EICC, which can be understood as populating their "domain-specific ethical" cell for the design profession. The capability-based training approach [8] offers complementary pedagogical strategies for competence development in higher education. Ismail et al.'s [16] conceptual model for generative AI in advertising image creation confirms the need for profession-specific approaches rather than generic AI literacy. EICC distinguishes itself from these adjacent approaches by integrating ethical criteria directly into all four components of professional design activity, with assessable proficiency levels.

9.3. Practical implications

For curriculum designers, EICC provides a structured basis for integrating ethical competence into existing design programs without requiring separate "AI ethics" courses. The ethical reasoning levels (compliance, deliberative, transformative) enable progressive development across multiple courses: foundation courses can target compliance-level competencies, while advanced studios can target deliberative and transformative levels. The criteria and indicators provide assessment rubrics that can be adapted for specific course contexts. The graduated structure aligns with the AI Assessment Scale [28], which similarly advocates progressive integration of AI tools into educational assessment rather than binary permission or prohibition.

For accreditation bodies and standards developers, the gap analysis provides specific recommendations for updating competency standards. The three categories of gaps identified – absent constructs, AI-unaware constructs, and structural omissions – suggest different reform strategies: addition, extension, and restructuring, respectively. The specificity of the EICC criteria makes them directly translatable into competency descriptors for revised standards.

For design educators, TPACK-Ethical provides a pedagogical model that uses the studio critique – a central element of design education – as a site for ethical deliberation. This integration draws on existing pedagogical practice because ethical judgment, like design judgment, develops through practice, critique, and iteration rather than through declarative knowledge alone. Practical implementation might include: ethics review as a standard element of studio critiques, where students address the ethical dimensions of their AI tool use alongside aesthetic and functional evaluation; "ethical audit" assignments in which students apply EICC criteria to analyse published design projects

that used generative AI; and reflective portfolios that document students' ethical reasoning across multiple projects, enabling assessment of ethical development over time.

For the design profession more broadly, EICC provides a common vocabulary for discussing ethical competence that bridges academic and professional contexts. The model's grounding in professional codes [2, 3, 30] ensures that educational outcomes align with the ethical expectations that professional bodies are articulating for practitioners. This alignment is particularly important given that professional codes are evolving rapidly in response to AI – EICC provides the educational infrastructure to prepare graduates for professional ethical expectations that may not yet exist when they begin their studies.

9.4. Limitations

Four limitations should be acknowledged. First, this is a conceptual paper: the EICC model has not been empirically validated. The criteria, indicators, and proficiency levels are theoretically derived; their practical applicability requires testing in actual design education contexts. Second, the gap analysis was conducted against a single national standard (Ukrainian B2 Design). While the pattern of omissions is likely similar across jurisdictions given the global nature of the AI transformation, cross-national comparison would strengthen the findings. Third, the proficiency levels are presented as discrete categories, but ethical competence development is more realistically a continuum. The three-level structure is a pedagogical simplification that serves curriculum design purposes. Fourth, the rapid evolution of generative AI means that the specific tools, capabilities, and ethical challenges discussed will change; the framework's value lies in its structural architecture rather than its specific technological references.

10. Conclusion

This paper addressed the question of how ethical competence should be conceptualised, operationalised, and developed for graphic designers in the generative AI era. The answer – EICC as a cross-cutting dimension that permeates all professional domains – differs from approaches that treat AI ethics as either a standalone module, a secondary aspect of broader competency constructs, or a subcomponent of professional reflection.

The EICC model maps five cross-cutting ethical challenges (bias, provenance, disclosure, intellectual property, sustainability) across four professional domains, providing a criteria matrix that makes visible how each challenge manifests differently depending on the domain. Ethical reasoning levels (compliance, deliberative, transformative) define the progression not as increasing skill but as qualitatively different kinds of moral reasoning – from rule-following through principled judgment to norm-shaping. TPACK-Ethical offers a pedagogical architecture for integrating these criteria into studio-based instruction, and the gap analysis reveals a systematic pattern of ethical absence in the Ukrainian B2 Design standard that is architectural rather than incidental.

The cyclical integrative framework – linking ethical awareness, curriculum design, studio practice, and assessment through constructive alignment – offers a replicable model for professional fields beyond design that face similar AI-driven ethical disruptions. The underlying principle – that ethical competence is not a module to be added but a dimension woven through all professional activity – has implications for any field in which AI is transforming practice while creating ethical obligations that existing approaches fail to address.

Future research should pursue three directions. First, empirical validation of the EICC model through curriculum implementation and assessment in design education programs, examining whether the cross-cutting challenge structure and ethical reasoning levels effectively capture and develop ethical competence in practice. Second, cross-national gap analysis comparing design competency standards across multiple jurisdictions to determine whether the systematic pattern of ethical absence identified in the Ukrainian standard is universal or context-specific. Third, longitudinal

studies tracking ethical reasoning development in students exposed to EICC-aligned curricula, examining how compliance, deliberative, and transformative reasoning levels correspond to observable professional behaviour.

When machines create, the question of responsibility does not disappear – it becomes more urgent, more complex, and more consequential. The EICC framework ensures that designers are prepared to use AI tools with the ethical judgment that professional practice demands. That preparation begins in the curriculum.

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