



Artificial Intelligence
for a New Design Education
Approach

DELIVERABLE D.2.1

Desk research & State of the art report

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1. Executive Summary

This desk research and state of the art report (Deliverable D.2.1) synthesise findings from more than 70 scientific publications, industry analyses and EU policy documents mainly published between 2022 and 2026. It constitutes the evidential foundation for all subsequent AIDEA deliverables, including the Manifesto for Collective AI Design (D.3.1.) and the Handbook of Teaching Tools (D.3.2.).

The creative and design industries are currently undergoing a structural transformation driven by Generative AI, Large Language Models (LLMs) and multi-agent AI systems. This transformation is simultaneously an opportunity and a risk. On one hand, AI accelerates ideation, automates repetitive workflows and enables data-driven sustainable design. On the other hand, it introduces systematic algorithmic biases, disrupts intellectual property frameworks, threatens the intrinsic value of human craftsmanship and risks producing a homogenised, culturally reductive aesthetic landscape.

Across all research domains, a consistent three-part tension emerges, precisely mirroring AIDEA's conceptual framework of the three intelligences: Technological acceleration (Artificial Intelligence) must be constantly balanced against ethical responsibility (Social Intelligence) and the irreplaceable value of embodied, material creativity (Intelligence of the Hand).

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Key Findings at a Glance

- **Profession:** The designer's role is evolving from manual executor to strategic curator and AI orchestrator with a new "Hybrid Artisan" model achieving 30-70% design time reductions while maintaining up to 95% cultural authenticity scored (McKinsey, 2024; Jiang et al., 2026; Pop-Cohut, 2026).
- **Sustainability:** AI is a demonstrably powerful analytical tool for circular economy applications, material optimisation and lifecycle extension, effectively reducing furniture waste by up to 30% (Ghaith, 2025) and cutting jewellery carbon footprints from 3.1kg to 0.8 kg CO₂ through AI-driven material selection (Jiang et al., 2025).
- **Regulatory Compliance:** Design students must be prepared for two distinct EU legal frameworks: the AI Act (2024) governing algorithmic transparency and the Eco-design for Sustainable Products Regulation (ESPR) mandating durability, repairability and modularity in physical products (Chaloff, 2024)
- **Ethics & Bias:** Generative AI tools encode systematic biases relating to gender, race, body type and occupation. These are structural features, not bugs and require deliberate designer intervention (Ferrara, 2023; Zhou et al., 2024; Vargas-Veleda et al., 2025; Yang, 2025).

- **Legal Landscape:** Copyright ownership of AI-generated work is legally fragmented internationally, creating urgent unmet needs for regulatory clarity (Furfaro, 2025; Lucchi, 2025; EU AI Act, 2024).
- **Pedagogy:** Effective AI integration in design education requires scaffolded learning progressions, Prompt Literacy as a foundational skill, and explicit management of emotional and cognitive impacts on students (Rodriguez-Ferradas et al., 2025; Hwang & Lee, 2025; Li et al., 2025).
- **Craft Preservation:** Physical, tactile prototyping cannot be replaced by digital generation. Material Intelligence must be preserved as a co-equal component alongside AI capabilities (Almrott et al., 2024; Vandi et al., 2024).

AIDEA Alignment Note

All findings in this report directly inform AIDEA's three core pillars. Where literature highlights risks such as “mental laziness” (Rodriguez-Ferradas et al., 2025), worker alienation (Riso et al., 2022) or cultural decontextualization (Zhang et al., 2023), the AIDEA pedagogical response is embedded in the corresponding sections of this report.

2. How AI Will Influence Industry Professions

Generative AI and LLMs have transitioned from experimental tools to core drivers of productivity across industrial design, product design, applied arts, fashion, architecture and communication design. The transformation is not uniform, it manifests across three interconnected dimensions: (i) the redefinition of the designer’s creative role, (ii) the emergence of agentic multi-AI workflows (iii) and the structural disruption of intellectual property and labour markets.

2.1. The Shift in the Designer’s Role: From Creator to Curator

The most consistently documented finding across the literature is the professional pivot from manual execution to strategic oversight and curation.

Industry reports from McKinsey (2024), Autodesk (2025) and Deloitte (2024) converge on a single conclusion: AI’s primary industrial value lies in automating repetitive tasks, accelerating iteration cycles and enabling rapid prototyping. Concretely, Daarenyi et al. (2025) demonstrate that LLMs can automatically generate Computer-Aided Design (CAD) models directly from natural language prompts, bypassing hours of manual drafting work that previously defined entry-level design roles.

Lei and Wang (2026), studying AI-empowered ceramic design, articulate the emerging paradigm most clearly: the designer is no longer primarily a “creator” in the traditional sense but a “curator”, i.e., someone who relies on high aesthetic literacy, cultural awareness and the critical capacity to evaluate and refine algorithmic outputs. McKinsey (2024) corroborates this at scale, noting that as AI absorbs repetitive tasks, the professional role of the human designer shifts toward “oversight and creative decision-making”. Jiang et al. (2025) formalise this into a Human-GenAI Co-Creation framework that structures ideation and 3D modelling while maintaining strict human traceability and accountability.

AIDEA Relevance – Intelligence of the Hand

The Curator paradigm does not diminish craft, it elevates it. Students must develop robust aesthetic and cultural literacy to supervise AI outputs critically. The AIDEA curriculum must therefore maintain physical, tactile prototyping exercises alongside AI-mediated generation, not as tradition for its own sake, but as the very competency base from which curatorial judgment grows.

The most concrete and quantified articulation of this new professional identity comes from Pop-Cohut (2026), who identifies the emergence of the “Hybrid Artisan”, i.e., a practitioner who strategically integrates AI tools such as fine-tuned Diffusion models and GANs to reduce design time by 30–70% while maintaining cultural authenticity scores of up to 95%. Critically, Pop-Cohut establishes that successful integration depends on three non-negotiable conditions: (i) positioning AI as collaborative rather than autonomous, (ii) implementing explicit cultural safeguards in the design and prompting process and (iii) maintaining transparent communication with consumers about the role AI played in the work. These conditions map precisely onto AIDEA’s three pillars: the Intelligence of the Hand (craft safeguards), Social Intelligence (consumer transparency) and AI (collaborative deployment).

This quantified model is significant because it resolves the false binary that often dominates AI-in-craft discourse that efficiency and authenticity are mutually exclusive. The evidence shows they are not, provided the designer retains curatorial authority and cultural knowledge. This makes the Hybrid Artisan model the most teachable and industry-validated professional paradigm currently available to AIDEA educators.

2.2. The Adaption Challenge: Craftsman Psychology and Trust

While the Hybrid Artisan model demonstrates that AI and craft can coexist productively, the adoption pathway is not automatic. Tian et al. (2025) deployed a hybrid SEM-ANN (Structural Equation Modelling — Artificial Neural Network) approach to study AI adoption behaviour among Thai traditional craftsmen, one of the few empirical studies examining this specific professional population. Their findings are both sobering and actionable: while performance expectancy (perceived usefulness) and social influence (peer adoption) drive uptake, perceived risk is the dominant negative barrier and trust is the single most important factor determining whether a craftsperson will engage with AI tools at all.

This has direct implications for AIDEA’s industry engagement strategy. When working with artisan partners during the innovation camp and pre-incubation programme, AIDEA facilitators cannot assume a neutral or receptive stance. They must actively build trust through demonstrated cultural safeguards, transparent workflows, and evidence that AI adoption does not require surrendering professional identity or craft authority.

2.3. Agentic AI and the New Design Workflow

The most significant near-term industrial shift is from single-model AI tools to multi-agent agentic systems. Jiang et al. (2026) introduce “Intelligent Design 4.0”, where specialised AI agents, e.g., requirements analysis agent, concept generation agent and detailed modelling agent, autonomously orchestrate entire design workflows. The designer’s role becomes that of a strategic initiator and evaluator rather than a hands-on producer.

Maldonado-Romero et al. (2026) propose a 5S agentic framework (Sensing, Smart, Sustainability, Social, Safe) where AI acts as a translator between high-level human intent, such as a preference for recycled materials and strict quantitative engineering constraints. Chen et al. (2026) further define the division of labour in a 4-stage co-creation process: (i) AI provides fast synthesis and scalable generation, while humans supply (ii) contextual understanding, (iii) ethical judgment and (iv) data quality control.

Choudhury et al. (2025) and Han et al. (2025) document that AI is now applied across the entire product lifecycle, from early textual brainstorming through to digital twin performance analysis, with the most effective industrial integrations relying on hybrid workflows bridging text-based and visual AI tools.

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2.4. Intellectual Property, Labor and Workplace Dynamics

The integration of generative AI into professional design workflows creates an immediate and unresolved legal crisis. Furfaro (2025) documents the extreme international fragmentation: the United States strictly denies copyright for AI-generated works created without human input; Chinese courts may grant protection where human intellectual involvement and originality are demonstrable; the UK adopts a flexible approach favouring the individual who made the necessary arrangements. Within the EU, Lucchi (2025) warns that the existing text-and-data mining (TDM) exception was not designed for the synthetic nature of generative AI, risking market concentration and cultural homogenisation without urgent regulatory reform. Olubiyi et al. (2024) argue that formal regulation must now balance IP, labour law and fundamental human rights simultaneously. While AI boosts productivity, Riso et al. (2022) identify a profound risk: if designers are relegated to supervisory tasks or exception handling, they may experience deep alienation and a loss of creative agency. The ETUC (2025) report strongly argues that AI's impact depends entirely on who controls it and that without worker-centred governance, AI actively threatens the intrinsic value of human labour and widens socioeconomic inequalities. Drezgic et al. (2025) reinforce this, pointing to imminent systemic challenges including job displacement.

3. Up-to-Date Applications of AI in Sustainable Design Processes

Beyond its well-publicised role in generative ideation, AI is proving to be an equally powerful analytical and optimisation engine for ecological design. The literature across applied arts, technology and visual arts identifies four distinct domains of application: (i) industrial eco-innovation, (ii) sustainability workflows, (iii) circular economy in textiles and (iv) the revitalisation of cultural heritage crafts.

3.1. AI as an ECO-Innovation Engine and Regulatory Compliance Tool

Multiple sources confirm AI's capacity to drive significant gains in environmental performance across manufacturing and product design. Ashkbous et al. (2026) and McKinsey (2023) document AI's role in supporting circular design strategies, minimising energy consumption and substantially reducing industrial waste. Afifi et al. (2025) and Autodesk (2025) demonstrate that by optimising manufacturing processes and assisting in the selection of sustainable materials, AI can measurably reduce the environmental footprint of industrial design. The most quantified evidence comes from furniture design. Ghaith (2025) demonstrates that AI lifecycle management systems, predictive analytics and adaptive design paradigms can reduce waste materials by up to 30% and extend product lifecycles by 25% - concrete metrics that translate directly into teachable design outcomes for AIDEA students.

A critical and previously under addressed dimension of sustainable design is regulatory compliance. Chaloff (2024) examines the EU's Eco-design for Sustainable Products Regulation (ESPR), a binding legal framework that directly affects physical product design in sectors including furniture, fashion and consumer goods. The ESPR mandates strict eco-design requirements covering product durability, repairability, availability of spare parts and material circularity. Crucially, Chaloff identifies that poor material choices and mixed/cheap material compositions are currently the primary structural barriers to a circular furniture industry, precisely the decisions that AI-assisted material selection tools can address.

For AIDEA, the ESPR is not a peripheral legal detail, it defines the professional operating environment that students will enter. Teaching students to integrate ESPR compliance criteria into their AI prompting and ideation phases from the outset transforms regulatory literacy into a practical design skill. Students should be taught to prompt AI tools to generate designs that specifically optimise for repairability, modularity and material transparency, building compliance into the creative process rather than retrofitting it at the end.

One of the most compelling sustainability applications in the applied arts domain comes from jewellery design. Jiang et al. (2025) demonstrate how AI can predict the environmental impact of jewellery designs based on material properties before any physical production takes place. Their findings are striking in their specificity: simple designs using renewable biomaterials generate just 0.8 kg of CO₂ equivalent, compared to 3.1 kg for intricate designs using precious metals, i.e., a fourfold difference determined entirely at the design decision stage. Water usage shows similarly dramatic variation. This means that a student equipped with AI-based environmental modelling tools can, at the ideation stage, make data-driven material choices that fundamentally determine the ecological footprint of the final product.

3.2. Upcycling, Waste Repurposing and Extended Reality

Yuan and Fang (2024) present a cross-disciplinary sustainability workflow that combines machine learning, computer vision and VR/AR technologies to repurpose waste denim into aesthetic patchwork art. The workflow addresses a specific and quantifiable environmental challenge in the textile industry (e.g., denim waste) by using digital visualisation to enable creative reuse decisions that would be impractical without computational assistance. Fabric condition, colour variation and texture are analysed via computer vision, AR overlays allow designers to visualise potential patchwork compositions before cutting and the resulting designs bridge industrial waste reduction with applied arts practice. This workflow is directly translatable to AIDEA's applied arts curriculum as a studio module integrating computational sustainability with hands-on material work.

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3.3. Circularity in Textiles and Applied Arts

The textile and apparel sectors present some of the most documented cases of AI-enabled circular economy transition. Nisa et al. (2025) systematically review AI applications in the circular economy, finding that AI is highly effective in automating clothing quality assessment, evaluating garment condition for resale suitability and streamlining textile sorting for recycling, functions that were previously entirely manual and thus prohibitively labour-intensive at scale. At the strategic level, Raman et al. (2025) deploy AI-based topic modelling to build a scalability roadmap for the Circular Economy in fashion and apparel. Their ADO (Antecedents-Decisions-Outcomes) framework demonstrates that AI can function as a strategic analytical tool to overcome systemic barriers such as supply chain fragmentation, i.e., barriers that have historically prevented sustainability initiatives from reaching viable scale.

3.4. AI for Cultural Heritage and Craft Revitalization

A particularly rich application domain lies at the intersection of AI and traditional craftsmanship. Vandi et al. (2024) explore how Human-Computer Interaction (HCI) and additive manufacturing (3D printing) can revitalise fashion heritage artefacts, underscoring that tactile, material, and oral knowledge exchanges are irreplaceable for understanding fashion heritage and preventing the decline of true craftsmanship.

Ma et al. (2025) apply a three-phase human-AI collaborative workflow to environmental art design, demonstrating that AI helps students reinterpret traditional cultural heritage into contemporary designs. This yielded a 26.7% improvement in pattern recognition accuracy and high enterprise adoption rates.

Lei and Wang (2026) similarly demonstrate in ceramic design how an AI-empowered framework can reconcile efficiency with personalisation in traditional crafts, though they explicitly flag the risk of cultural decontextualization when AI is deployed without deep multidisciplinary oversight.

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AIDEA Curriculum Note

The AIDEA curriculum should expand its definition of “AI in Design” far beyond image generation (Midjourney, DALL-E). Teaching modules should explicitly cover sustainability analytics using AI for material efficiency, waste reduction and lifecycle extension as practical and commercially relevant design competencies.

Key Metrics

AI lifecycle management in furniture design: waste -30%, lifecycle +25% (Ghaith, 2025). ANN-driven material selection in jewellery: carbon footprint 0.8 kg vs 3.1 kg CO₂ depending on material and complexity choices (Jiang et al., 2025). These figures give AIDEA educators concrete, discipline-specific targets for eco-design teaching modules.

4. Benefits, Critical Risks and Open Issues of AI in Design

A balanced assessment of AI in design requires rigorous acknowledgement of both its demonstrated benefits and its systemic risks. The following analysis draws on evidence across the entire desk research to provide the most comprehensive picture currently available in the literature.

4.1. Key Benefits

Benefit	Evidence	Design Domain
Workflow acceleration & rapid prototyping	McKinsey, 2024; Autodesk, 2025; Deloitte, 2024	All design disciplines
Automated CAD generation from text prompts	Daarenyi et al., 2025	Industrial / Product Design
Structured human-AI co-creation frameworks	Jiang et al., 2025; Chen et al., 2026	Industrial / 3D Modelling
30-70% design time reduction with 95% cultural authenticity	Pop-Cohut, 2026	Applied Arts / Heritage Craft
Waste reduction up to 30%, lifecycle +25%	Ghaith, 2025	Furniture / Industrial
CO ₂ footprint: 0.8 vs 3.1 kg via material selection	Jiang et al., 2025	Jewellery / Applied Arts
Denim waste repurposing via ML + VR/AR	Yuan & Fang, 2024	Fashion / Circular Economy
Textile sorting & quality assessment	Nisa et al., 2025	Fashion / Circular Economy
Pattern recognition in heritage craft (+26.7%)	Ma et al., 2025	Environmental / Applied Arts
Eco-design and material selection optimisation	Afifi et al., 2025; Ashkbous et al., 2026	All design disciplines
Overcoming “blank page” and ideation blocks	Rodriguez-Ferradas et al., 2025	Design Education
Objective, scalable assessment of creative work	Fan & Li, 2023; Zheng, 2025; Zhang, 2023	Design Education
Enhanced creative performance via AIGC tools	Wang et al., 2025 (EEG study)	Design Education

Table 1. Key documented benefits of AI integration in design workflows and education

4.2. Critical Risks and Open Issues

The evidence for systematic bias in generative AI visual tools is overwhelming and consistent across multiple independent studies. Ferrara (2023) provides the foundational taxonomy, categorising bias into data bias (non-representative training datasets), algorithmic bias (design choices baked into model architectures) and user/human bias (how humans label data or set goals). All three require interventions at pre-processing, in-processing and post-processing stages – none of which are currently standard in professional design tools.

Empirically, Vargas-Veleda et al. (2025) analysed 1455 images generated by DALL-E and Flux 1, revealing systematic patterns of hegemonic beauty standards: men depicted as muscular, women as slender and frequently sexualised with documented fatphobia. Zhou et al. (2024) found severe representation and portrayal biases across occupations, women and Black individuals vastly underrepresented and when depicted, women shown as younger and smiling while men appear older and serious, reinforcing stereotypes about authority and competence. Yang (2025), studying the Chinese app Meitu, found that AI image-to-image generation disproportionately affects Black women and East Asian men, defaulting to rendering people of colour as White – a phenomenon the author terms “white normativity”. Sun et al. (2024) extended these findings to a systematic audit of DALL-E 2 across 153 occupations, confirming persistent gender bias across the board.

Sufyan et al. (2024) conducted a striking comparison of the social intelligence scores of LLMs (GPT-4, Bing, Bard) against human psychology students. GPT-4 outperformed all human participants on standardised social intelligence scales. However, the authors argue compellingly that this represents an illusion of competence: rapid model updates produce inconsistency and passing a test does not equate to safe, ethical empathy in real-world human-centred contexts. Mathur et al. (2024) identify the technical root causes: current AI struggles with the ambiguity of social constructs, the interpretation of nuanced multimodal signals and the need to adapt to multiple shifting human perspectives.

Brachtendorf (2025) warns that multimodal AI in fashion is inherently reductionist: because AI models are built on indexed past data, their outputs are stylistically normative, generating “statistical possibilities” that lack grounding in reality and leave little room for ideas falling outside established conventions. Choudhury et al. (2025) and Rodriguez-Ferradas et al. (2025) identify the parallel educational risk of “design fixation”, where relying on AI-generated examples too early limits divergent thinking, ultimately leading to the commodification of the creative process.

Li et al. (2025) investigated the emotional experiences of visual communication students using customised Generative AI. While AI initially stimulated positive emotions and a sense of learning control, it simultaneously triggered severe negative emotions: anxiety, frustration and self-doubt driven by technological dependency and learning pressure. These psychological effects ultimately inhibited student performance. Nasir et al. (2025) add a systemic equity concern: current AI graphic design education lacks global representation, risking the imposition of a homogenised Western aesthetic on design curricula across the Global South.

A dimension of risk specific to the applied arts and heritage craft sectors, and largely absent from the broader AI-in-design literature, is the psychological resistance of professional craftspeople to AI adoption. Tian et al. (2025) demonstrate that the perceived risk of using AI is the dominant barrier among traditional artisans, overriding the pull of performance expectancy. This risk perception encompasses fears of cultural dilution, loss of professional identity and commodification of skills developed over years. Without deliberate trust-building strategies and demonstrable cultural safeguards, this resistance is rational and evidence-based, not merely technophobic. The implication for AIDEA is that the project must address not just student attitudes toward AI but the attitudes of the professional craftspeople and industry mentors with whom students will collaborate.

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Chaloff (2024) identifies a structural misalignment between current design education and the EU's ESPR requirements. Students are not being trained to design within the legal constraints that will govern their professional work. In furniture, fashion and applied arts, the ESPR's mandates on durability, repairability and material transparency are not yet integrated into standard design curricula, creating graduates who are technically skilled but legally underprepared. As AI tools increasingly assist with material selection and design generation, embedding ESPR literacy into the AI-prompting process becomes both urgent and feasible.

Domain	Unmet Need	Evidence
Legal	Absence of international consensus on AI copyright and authorship. The EU AI Act provides a regulatory foundation but does not resolve all IP ambiguities.	Furfaro, 2025; Lucchi, 2025; The EU AI Act;
Regulatory	Design education has not yet integrated the EU ESPR's requirements on product durability, repairability and material transparency – creating a gap between graduate competencies and the legal constraints of professional practice.	Chaloff, 2024;
Ethical	No inherent neutrality or transparency in generative AI tools. Statistical probability prioritised over ethical representation.	Ferrara, 2023; Bertaina et al., 2025
Professional	Risk of worker alienation and devaluation of human creative labour as designers are relegated to supervisory roles.	Riso et al., 2022; ETUC, 2025;
Craft-Specific	Psychological resistance among traditional craftspeople driven by perceived risk and lack of trust. AI adoption in the heritage craft sector requires explicit trust-building strategies and cultural safeguard frameworks.	Tian et al., 2025;
Cultural	Algorithmic homogenisation threatens aesthetic diversity, cultural authenticity, and non-Western design traditions.	Brachtendorf, 2025; Zhang et al., 2023; Nasir et al., 2025;
Technical	AI's social and contextual reasoning remains elusive; current models cannot reliably navigate ambiguous social constructs or multimodal signals.	Mathur et al., 2024; Sufyan et al., 2024;
Pedagogical	Absence of scaffolded, discipline-specific AI literacy curricula. A 'one-size-fits-all' approach to AI education is demonstrably insufficient.	Choudhury et al., 2025; Rodriguez-Ferradas et al., 2025;

Table 2. Synthesis of unmet needs (overview table)

5. Best Practices for Integrating AI into Design Education

The literature converges on a set of evidence-based pedagogical principles for safely and effectively integrating AI into design education. These principles are directly actionable for AIDEA's Handbook of Teaching Tools (D.3.1), Train-the-Trainers (TTT) programme and Piloting activities (WP4).

5.1. Foundational Pedagogical Frameworks

Rodriguez-Ferradas et al. (2025) provide the most empirically grounded pedagogical warning in the literature: the risk of mental laziness and overreliance is real and measurable in design students using AI tools. Their recommended counterstrategy is a scaffolded approach. It starts with structured, precisely constrained prompt exercises and gradually progressing toward student autonomy and independent AI orchestration. This scaffolding logic is planned to be architecturally embedded in the AIDEA Handbook module sequence.

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Almrott et al. (2024) extend this principle to physical craft, proposing a 4-P pedagogical framework (Principles, Process, Practice, Perfect) that treats AI as a complementary tool and explicitly ensures that digital rendering does not replace physical prototyping and modelling, preserving Material Intelligence (Intelligence of the Hand) throughout.

Kim (2025) introduces a concrete 5-stage SAL framework successfully deployed in a functional clothing and materials course: (1) Instructor-led conceptual lectures (2) Problem identification (3) AI-assisted research using scheduled tools (ChatGPT, Claude, Gamma) in distinct weeks (4) Collaborative solution development and (5) Final presentations with reflective critique. Students demonstrated improved creative thinking and industry readiness within a highly structured environment. This framework provides a deployable template for AIDEA's curriculum module design.

Wang et al. (2025) demonstrate that full curriculum restructuring is not always necessary or desirable. By embedding targeted, modular AI tools into a core architectural design studio, they enabled students to acquire AI technical skills while maintaining the integrity of iterative design and peer critique. Zheng (2025) develops this into an "AI-Empowered Framework for University Aesthetic Education Curriculum Design", providing institutional guidance on faculty training and platform development. Alenezi (2023) adds that digital transformation requires administrative and sociological institutional support to succeed.

Chan (2023) proposes a framework for institutional AI integration across three dimensions: Pedagogical (learning outcomes and student-centred design), Governance (privacy, security, accountability) and Operational (platform selection, staff training). This framework is directly applicable to AIDEA partner institutions' planning for WP4 piloting activities.

5.2. Prompt Literacy as a Core Design Skill

One of the most robust findings across the pedagogical literature is that the ability to formulate, refine, and critically evaluate AI prompts, i.e., prompt literacy, is not merely a useful technical skill but a foundational design competency analogous to sketching or drafting.

Hwang and Lee (2025) provide direct empirical evidence: students trained in Prompt Literacy showed significantly enhanced creative problem-solving and intellectual curiosity compared to those using only traditional digital tools. Rana et al. (2025) demonstrate that scaffolded prompt literacy instruction evolves students from passive tool users into critical evaluators capable of detecting algorithmic bias. Choudhury et al. (2025) argue that AI literacy must shift from basic tool operation to advanced prompt engineering and the critical filtering of AI-generated noise and that this must be taught in a discipline-specific manner, since AI's role varies drastically across UX/UI, physical product design and applied arts.

Skilton and Cardinal (2024) offer the most actionable methodology in the entire literature corpus: Inclusive Prompt Engineering. Recognising that AI-generated images increasingly populate marketing and media, the authors developed a methodology that teaches designers how to strategically use generative AI to produce results that actively subvert stereotypical images, particularly regarding BIPOC communities and older individuals. This framework transforms ethics from a theoretical concept into a hard, employable design skill and should constitute a dedicated module in the AIDEA Handbook.

5.3. Ethical and Social Intelligence in the Classroom

Ferrara's (2023) three-stage bias mitigation taxonomy (pre-processing, in-processing, post-processing) and Bertaina et al.'s (2025) Fundamental Rights Impact Assessment (FRIA) methodology, utilising a structured questionnaire, are the two most operationally concrete tools available for embedding bias awareness into design critiques. AIDEA's evaluation rubrics should incorporate both as mandatory components of student design submissions.

Zhang et al. (2023) serve as a cautionary case study: AI applied to costume design without deep multidisciplinary and cultural contextualisation produces superficial, decontextualised innovations. Lei and Wang (2026) propose that every AI-assisted design output in applied arts should be evaluated against cultural appropriateness, material feasibility and freedom from reductive normativity. AIDEA's cross-disciplinary critique sessions should formalise this multi-axis evaluation.

Naik et al. (2025) document that design students actively struggle with assessing the reliability, trustworthiness and fairness of AI-generated outputs, highlighting the need to explicitly teach students how to distribute agency between themselves and the machine. The European Commission (2022) provides practical frameworks emphasising privacy, transparency and student-centred learning. Lucchi (2025) underscores that students must understand that generating an image via AI does not automatically grant ownership, and they must be equipped to navigate IP uncertainties in commercial project delivery.

Regulatory literacy must now extend beyond the EU AI Act to include the ESPR. Chaloff (2024) makes clear that design decisions made at the ideation stage, i.e., material selection, product architecture, component modularity, directly determine ESPR compliance downstream. AIDEA educators should introduce ESPR constraints as creative prompting parameters: students learn to frame AI queries not merely around aesthetics or function, but around reparability scores, recyclable material ratios, and disassembly sequences, integrating legal compliance into the earliest creative decisions rather than treating it as a post-design audit.

Pop-Cohut's (2026) "task-level cooperation" and "system-level co-creation" models offer a concrete instructional scaffold for blending AI generation with manual, physical finishing in heritage craft contexts. At the task level, AI handles discrete, time-intensive subtasks (e.g., generating form variations, exploring surface treatments, producing colourway permutations), while the artisan retains full decision authority at each selection gate. At the system level, AI and the designer co-create the workflow architecture itself, defining which stages benefit from algorithmic acceleration and which demand irreplaceable human judgment and material knowledge. Teaching students to make these architectural decisions, not just to use AI tools, is the pedagogical breakthrough the Hybrid Artisan model offers.

Wang et al. (2025) demonstrate through EEG assessment that AIGC tools fundamentally alter cognitive dynamics: ideation shifts from relaxation-linked states to concentration-intensive states, accelerating feedback cycles and optimising cognitive resource allocation, but also increasing cognitive load. Li et al. (2025) identify the psychological downstream effects: technological dependency and learning pressure drive anxiety, frustration and self-doubt. AIDEA educators must be trained to recognise these patterns and incorporate explicit mental well-being and confidence-building strategies into their teaching practice.

5.4. Assessment and Feedback Methodologies

Fan and Li (2023), Zheng (2025) and Zhang (2023) all highlight AI's emerging role as an evaluation tool in creative disciplines, monitoring student engagement, analysing learning behaviours and providing objective, scalable, personalised feedback in areas that are traditionally subjective and inconsistently assessed. Chen et al. (2026) propose a six-dimensional evaluation criteria system (Design, Technology, Society, Economy, Environment, Ethics) that can serve as the basis for AIDEA's assessment rubrics across all studio modules. The principle that 'generation does not equal validity' must be architecturally embedded in every assessment instrument.

Core Pedagogical Principle for AIDEA

Technical AI literacy cannot be taught in a vacuum. As Wang et al. (2025) and Zhang (2023) emphasise, every teaching methodology must explicitly pair technical AI execution with deep ethical reflection and “profound professionalism”. AI platforms elevate student engagement, but only when the curriculum requires human judgment, interpretation and accountability at every stage (Liao & Cao, 2025).

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6. Recommendations and Implications for AIDEA

This report has synthesised evidence from more than 70 references spanning peer-reviewed research, industry analysis and EU policy documentation. The findings are unequivocal: AI is not a future consideration for design education, it is an active, structural force reshaping professions, sustainability practices, intellectual property frameworks and creative cognition right now. AIDEA's pedagogical response must be commensurate with this urgency.

Manifesto for Collective AI Design (D.3.1)

- Define the “Agentic Era” of design, establishing human decision authority as non-negotiable within multi-agent AI workflows (Jiang et al., 2026).
- Address the relational shift: teach students to treat AI as a co-creative conversational partner, not a generation vending machine (Creely & Carabott, 2025; Lim et al., 2023).
- Embed the principle “generation does not equal validity” as a founding tenet (Chen et al., 2026).
- Ground the Manifesto in the EU AI Act (2024) and address copyright fragmentation explicitly (Furfaro, 2025; Lucchi, 2025).
- Address copyright fragmentation explicitly and prepare students for the absence of settled international law on AI authorship (Furfaro, 2025; Lucchi, 2025)
- Affirm the psychological impact of AI on emerging designers and commit to well-being-aware pedagogy (Li et al., 2025).
- Adopt the concept of “response-able agency” (Hultin & Mahring, 2025): frame AI not merely as an optimisation engine but as a co-actor that supports imagination, ecological care and ethical interdependence – positioning AIDEA's approach within a sustainability framework that considers environmental, social and technological impacts beyond a purely human-centered perspective.

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Handbook of Teaching Tools (D.3.2)

- Adopt a scaffolded module sequence: structured prompt exercises first, autonomous orchestration later (Rodriguez-Ferradas et al., 2025).
- Treat Prompt Literacy as a foundational design skill, not optional enrichment (Hwang & Lee, 2025; Rana et al., 2025).
- Include Inclusive Prompt Engineering as a dedicated, employable module (Skilton & Cardinal, 2024).
- Incorporate Ferrara's (2023) bias taxonomy and Bertaina et al.'s (2025) FRIA methodology into all design critique rubrics.

- Integrate ESPR compliance criteria as creative prompting parameters across design modules (Chaloff, 2024).
- Integrate the ADO Framework (Raman et al., 2025) into sustainability design modules.
- Include AI-based environmental impact simulation as a practical eco-design exercise, using the 0.8 vs 3.1 kg CO₂ jewellery case as an entry-level dataset (Jiang et al., 2025).
- Teach the Hybrid Artisan methodology using Pop-Cohut's (2026) task-level cooperation and system-level co-creation models, including trust-building protocols for industry craft partners (Tian et al., 2025).
- Categorise tools and exercises by design discipline — avoid a one-size-fits-all approach (Choudhury et al., 2025).
- Maintain physical, material prototyping exercises alongside digital generation throughout (Almrott et al., 2024; Vandi et al., 2024).
- Apply the SAL 5-stage framework as a structural template for curriculum module design (Kim, 2025).

Train-the-Trainers Programme (WP3)

- Train educators to transition from knowledge-holders to facilitators of human-AI relational dynamics (Creely & Carabott, 2025).
- Equip educators to recognise AI-induced technological dependency, anxiety, and self-doubt and to respond with confidence-building strategies (Li et al., 2025).
- Prepare educators to engage with traditional craftspeople and industry artisan partners, using Tian et al.'s (2025) trust-building and perceived-risk mitigation frameworks.
- Train educators to use AI as an assessment and feedback tool, not merely a student creation tool (Fan & Li, 2023; Zheng, 2025).
- Adopt Chan's (2023) three-dimensional governance framework for institutional AI policy at partner universities.
- Include a change management element to help educators handle institutional resistance to AI adoption (Li et al., 2025; Tian et al., 2025; Creely & Carabott, 2025).

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Piloting and Innovation Camp (WP4)

- Use the workflow case studies from Section 3 as a living case library for student teams.
- Require all student prototypes to be evaluated against Chen et al.'s (2026) six-dimensional criteria.
- Engage industry partners in co-creating the “human oversight checkpoints” within student AI workflows (Han et al., 2025).
- Document student workflow modifications systematically to build the AIDEA-originated workflow repository for dissemination.



7. Conclusion

Every recommendation in this report maps back to AIDEA's three intelligences framework. The intelligence of the hand (craft, material knowledge, embodied creativity) must be preserved and elevated, not replaced. Artificial Intelligence (generative tools, LLMs and agentic systems) must be used to amplify, not to automate away, human creativity. Social intelligence (ethical awareness, legal literacy, cultural responsibility, psychological well-being) must be woven through every module, every critique and every assessment, not treated as a standalone ethics addendum. This triangulation is AIDEA's unique and irreplaceable contribution to European design education.

8. References

The insights and claims made throughout this report are supported by the following consolidated reference list. It contains over 70 sources collected during the desk research, with a deliberate focus on the most recent literature (2022–2026) to accurately reflect the latest developments in the post-generative AI landscape.

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