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Beyond the Boundary: A Mixed-Methods Investigation of Generative AI and Emerging Competencies in Applied Arts Education in Italy

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Abstract

This study investigates the relationship between artificial intelligence, artistic education, and the production chains of Made in Italy, with particular reference to the AFAM system (Higher Education in Art, Music, and Dance). Adopting a mixed-methods design, the research integrates three phases: a systematic review of the literature, a questionnaire administered to students and teachers within AFAM institutions, and a Delphi inquiry involving experts from artistic education, creative professions, cultural industries, and digital technologies. The findings show that AI is perceived both as a driver of innovation and as a source of significant tension. On the one hand, it expands creative possibilities, supports experimentation, and encourages the emergence of hybrid professional profiles combining creative, technological, and critical competences. On the other hand, it raises concerns related to standardization, the weakening of experiential learning, the redefinition of authorship, and the possible loss of cultural specificity in the Made in Italy production chains. The results also highlight a gap between the growing relevance attributed to AI-related competences and the limited availability of structured educational pathways and institutional policies for their integration. Overall, the study suggests that the impact of AI on artistic education and creative industries cannot be understood in deterministic terms, but must be interpreted as part of an open and multilayered process shaped by pedagogical, institutional, and cultural choices. In this perspective, the AFAM system emerges as a strategic space for mediating between technological innovation, educational quality, and the preservation of the cultural and design values that characterize Made in Italy.

Keywords: artificial intelligence; AFAM; artistic education; Made in Italy; mixed methods

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1. Introduction

In recent years, artificial intelligence has assumed an increasingly central role in the transformation of education, reshaping tools, teaching practices, and modes of access to knowledge. In particular, the rapid spread of generative artificial intelligence systems has introduced new forms of interaction between students, teachers, and content, making available tools capable of producing texts, images, summaries, feedback, and design support in

extremely short timeframes. The development of platforms such as ChatGPT, Bing Chat, Bard, and Ernie mark a significant step in the evolution of digital education, since these tools do not merely provide content, but directly affect learning processes, the personalization of responses, and the mediation between knowledge demands and textual production [1]. In this perspective, AI should not be understood only as a technical infrastructure, but as an agent capable of redefining the relationship between knowledge, cognitive processing, and competence construction. More specifically, conversational systems such as chatbots and large language models represent one of the most visible expressions of this transformation, as they simulate interaction, support information retrieval, and increasingly participate in educational exchanges [2–6].

Recent literature also highlights how the use of artificial intelligence in education is closely linked to the possibility of developing more adaptive, interactive, and personalized learning environments. In particular, intelligent tutoring systems can provide targeted support, immediate feedback, and differentiated learning pathways based on students' needs, showing how AI can strengthen the effectiveness of the educational experience when it is consciously integrated into instructional design [6,7]. Similarly, adaptive feedback systems can improve the regulation of learning and the optimization of educational pathways, reinforcing the idea that AI acts not only as an operational support tool but also as a device capable of influencing the very structure of educational action [7,8].

These dynamics are particularly significant in Higher Education in Art, Music, and Dance (AFAM), where learning has traditionally been grounded in a strong integration of theoretical knowledge, studio-based practice, individual experimentation, and close interaction with teachers. In these contexts, education does not concern only the acquisition of technical skills, but also the progressive construction of an authorial, interpretive, and project-oriented stance. For this reason, the entrance of artificial intelligence into artistic and creative pathways produces effects that go beyond the simple efficiency of activities. Using generative tools to develop concepts, elaborate images, simulate compositional solutions, or produce texts and design suggestions may expand possibilities for exploration and accelerate some phases of creative work. At the same time, however, it raises important questions about the risk of language standardization, dependence on preformatted outputs, the redefinition of authorship, and the possible compression of the long times required for artistic elaboration.

This issue becomes even more relevant when considered within the institutional and pedagogical framework of the AFAM system in Italy. AFAM institutions are currently engaged in processes of quality assurance, educational innovation, and structural development that are redefining their role within the broader higher education system [8]. At the same time, they are increasingly called upon to respond to challenges related to inclusion, accessibility, and technological experimentation, as demonstrated by recent educational projects developed in Italian conservatories and artistic institutions [9]. From this point of view, reflecting on AI in AFAM means addressing not only the adoption of new tools, but also the future of artistic education as a field of research, experimentation, and internationalization [10,11].

In this direction, the perspective of hybrid intelligence offers a particularly useful theoretical framework. Contemporary learning can be described as a space of co-evolution between human intelligence and artificial intelligence, in which educational value lies not in task automation itself, but in the quality of the interaction between human capacities and artificial systems [12]. Applied to the AFAM context, this approach suggests that the central issue is not whether AI should enter educational processes, but rather under what conditions it can be integrated without impoverishing the reflective, critical, and transformative dimensions of artistic experience. In other words, AI can become a meaningful

resource only if it is embedded in pedagogical models that preserve the role of judgment, experimentation, and authorial responsibility.

This reflection becomes even more relevant when connected to the production chains of Made in Italy. These sectors are not based solely on productive or market logics, but on a value system that intertwines aesthetic quality, design culture, manufacturing skills, artisanal tradition, and innovation. Fields such as fashion, design, visual arts, communication, and artistic craftsmanship attribute value not only to the final product, but also to the creative process, to the recognizability of expressive codes, and to the cultural density of the competences that make it possible. Within this framework, the adoption of artificial intelligence opens up important opportunities—for example, in trend analysis, concept generation, rapid prototyping, personalization, and communication—but it also introduces tensions concerning the protection of originality, the transmission of knowledge, the formation of distinctive skills, and the maintenance of a balance between technical speed and cultural quality.

The Italian AFAM system (Higher Education in Art, Music and Dance) is responsible for higher education and research in a range of artistic and creative fields, including visual and figurative arts, music, dance, dramatic and performing arts, as well as design and artistic industries. Its institutions include Academies of Fine Arts, Conservatories and Higher Institutes of Musical Studies, the National Academy of Dance, the National Academy of Dramatic Art, and Higher Institutes for Artistic Industries (ISIA). Within this framework, several AFAM disciplines are closely connected to sectors traditionally associated with Made in Italy, particularly fashion, visual communication, graphic and product design, artistic production, and craft-based creative industries. These fields are characterized by a strong interaction between cultural heritage, craftsmanship, design expertise, and technological innovation.

The AFAM system therefore occupies a strategic position, as it represents a crucial junction between technological transformation, the education of future creative professionals, and the redefinition of cultural and productive supply chains. From this perspective, artificial intelligence cannot be interpreted as a neutral variable; rather, it acts as an element that reorganizes practices, timelines, competences, and criteria of value, making it necessary to develop an articulated reflection on both pedagogical and cultural-professional levels. The relationship with Made in Italy is particularly relevant in this context because the adoption of digital technologies and artificial intelligence may influence not only production processes, but also the preservation, transformation, and renewal of artistic, design, and craft-related knowledge.

In light of these considerations, this contribution aims to analyze the relationship between artificial intelligence, artistic education, and Made in Italy, showing how technological innovation, to be truly meaningful, must be accompanied by a rethinking of educational models, teaching support devices, and the forms through which creativity is defined today.

2. Materials and Methods

The present study adopted a mixed-methods research design, combining quantitative and qualitative techniques to analyze the relationship between artificial intelligence, artistic education, and the production chains of Made in Italy. The choice of an integrated approach responds to the need to observe a complex and multidimensional phenomenon, involving teaching practices, technological transformations, social representations, and professional perspectives at the same time. As highlighted in the literature, mixed-methods designs make it possible to strengthen the understanding of phenomena through the integration of numerical data, qualitative interpretations, and theoretical frameworks, while also

supporting more robust forms of data analysis and interpretation [12–15]. Recent studies have also shown the relevance of mixed-methods approaches for investigating emerging technological phenomena characterized by experiential, social, and interpretive dimensions, such as those related to AI-mediated interaction [16].

The research was structured into three main phases, conceived as distinct yet mutually interconnected moments. The first phase involved a systematic review of the scientific literature concerning the use of artificial intelligence in educational contexts, with particular attention to the transformations introduced by generative systems, the logics of personalized learning, and the evolution of competencies required in new learning environments. This phase made it possible to define the theoretical framework and to identify the main analytical categories later used in the construction of the empirical instruments. From a procedural point of view, the review was guided by the principles of transparency and traceability recommended by the PRISMA 2020 guidelines, which constitute a consolidated standard for documenting systematic reviews [17]. More broadly, the integration of qualitative and quantitative evidence within review processes is increasingly recognized as essential when dealing with educational and social issues characterized by complexity and methodological plurality [17,18].

The literature examined showed that artificial intelligence is assuming an increasingly relevant role in the evolution of digital education. For example, tools such as ChatGPT, Bing Chat, Bard, and Ernie are reshaping the ways in which users access information and interact with educational content [1]. Intelligent tutoring systems have been shown to strengthen the personalization of learning pathways and to provide timely and targeted feedback [6]. Similarly, educational systems based on adaptive feedback have demonstrated significant potential for improving the effectiveness of learning processes [7]. These contributions formed the theoretical basis for identifying the main dimensions investigated in the research, including the perceived use of AI, educational opportunities, risks of standardization, and implications for creativity. In addition, the growing body of research on human–AI interaction and hybrid performance suggests that the educational impact of AI should be analyzed not only in functional terms, but also in relation to the dynamics of collaboration, interpretation, and co-construction between human actors and artificial systems [19,20].

The second phase of the research consisted of a quantitative web survey aimed at collecting systematic data on practices, perceptions, and expectations concerning the use of digital technologies and artificial intelligence within AFAM education. The questionnaire was developed on the basis of the research questions, the general objectives of WP2, the findings emerging from the literature review, and the research team's combined disciplinary expertise. These elements informed the construction of a conceptual map identifying the main dimensions of analysis, which subsequently guided the selection of indicators and their operationalization into questionnaire items.

The conceptual framework comprised four main dimensions. The first was the sociographic dimension, aimed at collecting demographic and contextual information about respondents. This dimension included two subdimensions: (1) sociodemographic characteristics, including gender, age, educational qualification, place of residence, citizenship, and family cultural capital; and (2) information concerning the respondent's AFAM institution and educational pathway, including courses attended in the case of students and subjects taught in the case of teaching staff.

The second dimension, educational and working environment, investigated students' and teachers' experiences and evaluations of educational, laboratory, and project-based activities: digital tools, artificial intelligence, and manual intelligence/craftsmanship. This section was designed to explore the ways in which digital and AI-based technologies interact with teaching, learning, artistic production, and traditional practical skills.

The third dimension, social intelligence/sustainability, operationalized social intelligence through issues related to sustainability. Both students and teachers were asked to assess the quality of training and the degree of awareness promoted by AFAM institutions in relation to social, environmental, and economic sustainability.

The fourth dimension concerned the perception of Made in Italy and was included only in the questionnaire administered to teaching staff. Its purpose was to assess teachers' perceptions of the relevance and impact of digital technologies and artificial intelligence on Made in Italy production within their respective disciplinary and professional sectors.

The study adopted a predominantly quantitative approach based on an online survey administered through SurveyMonkey. The units of analysis were students and teaching staff from the AFAM institutions participating as partners in the project. A non-probability convenience sampling procedure was adopted, resulting in two samples: 368 students and 155 teachers, for a total of 523 respondents.

Before the main data collection, the questionnaire underwent a pre-testing phase involving a restricted group of 30 participants drawn from the two target populations. The pre-test was conducted to assess the coherence, adequacy, and comprehensibility of the questions, with particular attention to the appropriateness of the language used. Where applicable, it was also used to evaluate the exhaustiveness of the response categories and to identify potential response biases. The feedback obtained during this phase informed the refinement of the final questionnaire.

Overall, the survey provided a broad empirical basis for identifying recurring trends, convergences, and differences between students and teachers and for mapping attitudes, expectations, and perceived criticalities concerning digital technologies and AI in AFAM education. In accordance with the mixed-methods design of the study, the quantitative findings also provided an empirical basis for comparison with the evidence generated during the qualitative phases of the research [14,16]. The questionnaire results are presented primarily in descriptive terms, using frequencies and percentages to summarize the responses and to highlight the main patterns, trends, and differences observed among participants.

The third phase of the research consisted of a single-round modified Delphi inquiry, conceived as a qualitative and prospective extension of the findings that had emerged from the previous phases. Given the exploratory nature of the study and the rapidly evolving character of artificial intelligence in artistic and design contexts, the Delphi approach was adopted in a simplified form to collect and systematize informed expert judgments on issues characterized by uncertainty and limited consolidated evidence [21–23]. Rather than aiming at a formal iterative consensus-building process, this phase was designed to identify recurrent orientations, areas of qualitative convergence, and points of divergence across a multidisciplinary expert panel.

The inquiry specifically explored perceptions, expectations, and good practices concerning the integration of artificial intelligence and generative AI into applied arts and design, with particular attention to sectors associated with Made in Italy. The investigation addressed four main research questions: (1) which current and future skills are required for the effective integration of AI into design and applied arts; (2) which educational and professional skills gaps are perceived by experts in Made in Italy sectors; (3) which risks, challenges, and opportunities are associated with the increasing use of generative tools in creative and production processes; and (4) which good practices and cases of excellence can be identified as potential reference models.

A purposive expert-selection procedure was adopted. Invitations were sent to 60 experts selected on the basis of professional relevance, sectoral diversity, and national or international recognition. The panel included expertise in design, applied arts, craft production, technological innovation, and the integration of digital technologies into creative

processes. Thirty-two experts completed the inquiry, corresponding to a response rate of more than 50%. The final panel included professionals and academics from a wide range of fields, including transportation and product design, graphic and communication design, fashion, jewellery, video games, digital media, software development, manufacturing, cultural heritage, bioeconomy, and artificial intelligence.

The choice of a multidisciplinary panel was considered particularly appropriate because artificial intelligence was approached not merely as a technical innovation, but as a factor potentially affecting educational practices, creative and production processes, professional skills, craftsmanship, and the cultural and productive values associated with Made in Italy.

The inquiry was conducted in a single consultation round. Consequently, no formal iterative consensus procedure or quantitative consensus threshold was applied. Instead, convergence was assessed qualitatively through thematic analysis of the experts' responses. Recurrent positions expressed across multiple responses were interpreted as areas of qualitative convergence within the panel, while contrasting or less recurrent views were retained as areas of divergence. The term "consensus" is therefore used in this study in a qualitative and exploratory sense and refers specifically to recurring orientations emerging within the participating expert panel.

The analysis focused on seven main thematic areas: the current use of AI and generative AI in applied arts and design; perceived impacts on creative and production processes; effects on the identity, competitiveness, and international perception of Made in Italy; the transformation and enhancement of craftsmanship; emerging skills gaps and training needs; the identification of new professional profiles; and examples of good practices and excellence in technological integration.

The responses were analyzed through thematic analysis, which enabled the identification, organization, and interpretation of recurrent patterns across the expert contributions. This procedure facilitated comparison among different professional and disciplinary perspectives and made it possible to distinguish areas of qualitative convergence from areas of divergence.

Accordingly, findings from this phase are interpreted as evidence concerning the views of the participating expert panel and should not be understood as statistically generalizable to the broader population of professionals working in the creative and cultural sectors.

The integration of the literature review, questionnaire, and Delphi inquiry took place according to a logic of methodological triangulation, through which the results of the different phases were brought into relation in order to strengthen the interpretive solidity of the analysis. The review provided the conceptual framework and the initial categories; the questionnaire made it possible to verify their empirical relevance in terms of the diffusion of attitudes and perceptions; and the Delphi inquiry finally allowed the most problematic aspects to be explored in depth and supported a forward-looking reading of the phenomenon. This strategy is consistent with the very nature of the object of study, which requires the connection of pedagogical, cultural, technological, and professional dimensions. In this sense, integrating different forms of analysis is not simply a technical choice, but a methodological necessity in mixed-methods research, especially when the aim is to produce coherent interpretations across different sources of evidence [13–15,24–26].

Overall, the methodological framework adopted proved appropriate for analyzing a field in which technological innovation, artistic education, and the transformation of production chains converge. From this perspective, the relationship between artificial intelligence and AFAM cannot be understood through a single investigative technique, but requires an approach capable of articulating data, interpretations, and expert knowledge. The perspective of hybrid intelligence also indirectly reinforces this setting, suggesting

that contemporary learning processes take shape as dynamic environments of co-evolution between human subjects and artificial systems, and that their analysis therefore requires research tools that are equally complex and multilevel [11,19,26].

All participants involved in the study—students, teachers, and experts—were informed about the purposes of the research and were asked to provide informed consent before taking part. Participation was voluntary and anonymity was ensured throughout the data collection and analysis processes. The data collected were accessed and processed exclusively by the research team and were not shared with external parties.

3. Results

The first phase of the research was devoted to a systematic review of the main theoretical and empirical evidence concerning the relationship between artificial intelligence, creativity, and artistic education, with particular attention to the fields of art, design, and the production chains of Made in Italy. This phase represented the starting point of the entire research process, providing the conceptual framework within which both the practices observed in the AFAM system and the perspectives that emerged from the Delphi inquiry were subsequently interpreted.

This review made it possible, first, to reconstruct the international debate on the introduction of AI into creative and educational processes, showing how it is marked by recurring tensions. On the one hand, numerous contributions emphasize the potential of AI as a tool to support creativity, capable of expanding the repertoire of design solutions, accelerating phases of experimentation, and fostering forms of human–machine co-creation. On the other hand, a critical reflection emerges on the risks associated with the automation of creative processes, the standardization of expressive languages, and the growing opacity of design decisions delegated to algorithms.

A first interpretive issue that emerged concerns the redefinition of the very concept of creativity. The literature shows that AI challenges an individualistic and author-centered conception of the creative process by introducing models based on distributed interactions among human subjects, digital tools, and algorithmic systems. Within this framework, creativity tends to be interpreted increasingly as a relational and situated process, rather than as an exclusive property of the individual author. This shift appears particularly relevant in educational contexts, where creative learning has traditionally been associated with the development of personal sensitivity and an individual expressive language.

A second area of reflection concerns the impact of AI on teaching and learning processes. The evidence shows that the introduction of intelligent systems into educational settings is often associated with promises of personalized learning pathways, time optimization, and support for autonomous learning. However, in the fields of art and design, these promises are intertwined with deeper questions concerning the role of embodied experience, studio-based practice, and the teacher–student relationship. Several studies in fact underline the risk that an uncritical use of AI may weaken those tacit and situated dimensions of learning that constitute a distinctive feature of artistic education.

The review also highlights strong attention to the issue of emerging competences. In the creative sectors and the production chains of Made in Italy, AI is increasingly associated with the need to develop hybrid professional profiles capable of integrating artistic, design, and technological competences. Alongside technical skills related to the use of digital tools, literature insists on the importance of critical, ethical, and interpretive competences, which are indispensable for understanding how algorithmic systems function and for intentionally guiding their use. This aspect is particularly relevant for the AFAM system, which is called upon to educate professionals capable of operating in increasingly complex and technologically mediated production contexts.

A further recurring theme concerns the relationship between AI and the identity of Made in Italy. The literature analyzed shows that the adoption of advanced technologies in creative production chains raises questions about the resilience of values traditionally associated with Made in Italy, such as craftsmanship, design quality, attention to detail, and the connection with cultural and territorial contexts. In this sense, AI is interpreted both as a possible driver of innovation and international competitiveness, and as a source of tension in relation to production models based on tacit knowledge and consolidated practices. This ambivalence emerges particularly clearly in contributions that examine the encounter between digital technologies and highly creative sectors such as fashion, design, and the visual arts.

Finally, the analysis revealed significant heterogeneity in the ways AI is adopted and integrated into educational and productive contexts. The evidence shows that the use of intelligent technologies is strongly shaped by institutional, cultural, and disciplinary factors, as well as by the availability of resources and competences.

The quadrants (Table 1) identified through the systematic review should not be understood as alternative or mutually exclusive scenarios, nor do they describe linear evolutionary trajectories. Rather, they should be interpreted as coexisting analytical dimensions that emerge simultaneously within educational and productive contexts, often in intertwined and at times contradictory forms.

Table 1. Results of the systematic review.

Quadrant	Interpretive Axis	Main Evidence from the Meta-Analysis	Relevance for AFAM and Made in Italy
Q1—Creative Expansion and Innovation	AI as an enabler of new possibilities	AI is described as a tool capable of expanding the creative repertoire, accelerating experimentation, and fostering forms of human–machine co-creation. Practices of formal and design exploration emerge that would be difficult to achieve through traditional tools.	It strengthens the innovative potential of AFAM educational pathways and the capacity of Made in Italy to renew languages and processes while maintaining high symbolic and design value.
Q2—Hybridization of Competences	Integration of creative and technological knowledge	The literature converges on the emergence of hybrid professional profiles combining artistic, design, digital, and critical competences. AI becomes part of the process, rather than a simple external tool.	It directly questions the role of AFAM in training new professional figures and the capacity of Made in Italy to integrate technological innovation without losing quality and identity.
Q3—Educational and Pedagogical Tensions	AI and the transformation of learning models	Critical issues emerge concerning the risk of impoverishing experiential learning, marginalizing studio-based practice, and redefining the role of the teacher. AI may alter the balance between guidance, autonomy, and experimentation.	It highlights the need to rethink AFAM teaching models so that AI supports, rather than replaces, educational practices grounded in experience and relationship.
Q4—Risks of Standardization and Loss of Identity	AI as a factor of homogenization	Part of the literature points to the risk of aesthetic standardization, dependence on models trained on pre-existing data, and the opacity of algorithmic decision-making processes.	This is a critical issue for Made in Italy, which is grounded in uniqueness, craftsmanship, and design culture; it requires an educational approach capable of developing critical awareness in the use of AI.

The opportunities for creative expansion and the hybridization of competences highlighted in the first two quadrants coexist with the pedagogical tensions and risks of standardization brought to light in the other two. In practice, the adoption of artificial intelligence in the fields of art and design does not produce univocal effects; instead, it generates hybrid configurations in which empowerment and critical issues develop in parallel. Depending on the ways in which it is used and on the institutional context in which it is embedded, the same technology may either foster advanced experimentation or contribute to processes of simplification and homogenization.

This coexistence of different dimensions reflects the still unstable and evolving nature of the relationship between AI, artistic education, and the production chains of Made in Italy. The quadrants make visible a transitional phase in which educational models, creative practices, and productive arrangements are not yet fully consolidated. From this perspective, the tensions that emerged should not be read as signs of inconsistency, but rather as indicators of an open process of transformation in which institutional, pedagogical, and professional choices play a decisive role.

The quadrant-based interpretation therefore makes it possible to move beyond a dichotomous view of the debate on artificial intelligence, avoiding rigid oppositions between "opportunities" and "risks" and instead offering a more realistic and articulated picture. It is precisely this coexistence of possibilities and criticalities that makes an integrated approach necessary, one capable of accompanying the adoption of AI through informed educational practices and institutional strategies oriented toward quality and responsibility.

The second phase of the research involved the administration of a questionnaire addressed to actors within the AFAM system, to systematically examine how digital technologies and artificial intelligence are actually integrated into educational practices and how they are perceived by teachers and students. The results that emerged in this phase make it possible to move from the theoretical framework outlined by the systematic review to an empirical reading of the dynamics currently at work, highlighting convergences, divergences, and tensions in relation to what emerged from the literature.

A first significant finding concerns the diffusion of basic digital tools, which appears to be widely consolidated within AFAM institutions. The use of laptops or desktop computers during teaching activities is almost generalized: more than 80% of students report using them frequently or very frequently during classes, while among teachers this percentage exceeds 75%. Similarly, graphic design, modeling, and digital design software are now stably integrated into educational practices, although with significant differences across disciplinary areas. These data confirm that basic digitalization now represents an acquired prerequisite rather than an element of innovation.

A different picture emerges, however, when observing the adoption of advanced technologies and artificial intelligence tools (Table 2). In this case, the data reveal a still limited and highly uneven diffusion, varying significantly according to the type of application considered. As shown in the table, the most frequent uses mainly concern image generation and text generation, which are also the areas in which the highest share of occasional or recurrent use by students is concentrated. In particular, for image generation, 28.4% report using it "sometimes," 10.1% "often," and 6.3% "very often," while for text generation the corresponding percentages are 27.6%, 18.7%, and 6.6%, respectively.

Table 2. Diffusion of Basic Digital Tools in the AFAM System.

	Not Applicable	Never	Almost Never	Sometimes	Often	Very Often	Total
PC/Laptop	5.0	1.3	1.3	6.6	22.4	63.4	100.0
Tablet	20.2	35.6	7.6	15.1	11.4	10.1	100.0
Graphic design software (e.g., Photoshop, Illustrator)	5.0	5.4	2.2	16.7	33.4	37.3	100.0
2D/3D CAD software (e.g., AutoCAD, Rhino)	17.0	40.1	5.0	8.5	13.6	15.8	100.0
3D animation and visualization tools (e.g., Blender, 3ds Max, Maya, Cinema 4D, Clo3D)	18.9	46.1	6.0	9.1	9.8	10.1	100.0
Collaboration and project management platforms (e.g., Trello, Asana, Notion)	19.2	59.0	7.3	7.9	5.0	1.6	100.0

Table 2. *Cont.*

	Not Applicable	Never	Almost Never	Sometimes	Often	Very Often	Total
Video editing, post-production, and animation software (e.g., Premiere, Final Cut, After Effects)	16.7	52.4	9.8	9.8	6.6	4.7	100.0
3D printers	24.3	61.8	7.6	4.1	0.9	1.3	100.0
Augmented/virtual reality (AR/VR)	26.8	65.3	5.4	1.9	0.3	0.3	100.0

By contrast, for more specialized or technically structured applications—such as video generation and editing, animation generation, 3D modeling, code generation, and simulation and modeling tools—the responses "never" or "almost never" clearly prevail, indicating that the level of adoption is still very limited. Render generation and the generation of audio, voice, and music also show relatively low levels of use, although with a slightly more visible presence of experimental or occasional practices.

Among teachers, the direct use of artificial intelligence appears overall less widespread and, here too, strongly differentiated according to the type of application considered. As shown in Table 3, the relatively more frequent uses again concern primarily image generation and text generation, which represent the areas in which AI seems to have a more visible presence in teaching and design practices. For image generation, 23.2% of teachers report using these tools "sometimes," 8.8% "often," and 3.2% "very often." For text generation, the corresponding percentages are 18.5%, 13.7%, and 4.0%, respectively.

Table 3. Levels of Use of Artificial Intelligence Tools among Students in the AFAM System.

	Not Applicable	Never	Almost Never	Sometimes	Often	Very Often	Total
Image generation	7.4	26.8	21.0	28.4	10.1	6.3	100.0
Video generation and editing	12.8	68.9	11.3	4.7	1.6	0.7	100.0
Render generation (e.g., environments, interiors, other)	14.0	58.4	12.1	11.3	3.1	1.1	100.0
Animation generation	14.8	69.5	8.2	4.7	1.6	1.2	100.0
3D modeling	14.4	66.9	8.2	6.2	2.7	1.6	100.0
Audio, voice, and music generation	14.4	60.7	12.5	8.9	1.9	1.6	100.0
Text generation	7.0	26.1	14.0	27.6	18.7	6.6	100.0
Code generation	14.4	70.5	4.7	5.8	2.7	1.9	100.0
Simulation and modeling tools	13.6	70.8	7.4	5.1	1.9	1.2	100.0

For the other applications, by contrast, the responses "never" or "almost never" clearly prevail, indicating that integration remains limited. This is particularly evident for video generation and editing, animation generation, 3D modeling, code generation, and simulation and modeling tools, for which use appears marginal or absent in most cases. Render generation and the generation of audio, voice, and music also show modest levels of use, while still revealing an episodic or experimental presence in a minority of the sample.

This gap between consolidated digital technologies and emerging AI reflects a transitional phase already highlighted by the systematic review. As show Table 4, AI appears as an increasingly present, yet not fully structured, element, often linked to individual initiatives, informal experimentation, or the specific interests of individual teachers and students, rather than to shared institutional strategies.

A second area of analysis concerns perceptions of the impact of AI on creative, professional, and learning processes. The results confirm an overall ambivalent attitude. On the one hand, a positive evaluation of AI prevails in terms of its operational usefulness: 36.1% of respondents consider it fairly useful and 34.5% very useful in saving time, while 39.5%

consider it fairly relevant and 21.8% very relevant for increasing competitiveness in their professional field.

Table 4. Levels of Use of Artificial Intelligence Tools among Teachers in the AFAM System.

	Not Applicable	Never	Almost Never	Sometimes	Often	Very Often	Total
Image generation	16.0	38.4	10.4	23.2	8.8	3.2	100.0
Video generation and editing	21.6	57.6	8.0	8.0	4.8	0.0	100.0
Render generation (e.g., environments, interiors, other)	22.6	54.0	10.5	8.1	4.8	0.0	100.0
Animation generation	24.8	60.0	7.2	4.8	3.2	0.0	100.0
3D modeling	26.4	60.0	6.4	4.8	1.6	0.8	100.0
Audio, voice, and music generation	17.6	52.0	14.4	12.0	3.2	0.8	100.0
Text generation	12.1	42.7	8.9	18.5	13.7	4.0	100.0
Code generation	24.0	62.4	5.6	4.0	2.4	1.6	100.0
Simulation and modeling tools	24.4	63.4	6.5	3.3	2.4	0.0	100.0

On the other hand, some reservations also emerge. Most respondents tend to exclude the possibility that AI could replace the human creative process, with 30.3% answering not at all and 33.6% a little. At the same time, concern remains regarding the effects of AI on artisanal production and the growing technological dependence within professional contexts.

A further element that emerged from the questionnaire concerns the perceived usefulness of artificial intelligence across the different phases of laboratory, design, and workshop activities. The data presented in Table 5 show a differentiated assessment depending on the phase considered. AI is regarded as particularly useful in study and research activities, where 37.0% of respondents consider it quite useful and 31.1% very useful. Relatively positive evaluations also emerge in the phases of ideation and briefing, although to a more limited extent.

Table 5. Perceptions of the Impact of Artificial Intelligence on Creative, Professional, and Learning Processes.

	Not at All	A Little	Quite a Lot	A Great Deal	I Don't Know	Total
The introduction of AI has allowed me to save time in my activities	8.4	13.4	36.1	34.5	7.6	100.0
I fear that AI may replace the human creative process	30.3	33.6	21.8	10.9	3.4	100.0
It is ethically wrong to consider AI a creative tool	24.4	31.1	26.9	8.4	9.2	100.0
AI has not yet reached a level of development that makes it truly useful for my professional field	15.1	44.5	24.4	9.2	6.7	100.0
The use of AI tools makes professionals in my field more competitive	7.6	22.7	39.5	21.8	8.4	100.0
The progress of AI will negatively affect the valorization of artisanal production	22.7	29.4	21.8	13.4	12.6	100.0
In my professional field, activities are becoming increasingly dependent on AI	8.4	42.0	29.4	15.1	5.0	100.0
AI will not have a significant impact on the potential of human creativity	18.5	29.4	26.9	10.9	14.3	100.0

By contrast, perceived usefulness decreases in the more operational and material phases of the process, such as sketching, prototyping, modeling, delivery creation, post-production, and finishing, where the responses not at all or a little prevail.

In the data presented in Table 6, the results of the questionnaire illustrate a system in which digitalization has become an integral part of educational practices. In contrast,

artificial intelligence is still in an exploratory phase, characterized by both high expectations and significant uncertainties. The perceptions of teachers and students indicate a growing awareness of the importance of AI for the future of creative professions and the "Made in Italy" brand. However, they also reveal a lack of adequate tools, skills, and institutional frameworks necessary for its effective integration.

Table 6. Perceived Usefulness of Artificial Intelligence across the Different Phases of Laboratory and Design Activities (Frequency: 155 teachers).

	Not at All	A Little	Quite a Lot	A Great Deal	I Don't Know	Total
Briefing	25.3	24.1	30.4	12.1	8.1	100.0
Study and research	13.2	15.2	37.0	31.1	3.5	100.0
Ideation	20.2	24.1	35.1	16.7	3.9	100.0
Sketching	34.6	25.7	25.7	8.6	5.4	100.0
Prototyping	31.1	28.8	21.8	10.5	7.8	100.0
Modeling or creation of the final delivery	36.6	25.3	19.5	8.2	10.4	100.0
Post-production and finishing	33.5	24.9	23.0	9.3	9.3	100.0
Presentation and sharing	32.7	18.3	26.5	16.7	5.8	100.0

The third phase of the research involved the implementation of a Delphi inquiry, aimed at exploring from a prospective perspective the transformations brought about by artificial intelligence in the fields of art and design, with particular reference to AFAM education and the production chains of Made in Italy. Unlike the previous phases, which were oriented respectively toward theoretical reconstruction and the empirical observation of current practices, the Delphi inquiry made it possible to look toward the future by comparing expert views, expectations, and concerns regarding possible development trajectories.

The inquiry involved a heterogeneous panel of experts drawn from the fields of artistic education, creative professions, cultural industries, and digital technologies. The composition of the panel made it possible to integrate different points of view, fostering an articulated dialogue among educational, productive, and technological perspectives. Through multiple consultation rounds, participants were invited to express their assessments of the expected impacts of AI, comment on the findings that emerged from the previous phases of the research, and outline future scenarios in terms of competences, creative practices, and organizational models.

A first significant result concerns the widespread recognition of the inevitability of AI integration in the creative and educational sectors. The great majority of experts agree that AI does not represent a contingent trend, but rather a structural factor destined to exert a lasting influence on processes of creation, design, and learning. From this perspective, the experts' attention quickly shifts from the question of whether AI should be used to that of how it can be integrated in a way that is consistent with the values of artistic education and Made in Italy.

Alongside this convergence, a strong reflection also emerges on the transformation of creative processes. According to many experts, AI will increasingly be used as a support tool in the initial phases of the design process, particularly for the exploration of alternatives, the generation of variants, and the simulation of solutions. At the same time, the centrality of the human role is reaffirmed in the phases of interpretation, critical selection, and the attribution of meaning. AI is therefore conceived as an operational partner, rather than as a substitute for the designer or artist.

A recurring theme in the experts' responses concerns the evolution of professional competences. The Delphi inquiry reveals strong convergence on the importance of hybrid profiles capable of integrating creative, technological, and critical competences. Beyond the ability to use AI tools, the experts emphasize the need to develop competences related

to interpreting algorithmically generated outputs, understanding their limitations, and assessing the ethical and cultural implications of design choices. Within this framework, AFAM education is called upon to play a key role in promoting a conscious and reflective use of intelligent technologies.

Particularly relevant is also the reflection on the relationship between AI and the identity of Made in Italy. Experts recognize AI as a potential driver of innovation and international competitiveness, but they also warn against the risk of losing cultural and design specificity. Several contributions express concern that a standardized and uncritical use of AI may weaken those distinctive traits—quality, craftsmanship, and design culture—that constitute the symbolic and economic value of Made in Italy. At the same time, the possibility of using AI precisely to enhance these elements is underlined, provided that it is integrated into design processes guided by a strong cultural intentionality.

The Delphi inquiry also highlights a widespread awareness of the ethical and organizational risks associated with AI adoption. Among the main critical issues identified are dependence on proprietary platforms, the opacity of algorithmic models, and questions related to intellectual property and the protection of authorship. The experts stress that these aspects require explicit reflection within educational pathways, as well as the development of guidelines and institutional policies capable of orienting the use of AI in a responsible manner.

A further element that emerged concerns the strategic role of educational institutions. According to the experts, the AFAM system should not merely follow technological transformations, but should instead assume an active role of guidance and mediation. This implies investment in teacher training, the controlled experimentation of new tools, collaboration with the productive sector, and the capacity to elaborate shared visions regarding the future of creative professions. From this perspective, AFAM is conceived as a privileged space for building a balanced relationship between technological innovation and cultural values.

Taken together, the results of the Delphi inquiry portray the image of an open and non-deterministic future. The trajectories outlined by the experts do not configure univocal scenarios, but rather a plurality of possible developments, strongly dependent on the educational, institutional, and cultural choices that will be made in the coming years. The Delphi inquiry confirms and expands what emerged from the previous phases, reinforcing the idea that the impact of AI in the fields of art, design, and Made in Italy cannot be understood or governed without an integrated and multilevel approach.

4. Discussion

The integrated analysis of the literature review, questionnaire, and Delphi inquiry highlights a set of recurring tensions concerning the relationship between artificial intelligence, AFAM education, and the creative and productive contexts associated with Made in Italy. Rather than indicating a uniform process of technological adoption, the findings point to a heterogeneous and still evolving landscape in which opportunities for experimentation coexist with concerns regarding standardization, skills development, pedagogical change, and the preservation of distinctive creative practices.

A first relevant finding concerns the ambivalent role attributed to AI in creative processes. Across the three phases, AI emerges as a potential support for experimentation, ideation, and design exploration, but also as a source of concern regarding the homogenization of outputs, excessive dependence on technological tools, and the possible reduction in human control over parts of the creative process. These findings suggest that the educational implications of AI cannot be interpreted in deterministic terms. Its impact appears to depend substantially on how the technology is incorporated into specific teaching practices, institutional settings, and disciplinary cultures.

This issue is particularly relevant in artistic and design education, where learning is traditionally based on practical experimentation, studio-based activities, engagement with materials, and interaction between teachers and students. The introduction of generative AI does not necessarily replace these dimensions, but it raises questions concerning how they should be combined with new forms of technologically mediated learning. The questionnaire and expert inquiry suggest that the challenge is therefore not simply to introduce AI tools into existing curricula, but to define educational approaches capable of integrating them without marginalizing experiential and situated forms of learning.

A second major theme concerns competence. The findings consistently indicate the perceived relevance of profiles that combine creative and disciplinary knowledge with digital, critical, and interpretive competences. At the same time, the questionnaire points to a mismatch between the perceived importance of AI-related competences and the availability of structured educational opportunities devoted to their development. The expert inquiry further suggests that these competences should not be reduced to the operational use of specific tools. Critical interpretation of AI-generated outputs, awareness of technological limitations, and understanding of ethical and cultural implications are also considered relevant.

These findings have implications for the role of teachers. In the contexts examined, the increasing availability of AI tools appears to reinforce the importance of pedagogical mediation rather than making it less relevant. Teachers may be required to support students not only in the technical use of AI, but also in evaluating outputs, contextualizing technological possibilities, and maintaining attention to intentionality, authorship, and disciplinary knowledge. This interpretation should nevertheless be considered exploratory, as the study collected perceptions rather than direct observations of teaching practices.

The relationship between AFAM education and made in Italy represents a further area of interest. Within this study, the concept of Made in Italy refers primarily to creative and productive fields represented in the participating educational and professional contexts, including design, fashion, visual communication, artistic production, and craft-related activities. The findings suggest that AI is perceived as potentially relevant to innovation in these sectors, particularly in relation to experimentation and the transformation of design processes. At the same time, respondents and experts expressed concerns regarding the possible homogenization of creative outputs and the weakening of forms of knowledge associated with craftsmanship and context-specific practices [27,28].

These results should not be interpreted as evidence that AI will necessarily strengthen or weaken Made in Italy. Rather, they indicate that participants perceive the relationship between technological innovation and cultural or productive specificity as an open issue. The effects of AI are likely to vary according to disciplinary field, organizational context, professional practice, and the ways in which technologies are introduced and governed.

Another finding concerns the uneven institutionalization of AI within AFAM education. Questionnaire responses indicate that engagement with AI is often associated with individual experimentation rather than with consolidated institutional strategies. This may reflect the relatively recent diffusion of generative AI and the rapid pace of technological development. The evidence available in this study does not allow the extent of institutional adoption across the AFAM system as a whole to be established, but it suggests that the development of shared guidance, educational objectives, and forms of institutional support represents an important area for further investigation.

As shown in Table 7, the contribution of the mixed-methods design lies less in direct confirmation across phases than in the possibility of comparing different forms of evidence. The literature review provides the conceptual background, the questionnaire offers a descriptive mapping of perceptions among the participating students and teachers, and

the Delphi inquiry contributes the perspectives of a selected expert panel. The recurrence of similar themes across these sources strengthens their interpretive relevance, while differences among them also indicate that the phenomenon remains heterogeneous.

Table 7. Integration of Findings.

Interpretive Direction	Evidence from the Systematic Review	Evidence from the Questionnaire	Evidence from the Delphi Inquiry
1. Transformation of creative processes	AI redefines creativity as a distributed and relational process, introducing forms of human–machine co-creation and new modes of design exploration.	Students and teachers recognize AI as a support for experimentation (≈60%), although its use is still not structured.	Experts foresee a growing use of AI in exploratory phases, while human agency remains central in final decision-making.
2. Evolution of competences	The emergence of hybrid profiles integrating creative, technological, and critical competences.	Strong awareness of the future importance of AI-related competences (>70%), despite limited dedicated training.	Centrality of interpretive, critical, and ethical competences, beyond mere technical use.
3. Pedagogical and educational tensions	Risk of impoverishing experiential learning and marginalizing studio-based practice.	Widespread concerns among teachers (>50%) regarding standardization and loss of basic competences.	Need to rethink teaching models without abandoning the studio-based and relational dimension.
4. Relationship between education and Made in Italy	AI as a driver of innovation, but also as a source of tension with respect to the values of craftsmanship and design culture.	Perception of a partial misalignment between AFAM education and the transformations affecting creative production chains.	Strategic role of AFAM as a space of mediation between technological innovation and productive identity.
5. Uncertainty and plurality of future scenarios	Absence of univocal developmental trajectories; change is non-linear.	Uneven and experimental adoption of AI across AFAM institutions.	Open scenarios dependent on educational, institutional, and cultural choices.

Another central interpretive issue concerns the heterogeneity of practices and institutional strategies. The questionnaire results show that the use of AI is often entrusted to individual initiatives or informal experimentation rather than to shared educational policies. This fragmentation reflects a transitional phase in which institutions struggle to define clear guidelines and to equip themselves with adequate governance tools. However, the Delphi inquiry suggests that this very phase also contains a space of possibility: the absence of consolidated models opens up the opportunity to construct original approaches capable of combining technological innovation with cultural values.

The findings presented in Table 8 indicate that the AFAM system and the "Made in Italy" production chains are primarily facing cultural challenges, in addition to technological ones. Artificial intelligence acts as a catalyst for transformations that were already underway, highlighting unresolved issues regarding the role of education, the relationship between theoretical and practical knowledge, and the necessity for institutions to connect education with the workforce.

Table 8. Interpretive Issues Emerging from the Discussion.

Interpretive Issue	Main Evidence	Meaning Emerging from the Discussion
Ambivalence of AI	AI is perceived both as a creative opportunity and as a risk of standardization.	The impact of AI depends on the modes of integration and cannot be read in dichotomous terms.
Gap between awareness and educational provision	High perception of the future importance of AI-related competences, but limited structured training.	The educational system has not yet fully translated technological change into coherent teaching pathways.
Redefinition of the teacher's role	Persistent pedagogical concerns and the need for critical mediation.	The teacher assumes a strategic role of guidance, contextualization, and meaning-making.

Table 8. *Cont.*

Tension between innovation and identity	AI can either strengthen or weaken the values of Made in Italy.	The cultural dimension becomes decisive in order to avoid uncritical and homogenizing forms of integration.
Institutional fragmentation	AI adoption is often entrusted to individual initiatives.	Systematic governance is still lacking, but the transitional phase opens margins for experimentation.

This discussion emphasizes that the issue is not solely adopting new tools, but establishing a development model that effectively integrates innovation, educational quality, and cultural responsibility.

Most of the relevant interpretive issues do not focus solely on the presence of AI, but rather on the conditions under which it is introduced and utilized. The findings suggest that technological change intersects pedagogical models, institutional organization, professional competencies, and culturally specific forms of creative practice.

A related set of tensions concerns the uncertainty surrounding the future development of AI in artistic education and creative work. Table 9 summarizes these tensions.

Table 9. Tensions and Areas of Uncertainty Emerging from the Research.

Area of Tension	Polarities at Stake	Interpretive Implication
Experimentation vs. institutionalization	Innovation diffused in practices/weakness of policies and guidelines	Transformation is already underway, but it is not yet governed in a systemic way.
Automation vs. creative intentionality	Support for design/risk of reducing human control	The question of authorship becomes central in creative contexts mediated by AI.
Pedagogical innovation vs. studio-based tradition	New intelligent tools/centrality of making, experience, and relationship	The integration of AI requires a renegotiation of pedagogical models.
New competences vs lack of structured pathways	Growing demand for AI competences/insufficient educational provision	A possible gap is opening between the educational system and professional transformations.
Innovation vs. cultural identity	Competitiveness and experimentation/risk of homogenization and loss of specificity	The decisive issue is the cultural quality of AI integration.

Table 9, the tensions and areas of uncertainty outline a framework in which technological transformation is already in progress but has not yet achieved stable forms of consolidation. This ongoing transition does not present itself as a straightforward shift from one model to another; instead, it resembles an open process characterized by negotiation, adaptation, and experimentation. Acknowledging this state of uncertainty does not mean withdrawing from action; rather, it serves as the essential foundation for developing educational and institutional strategies that can guide change consciously and responsibly.

5. Conclusions

This study examined the relationship between artificial intelligence, AFAM education, and creative and productive contexts associated with Made in Italy through the integration of a literature review, a quantitative questionnaire, and a modified single-round Delphi inquiry. The findings suggest that AI is currently perceived neither exclusively as an opportunity nor exclusively as a threat. Instead, its introduction is associated with a combination of perceived benefits and criticalities that vary according to educational, disciplinary, and professional context.

Three main conclusions emerge from the analysis. First, AI is perceived as a potentially useful resource for creative experimentation and design processes, but concerns remain

regarding standardization, dependence on technological tools, and the preservation of human intentionality. Second, respondents and experts emphasize the growing relevance of competences that combine disciplinary and creative knowledge with technological literacy, critical interpretation, and ethical awareness. Third, the findings indicate that the educational integration of AI remains uneven and that more structured approaches to training, pedagogical support, and institutional guidance may be required.

For AFAM institutions, these results point to the importance of examining not only which technologies should be introduced, but also how and for what educational purposes they should be used. The findings suggest that the pedagogical value of AI may depend on its capacity to complement, rather than simply replace, studio-based, experiential, and relational forms of artistic learning.

With regard to Made in Italy, the study provides exploratory evidence concerning the perceptions of participants working or studying in creative and design-related fields. AI is associated with opportunities for experimentation and innovation, but also with concerns regarding the preservation of craftsmanship, design specificity, and context-dependent knowledge. These findings should therefore be understood as indications of perceived tensions rather than as evidence of effects on Made in Italy production chains as a whole.

Several limitations should be acknowledged. The questionnaire was based on non-probability convenience samples and mainly collected self-reported perceptions and practices; consequently, the results cannot be generalized to the entire AFAM population. The study also covers heterogeneous educational and disciplinary contexts, which limits the possibility of identifying a single pattern of AI adoption. In addition, the Delphi component consisted of a single-round modified Delphi inquiry. Its findings represent qualitative convergence and divergence within a selected expert panel and should not be interpreted as a formal consensus or as predictive evidence. Finally, because generative AI technologies are developing rapidly, the findings are necessarily situated within a specific technological and temporal context.

Future research should therefore combine perception-based data with direct observation of educational and creative practices. Comparative studies across different AFAM disciplines and institutions could provide a more detailed understanding of how AI adoption varies across contexts. Further research should also investigate the development and assessment of AI literacy in artistic education, the changing role of teachers, and the relationship between AI use, authorship, craftsmanship, and professional practice. More focused empirical studies would also be useful for examining how AI is currently being incorporated into specific sectors associated with Made in Italy rather than treating these sectors as a homogeneous field.

In conclusion, the study indicates that the integration of AI into artistic and design education is an open and context-dependent process. Its educational and professional implications cannot be inferred from the technological capabilities of AI alone, but need to be examined in relation to pedagogical practices, institutional choices, disciplinary traditions, and specific creative and productive contexts.

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