

## Education in Design and Generative AI: a kind of ‘Pandora's box’ in the context of creative teaching

**Abstract:** Generative Artificial Intelligence (AI) is rapidly transforming creative practices, raising profound questions about its role in design education. This study investigates how design students perceive this emerging technology, questioning whether it is primarily regarded as an automated tool that executes tasks or as a genuine collaborator in the creative process. A two-phase methodology was adopted: (1) a survey conducted with 243 students from IPMAIA, IPCA, ESMAD, ESAP, and ISLA, which gathered data on usage patterns, motivations, ethical concerns, and perceptions of AI's impact on design education and the future of the profession; and (2) the implementation of a classroom activity designed to explore the conscious integration of AI into creative practice. Findings indicate that 40.6% of students have already experimented with generative image AI, although significant obstacles persist, particularly technical limitations and ethical reservations. While more than half of the participants recognize AI as a valuable partner in design practice, many also express concerns about replacement and the erosion of authenticity. By addressing these perceptions, this study contributes to the ongoing debate on the pedagogical integration of generative AI, emphasizing the need for its critical, ethical, and educator-mediated use to safeguard the value of human creativity

**Keywords:** Generative AI; Design; Creative Process; Design Education; Higher Education.

### 1. Introduction

Throughout history, technology has been a disruptive force, profoundly transforming society and our relationship with the world. However, what is most pressing today is not change itself, but the speed and scale at which it occurs. The current democratization of Artificial Intelligence, while presenting inherent limitations, has generated much concern about its impact on creative fields, particularly design and its teaching. If the learning process involves effort, with the proliferation of Generative AI devices, it has become accessible to any individual to obtain sophisticated, fascinating, and immediate results, regardless of effort, commitment, or involvement, a disparity unmatched by other technological situations in history. Among other situations, teachers' concern about the discrepancy between the effort applied and the resulting quality becomes latent. This raises the question: will AI be understood by design students as the “genie in the lamp,” who is asked for anything and immediately responds, generating uncritical fascination; or, on the other hand, will it be understood as a brilliant collaborator in the creative process? This article aims to integrate this theme into the pedagogical universe, not only because of the critical issues raised by AI, but also to observe its potential to reinforce the sense of meaning, collaboration, involvement, and consistency that both designers and students should experience throughout the creative process and in the construction of results. Some of these concerns formed the basis of this study, guided by the conviction that, as design teachers, we are faced with a veritable “Pandora's box” in the context of creative teaching.

### 2. Theoretical Framework — Review of Scientific Literature

Recent literature on generative AI in the context of education and design reveals several trends, challenges, and potentials that help contextualize and deepen the results of the present study. In the field of generative AI and creativity in teaching, Zhou (2025) explore how the use of generative AI in pedagogical contexts can influence students' creativity, with implications mediated by engagement in learning and moderation of emotional variables. According to H. Lin & Q. Chen (2024) in a study on student and teacher perceptions of educational applications integrated with generative AI, they show that while there are benefits in stimulating creativity and engagement, there are also challenges such as anxiety, emotional discomfort, and feelings of devaluation of effort.

With regard to the attitude of design students towards generative AI, Fleischmann (2024) investigated students' attitudes, the frequency of use of this technology, and perceptions of its impact on their careers. The results indicate a pragmatic acceptance that AI generative will transform design practice, accompanied by ethical concerns and the need for critical training for its responsible use. Additionally, in "Generative Artificial Intelligence in Visual Design Courses," Lee (2025) analyzes the practical application of generative AI in visual design courses, operationalizing creativity factors (sensitivity, fluency, flexibility, originality, and elaboration). He concludes that generative AI can enhance certain dimensions of creativity, depending, however, on the teacher's pedagogical mediation, the students' prior experience, and the context of the project. However, there are integrated educational models and ethical challenges to consider in this scientific study. In this regard, the study "A Generative AI Integrated Educational Model for User-Centered Design Curriculum" (2025) developed a model that integrates ChatGPT and user-centered design practice and found that incorporating generative AI as a design tool requires training in prompts, ethical reflection, and hybrid assessments. Furthermore, in relation to ethics, Flick and Worrall argue that the curricular integration of creative AI should be anchored in technomoral virtues (honesty, humility, empathy, care, civility, and flexibility), operationalized in policies for disclosing the use of generative AI ("creative signaling") and process records. They also propose responsible curation of training data (provenance, licenses, and diversity) and respect for artistic identity/'essence' with informed consent where applicable. Finally, they recommend "human-in-the-loop" models with safeguards for output risks (e.g., biases, deepfakes, and sensory effects), aligning hybrid evaluation with ethical and post-editing criteria. Similarly, Anantrasirichai and Bull argue that, in the short term, the most effective adoption should remain human-centric—with generative AI augmenting, rather than replacing, creativity—and that building trust requires technical advances to go hand in hand with a robust understanding of ethical issues, data bias, and social impacts. In addition, they systematize three levels of ethical framework—Ethics by Design, Ethics in Design, and Ethics for Design—useful for operationalizing technomoral virtues in policies, processes, and evaluation. They also highlight concrete risks of authorship, piracy, and fakes (including deepfakes), reinforcing the need for transparency and detection/mitigation mechanisms. Finally, they recommend that AI tools be integrated into the workflow with feedback and human-in-the-loop, ensuring continuous verification and correction of outputs. Urmeneta (2025) presents a review of the literature on how generative AI can act as a facilitator, co-creator, or autonomous producer of creative artifacts, discussing how each level reconfigures the degree of student agency. The author points out that as AI autonomy increases, so does the risk of reduced student engagement and erosion of deep learning.

In line with this, the UNESCO report (2025) corroborates this by indicating that the autonomization of AI in creative tasks tends to homogenize ideas and reduce authorial appropriation and student engagement with the process, favoring superficial learning. However, there are still issues of authenticity, identity, and competition to consider. The study by Bartlett, K. A., & Camba, J. D. (2024) investigates originality and ethics in product design education, warning of pre-existing biases in datasets—the hidden work of creators whose works feed AI models, and copyright issues. In line with these concerns, Monib, W. K., et al. (2024) highlight the challenges of maintaining human value in creative processes in teaching, as well as the implications for assessment, professional identity, and social-emotional skills. In the context of collaboration, problem-solving, and creativity in groups with generative AI, Wei, X. (2025) investigated the effects of generative AI tools (e.g., ChatGPT, Midjourney) on group collaboration and problem-solving (DST) tasks. This author concludes that in environments where generative AI is used as support, there are significant improvements in collaborative skills, originality, and novelty, although tensions regarding leadership, creative control, and division of tasks also increase.

### **3. Materials and Methods**

#### **3.1. Participants and procedure**

The sample of the present study consisted of 243 higher education students, the majority of whom (98.8%) were enrolled in undergraduate programs, thus reflecting a predominantly undergraduate academic profile. Data collection was carried out in an academic context through the administration of an online questionnaire. The instrument included a brief description of the study's objectives, as well as the informed consent form, thereby ensuring compliance with the ethical principles inherent to research in the social sciences. Participation was voluntary, non-remunerated, and guaranteed the anonymity and confidentiality of responses. The choice of this sampling approach was based on the criteria of accessibility and convenience, considering the proximity of the target population and its adequacy to the objectives of the study. Data collection took place over two consecutive academic years, namely 2023/2024 and 2024/2025, allowing the gathering of up-to-date and representative information regarding the student population under analysis.

#### **3.2. Measures**

##### **3.2.1. Questionnaire for Higher Education Students**

The questionnaire was specifically designed for this study, taking into account its objectives and the characteristics of the target population. It was structured into five main sections. The first section focused on the sociodemographic and academic

characterization of participants, including variables such as gender, age, school, degree program, level of education, and year of study. The second section addressed the use of Artificial Intelligence (AI) tools within the academic context, investigating whether students had previously used AI-based image creation tools, the duration and frequency of usage, and the specific AI applications most frequently employed. The third section explored students' motivation and experience in using AI, including the purposes for which AI tools were used (e.g., facilitating creative processes, experimenting with ideas, accelerating work) and perceptions of the outcomes, such as satisfaction with results, modification of initial ideas, or the need for image post-processing. This section also examined the frequency of AI usage across different phases of design projects, both for image-based and text-based AI tools. The fourth section focused on the implementation of AI in the teaching and learning context of Communication Design, including students' perceived needs to maximize AI potential, suggestions for effective integration into courses, and interest in additional training or workshops. The fifth and final section evaluated the perceived impact of AI on Communication Design, capturing students' beliefs regarding its influence on creative processes, professional practice, and the authenticity of design work. Various question formats were employed, including Likert-type scales, multiple-choice questions, and open-ended responses, enabling a comprehensive understanding of both the quantitative and qualitative aspects of AI use in the academic context.

### **3.2.2. In-Class Pedagogical Activity**

In addition to data collection through the questionnaire, a practical pedagogical activity was implemented within the context of Communication Design classes. In this activity, students were invited to use AI-based generative image tools as an integral part of a creative project, under direct teacher guidance. The experience included a qualitative evaluation of the outcomes produced, as well as classroom discussions on the ethical implications of using AI in the design process. Students compared designs developed with AI incorporated from the initial phase of the project to those in which AI was used solely as a support tool or source of inspiration. This activity allowed for the observation not only of the visual and conceptual quality of the results but also of the level of student engagement, measured through active participation in tasks, interaction with peers, and commitment to exploring the tools, as well as their capacity for reflexivity, assessed through critical analysis of creative choices, identification of the limitations and potential of AI, and the articulation of design decisions with ethical and aesthetic considerations.

### **3.3. Statistical Analysis**

Descriptive statistics were used to characterize the sample and study variables, including means and standard deviations for ordinal variables and percentages for categorical variables. Graphical analyses were also conducted in Microsoft Excel to visualize distributions and trends. Differences between groups were examined using the non-parametric Kruskal-Wallis test, chosen due to the ordinal nature of the data and the non-normal distribution of variables. All statistical analyses were performed in SPSS version 29.0, with the significance level set at 0.05.

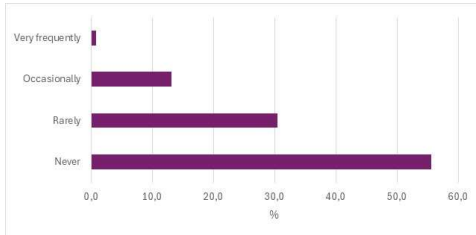
## **4. Results and Discussion**

The study sample consisted of 243 higher education students, with a balanced gender distribution: 48.1% identified as female, 50% as male, and 1.7% as other. Participants' ages ranged from 17 to 53 years, with a mean of 22.2 years (SD = 6.07). Most students were enrolled in undergraduate programs (98.8%), distributed across the first (58%), second (28%), and third year (13.6%). Regarding institutional affiliation, 43.2% of participants were students at IPCA, while the remainder came from other institutions (e.g., ESMAD, ESAP, IPMAIA, ISLA). This composition provides a diverse characterization in terms of age, academic year, and institutional background, reflecting the heterogeneity of higher education students included in the study. Based on this sample characterization, the results are first presented for the entire cohort, offering an overall view of observed trends. Subsequently, a comparative analysis by academic year is conducted, allowing identification of potential variations or patterns across different groups. It is important to emphasize that this study is exploratory in nature, and the findings should be interpreted as preliminary insights into the phenomenon under investigation. While the results provide valuable initial information and help generate hypotheses for future research, there remains considerable scope for further investigation through more extensive and rigorous studies that could consolidate and expand upon the conclusions presented here.

### **4.1. Use of AI Tools in the Academic Context**

Regarding the use of AI tools in the academic context, the results indicate that most students had limited experience with AI-based image creation. Specifically, 59.7% (Fig. 1) of participants reported never having used AI-generated image tools in their academic work. Among those who had used such tools, half indicated that they had been using generative image AI for approximately three months, while 55.6% reported never having created AI-generated images as part of school projects. These findings suggest that, although a subset of Design students has begun to integrate generative AI into their academic practices, overall engagement remains relatively low. This situation highlights an untapped potential within the field of

Design, indicating opportunities for more systematic incorporation of AI into creative projects and for the development of skills that enable students to fully explore the innovative possibilities offered by these technologies.



**Fig. 1.** Frequency of AI-generated image use in school project

**Table 1:** Descriptive Statistics of AI-Generated Image Use by Curricular Year and Group Differences (Kruskal-Wallis Test). (Source: authors)

Curricular Year	n(%)	Mean	SD	Min	Max	p
1 <sup>st</sup>	142(58)	1.37	0.65	1	4	<0.001
2 <sup>nd</sup>	68(28)	1.79	0.78	1	4	
3 <sup>rd</sup>	33(14)	2.12	0.70	1	3	

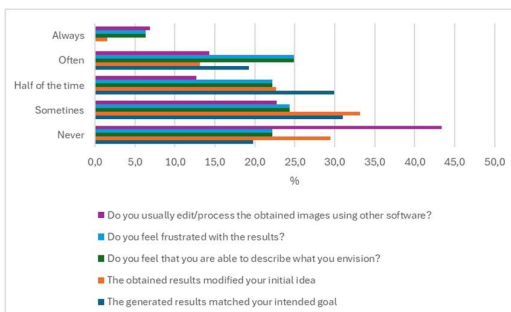
SD – Standard deviation; Min-Minimum ; Max - Maximum

The results presented in Table 1 show statistically significant differences in the frequency of AI-generated image creation in school projects according to curricular year ( $p < 0.001$ ). Specifically, students in the 2<sup>nd</sup> and 3<sup>rd</sup> years reported significantly more frequent use of these tools compared to 1<sup>st</sup>-year students (3<sup>rd</sup> year: 2.12 vs. 1<sup>st</sup> year: 1.37; 2<sup>nd</sup> year: 1.79 vs. 1<sup>st</sup> year: 1.37;  $p < 0.001$  for both comparisons). These findings suggest that academic experience and progression through the curriculum may be associated with greater familiarity and integration of AI tools in Design projects, reflecting a gradual increase in student engagement with these technologies over the course of their studies.

#### 4.2. Motivation and Experience in the Use of Artificial Intelligence

When asked about their use of AI-based image tools, participants reported different purposes for their application. The most common responses included curiosity (2.9%), fun (2.5%), and experimenting with new ideas (0.8%), often associated with the desire to explore creative possibilities or speed up the work process. Other motivations mentioned were creating concrete images, clarifying doubts, or obtaining technically challenging images. However, it is noteworthy that a significant proportion of respondents (20.6%) indicated that they did not know how to answer, while about 3% stated that they did not use AI tools for this purpose. These results suggest a scenario characterized both by an interest in exploring the potential of the technology and by some resistance or lack of familiarity with its use in the context of design. Figure 2 provides an overview of participants' interactions with image generation tools. Most rarely edit the generated images, while some experience occasional difficulties aligning results with their initial intentions. Many note that the outcomes can alter their original ideas, and a notable proportion feel the images rarely fully match their goals. These observations offer a concise picture of users' experiences, highlighting factors that may affect motivation and satisfaction with AI tools.

**Table 2:** Descriptive Statistics of AI-Generated Image – ‘Do you usually edit/process the images obtained with other software?’ by Curricular Year and Group Differences (Kruskal-Wallis Test). (Source: authors).



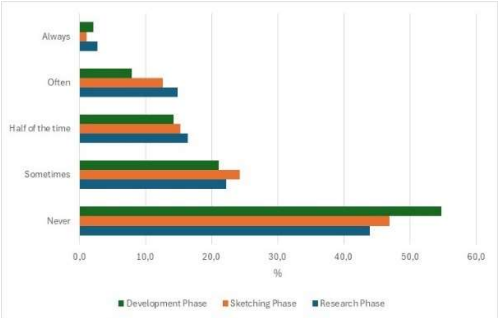
**Fig. 2.** Ratings of statements on the use of generative AI images

Curricular Year	n(%)	Mean	SD	Min	Max	p
1 <sup>st</sup>	100(53)	1.94	1.22	1	5	0.002
2 <sup>nd</sup>	60(32)	2.23	1.29	1	5	
3 <sup>rd</sup>	29(15)	2.93	1.41	1	5	

SD – Standard deviation; Min-Minimum ; Max-Maximum

Regarding participants' experiences with the results obtained through generative AI images, statistically significant differences were observed only for the question related to editing and processing images using other software (Table 2). The frequency of this practice varies according to the curricular year ( $p = 0.002$ ), with 3<sup>rd</sup>-year students reporting a higher tendency to edit and process images than 1<sup>st</sup>-year students (3<sup>rd</sup> year: 2.93 vs. 1<sup>st</sup> year: 1.94;  $p = 0.001$ ). This difference suggests that accumulated experience over the course of the program may influence the likelihood of using additional editing tools. In contrast, for the remaining questions, which assess agreement with the outcomes obtained, no statistically significant influence of the year of study was found. This indicates that, regardless of the year, students share similar perceptions regarding the alignment of results with their objectives, the alteration of initial ideas, the ability to describe what they envision, and the level of frustration with the outcomes. Therefore, the only relevant difference in terms of the year of study pertains to the practice of editing and processing images with additional software, suggesting that this aspect is more sensitive to practical experience acquired throughout the course. The following results refer to the frequency of use of generative image AI by participants in design projects they have already developed. The analysis is based on a scale from 1 (never) to 5 (always), applied to the different phases of the design process.

**Table 3.** Descriptive Statistics of Students' AI Use by Project Phase and Curricular Year (Kruskal-Wallis Test) Source: authors.



	Curricular Year	n(%)	Mean	SD	Min	Max	$p$
Research Phase	1 <sup>st</sup>	102(54)	1.92	1.16	1	5	0.035
	2 <sup>nd</sup>	59(31)	2.25	1.23	1	5	
	3 <sup>rd</sup>	28(15)	2.43	1.20	1	5	
Sketching Phase	1 <sup>st</sup>	102(54)	1.77	1.10	1	5	0.002
	2 <sup>nd</sup>	59(31)	2.05	1.07	1	4	
	3 <sup>rd</sup>	29(15)	2.48	1.06	1	4	
Development Phase	1 <sup>st</sup>	102(54)	1.67	1.09	1	5	0.009
	2 <sup>nd</sup>	59(31)	1.92	1.09	1	5	
	3 <sup>rd</sup>	29(15)	2.14	0.95	1	4	

**Fig. 3.** Frequency of Use of Generative Image AI in Different Phases of Design Projects

SD – Standard deviation; Min–Minimum ; Max–Maximum

The majority of participants reported that they never engage in certain activities across the Research (43.9%), Sketching (46.8%), and Development (54.7%) phases. Intermediate frequencies, such as “sometimes” or “half of the time,” were less commonly reported, while the highest frequency (“always”) was rarely selected, ranging from 1.1% to 2.6% across phases. These findings indicate that the targeted activities exhibit low recurrence throughout the different stages of the design process, suggesting that students engage in them only sporadically (Figure 3).

The results in Table 3 refers that analysis of the frequency of generative AI use in design projects revealed significant differences across curricular years in all phases of the process: Research ( $p=0.035$ ), Sketching ( $p=0.002$ ), and Development ( $p=0.009$ ). In the Research Phase, first-year students reported the lowest frequency of use, while third-year students reported the highest (3<sup>rd</sup> year: 2.43 vs. 1<sup>st</sup> year: 1.92;  $p=0.025$ ). This pattern suggests that as students advance through the curriculum, they become more confident and adept at integrating AI tools during the initial research and information-gathering phase. From a theoretical perspective, this trend can be understood in terms of progressive skill acquisition and self-efficacy. According to Bandura's (1997) theory of self-efficacy, repeated exposure and successful engagement with a task increase an individual's confidence in performing it. In the context of design education, first-year students may be less familiar with generative AI tools and therefore less inclined to incorporate them, whereas third-year students have had more opportunities to experiment, encounter challenges, and refine their skills, leading to greater confidence and autonomous use. Moreover, this trend aligns with models of technology adoption in educational settings, such as the Technology Acceptance Model (TAM), which posits that perceived usefulness and ease of use influence the likelihood of technology integration. As students progress, they not only acquire technical competence but also develop a clearer understanding of how AI can enhance research efficiency and idea generation, making its integration more intentional and frequent. Finally, this progression may also reflect the development of higher-order cognitive skills, including critical thinking and problem-solving, which are emphasized in advanced years of design curricula. As students become more capable of framing complex design problems, they are more likely to leverage AI strategically in the research phase to explore alternatives, gather diverse information, and support evidence-based decision-making.

In the Sketching Phase, a more pronounced increase in AI use was observed, rising from a mean of 1.77 in first-year students to 2.48 in third-year students ( $p=0.002$ ). This trend indicates that students' familiarity and competence with AI extend beyond the research stage, encompassing the generation and experimentation of visual ideas. Theoretically, this can be understood through experiential learning theory (Kolb, 2025), which emphasizes learning through active experimentation and reflection. As students' progress, they encounter more complex design tasks and are encouraged to explore alternative solutions, enabling them to leverage AI as a tool for ideation and creative experimentation.

This pattern also aligns with the concept of digital competence development, where proficiency with digital tools evolves progressively as learners engage with them in increasingly sophisticated contexts. The Sketching Phase requires not only technical skills but also creative decision-making, iteration, and visual problem-solving, making it a critical stage for strategic application of generative AI. By integrating AI into this phase, students can quickly visualize multiple concepts, test variations, and refine ideas, thereby improving both efficiency and the overall quality of their design outputs. Furthermore, this progression resonates with constructivist approaches to learning, where students actively construct knowledge by interacting with tools and media. AI use in sketching supports autonomous learning, encourages experimentation without high resource costs, and fosters a deeper understanding of design principles through iterative practice.

In the Development Phase, AI usage frequency also increased with curricular years, but the significant difference was observed primarily between first- and third-year students (3<sup>rd</sup> year: 2.14 vs. 1<sup>st</sup> year: 1.67;  $p = 0.009$ ), suggesting that substantial gains in AI integration occur as students reach the later stages of their curriculum. From a theoretical perspective, this pattern can be understood in terms of scaffolding and progressive skill acquisition. Early-year students may possess basic technical knowledge but limited experience in applying AI tools strategically within complex design processes. By the third year, students have accumulated sufficient experience and knowledge, allowing them to incorporate AI not only during initial conceptualization but also in the development and refinement stages, where iterative testing, evaluation, and enhancement of design outputs are critical.

Moreover, this trend aligns with principles from constructivist learning and cognitive apprenticeship. Advanced students engage in authentic, complex tasks that require integration of multiple skills and reflective decision-making. AI use at this stage supports higher-order cognitive processes, such as problem-solving, optimization, and creative decision-making, by enabling students to explore alternatives, simulate outcomes, and refine their designs more efficiently. Finally, the moderate but progressive increase in AI use highlights that technological integration in design education is cumulative: initial exposure builds familiarity, subsequent experimentation develops competence, and later-stage application reflects strategic, autonomous use. This suggests that curriculum design can further facilitate AI adoption by providing structured opportunities for students to apply these tools in increasingly complex project phases.

To better understand how generative AI is integrated into distinct stages of the design process, participants were asked to rate the frequency of AI use for various types of content during project development, using a five-point scale ranging from 1 (never) to 5 (always). This approach allows for a detailed examination of patterns in AI adoption across tasks, highlighting which activities are most and least supported by AI, and providing insights into students' engagement with these tools throughout the design workflow.

The analysis of AI use for different types of visual content in design projects shows a progressive increase in adoption across curricular years for all categories (Table 4;  $p < 0.001$ ). First-year students consistently reported the lowest frequencies of use, compared with second and third-year students, highlighting that engagement with AI grows with experience and familiarity. Specifically, images for creative exploration and generic images saw the most pronounced increases, suggesting that AI is primarily leveraged in ideation and exploratory tasks, which corresponds closely to the patterns observed in the Research and Sketching Phases. Students appear to use AI more for generating ideas, testing concepts, and experimenting visually as they advance through the curriculum. For images for mock-ups, simulations, and concrete images, the increase is also evident but slightly more moderate, indicating that AI is progressively incorporated into the practical and applied stages of project development. This mirrors the Development Phase results, where higher-year students were more likely to use AI strategically for refining and iterating project outputs.

Finally, illustrations showed a smaller, though still increasing, usage trend, suggesting that interpretative or stylistic tasks are less frequently delegated to AI but still benefit from it over time.

Taken together, these findings complement the previous phase-based analysis: students' AI use evolves both by task type and project phase, starting with exploratory and generative activities in early years and extending to applied, concrete, and development-focused tasks in later years. This cumulative adoption pattern reinforces the theoretical interpretation that progression through the curriculum builds technical competence, strategic understanding, and autonomous use of AI tools in design practice.



**Table 4** — Frequency of AI Use for Visual Content in Design Projects – Descriptive Statistics by Curricular Year and Group Differences (Kruskal-Wallis Test). (Source: authors).

	Curricular Year	n(%)	Mean	SD	Min	Max	p
Images for creative exploration	1 <sup>st</sup>	114 (56)	1.86	1.09	1	5	<0.001
	2 <sup>nd</sup>	61(30)	2.28	1.05	1	4	
	3 <sup>rd</sup>	30(15)	2.90	1.16	1	5	
Images for mock-ups and simulations	1 <sup>st</sup>	114 (56)	1.55	0.93	1	5	<0.001
	2 <sup>nd</sup>	61(30)	2.05	1.07	1	5	
	3 <sup>rd</sup>	30(15)	2.53	1.11	1	4	
Concrete images	1 <sup>st</sup>	114 (56)	1.78	1.16	1	5	<0.001
	2 <sup>nd</sup>	61(30)	2.43	1.24	1	5	
	3 <sup>rd</sup>	30(15)	2.57	1.25	1	5	
Generic images	1 <sup>st</sup>	114 (56)	1.59	1.03	1	5	<0.001
	2 <sup>nd</sup>	61(30)	2.08	1.17	1	5	
	3 <sup>rd</sup>	30(15)	2.53	1.04	1	4	
Illustrations	1 <sup>st</sup>	114 (56)	1.63	0.99	1	5	<0.001
	2 <sup>nd</sup>	61(30)	2.22	1.15	1	5	
	3 <sup>rd</sup>	30(15)	2.30	0.99	1	4	

SD – Standard deviation; Min-Minimum ; Max - Maximum

Still, considering the responses to the open-ended questions regarding curious or unusual experiences with AI shows that the majority of participants (76.5%) did not report any additional significant experiences. Among the remaining responses, each situation was mentioned by a very small proportion of participants (0.4–6.6%). The reported experiences ranged from AI errors in specific tasks (such as character counts, birthdays, or generating images with logically inconsistent elements) to creative or humorous interactions (such as worldbuilding, “convincing” a bot it was schizophrenic, or manipulating responses for comedic effects). Other responses highlighted the need for time and practice to master AI tools and a preference for manual work when AI did not produce satisfactory results.

Despite the diversity of these experiences, the low frequency of each occurrence indicates that such uses or interactions are occasional and experimental, and that most students keep their AI use focused on activities already analyzed quantitatively, such as research, creative exploration, sketching, and project development. These reports reinforce previous conclusions, showing that while AI can produce unexpected or curious results, the predominant pattern of use is structured and cumulative, increasing with curricular year and aligning with the development of technical and strategic competencies.

These qualitative responses illustrate that AI is primarily a supportive tool, with complementary or experimental uses occurring only occasionally, while more advanced students integrate it in a conscious, strategic, and progressive manner into their design workflow, corroborating the findings from both the phase-based and content-specific analyses.

### 4.3. Implementation of AI in the context of communication design education

In the context of AI implementation in Communication Design education, this study highlights key student needs to optimize the use of such technologies. The most prominent combination, reported by 9.9% of participants, was “greater prompt description skills” together with “more technical training in using the AI tool.” Other notable combinations included “technical training in AI tools and in Photoshop or other image-editing applications” (8.2%) and “greater prompt description skills combined with technical training in Photoshop or other editing applications” (9.1%). Importantly, 27.6% of respondents selected “I don’t know,” pointing to a substantial need for guidance and training in this area. When asked to share ideas and recommendations for effectively and engagingly incorporating AI tools into Communication Design education, the majority of participants (71.6%) offered suggestions. The most frequent proposals emphasized integrating AI into the educational system, overcoming taboos and prejudices related to its use, and providing technical training in both AI tools and graphic editing software. Participants also recommended creating dedicated courses on the functioning and application of AI in creative processes, as well as employing AI to accelerate idea generation and project development, particularly in the early stages. Conversely, a considerable group expressed resistance or indifference, citing concerns about reduced student creativity, ethical implications, or the lack of a clear stance. These results reflect diverse perceptions and underscore the need

for pedagogical strategies that address both technical training and resistance to ensure effective AI implementation in Communication Design.

In terms of which AI tools should be integrated into Communication Design curricula, responses revealed a wide range of suggestions, reflecting different levels of familiarity and exposure. Frequently mentioned tools included Adobe Firefly, ChatGPT, MidJourney, and DALL-E, highlighting students' recognition of both text- and image-generating platforms as valuable in academic contexts. Other tools, such as Canva, Adobe Sensei, Runway, and AI-based video or audio platforms, were also cited, albeit less often. Notably, around 27% of participants either reported not knowing which tools to suggest or indicated unfamiliarity with AI in general, revealing a significant knowledge gap. A smaller subset questioned the use of AI in education altogether, stressing the importance of fostering responsible and critical application rather than focusing solely on specific tools. The questionnaire also explored students' willingness to engage in training opportunities related to AI in Design. A large majority (72%) expressed interest in attending a course, workshop, or other resource to deepen their understanding and use of AI. Only a few concrete examples were provided, such as the Udemy course "Design AI: Creating User Experiences with AI" and training related to Adobe Firefly, Canva, or Photoshop. However, many participants either did not know of any available opportunities or expressed uncertainty, highlighting a clear lack of awareness. A smaller proportion reported no interest in further training. Overall, the findings demonstrate both strong student motivation to pursue AI-related education and the need for accessible, well-structured training opportunities to support the integration of AI into Communication Design curricula.

Finally, when reflecting on the broader use of AI in Design education, students raised several concerns. The most common included fears of diminished creativity, doubts about the ethical implications of AI, and uncertainties regarding the reliability and originality of AI-generated outputs. Some participants resisted the idea of incorporating AI into the learning process, while others remained undecided, showing a lack of clear positioning. These findings highlight the importance of addressing both technical and ethical dimensions in the pedagogical integration of AI, ensuring that its adoption strengthens rather than undermines creativity, critical thinking, and responsible design practice.

#### 4.4. The Impact of AI on Communication Design

The data reveal a predominance of positive perceptions regarding the impact of artificial intelligence (AI) in the field of design. The majority of participants agree or strongly agree that AI is profoundly transforming the field (60.0%) and accelerating work processes (71.6%). High levels of agreement were also observed regarding the change in professionals' relationship with images (64.6%). These results indicate that students perceive AI as a tool capable of optimizing workflows, enhancing creative exploration, and enabling more efficient visual experimentation, aligning with previous studies on technological integration in creative and educational contexts (McCormack & Hutchings, 2019).

At the same time, relevant concerns emerge. Approximately 50.7% of respondents believe that AI tends to devalue the creative aspect of the profession, while 52.6% consider that its use may compromise the authenticity of the work. These findings echo contemporary debates on authenticity and intellectual property in AI-mediated creation (Elgammal, 2020), indicating that while students acknowledge AI's benefits, they remain cautious about its ethical implications and its impact on professional identity.

By contrast, statements claiming that AI will "annihilate" the work of illustrators or enable anyone to act as a designer received high levels of disagreement (45.3% and 47.3%, respectively). This suggests skepticism about the full replacement of human professionals, reinforcing the view of AI as a complementary rather than a substitutive tool, consistent with concepts of human-machine collaboration and situated learning in creative contexts (Rezwana, & Maher, 2022).

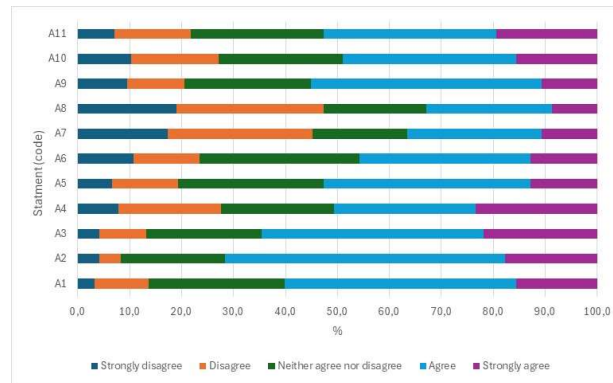
Students' views were more divided regarding AI's role as a technical or creative partner, with responses spread across agreement, neutrality, and disagreement. This indicates that while AI is widely recognized for its practical utility and ability to accelerate technical tasks, its creative function—particularly in generating original ideas and aesthetic decisions—remains more uncertain. Recent studies have highlighted this dichotomy, with some students viewing AI as a tool to enhance creativity, while others express concerns about its limitations in truly creative processes (Zhou, 2025).

Beyond these general perceptions, Table 5 provides further insights by comparing responses across curricular years. For the statement *"One may feel less creative because AI plagiarizes other artists"*, 3<sup>rd</sup>-year students reported significantly lower agreement than 1<sup>st</sup>-year students (2.79 vs. 3.43;  $p = 0.018$ ), suggesting that more advanced students are less concerned about creativity loss, possibly reflecting greater confidence in strategically integrating AI into their design process. For the statement *"Does the use of these tools compromise the authenticity of the work?"*, a significant difference was observed between 2<sup>nd</sup>- and 1<sup>st</sup>-year students (3.13 vs. 3.61;  $p = 0.014$ ), indicating that beginners express greater concern about authenticity, whereas more experienced students perceive this issue as less critical, likely due to increased familiarity with AI as a complementary tool.

For all other statements concerning AI's positive impact, acceleration of work, changes in the relationship with images, and its role as a technical or creative partner, no significant differences were found between curricular years. This suggests that overall perceptions of AI's benefits remain stable throughout the curriculum.



Taken together, these findings highlight that while students consistently value the practical and creative benefits of AI, ethical and creative concerns—particularly related to creativity and authenticity—tend to diminish with academic progression. This pattern reinforces the idea that experience and familiarity promote a more confident, strategic, and informed use of AI in design.



**Fig. 3.** Perceptions of AI in Design: Agreement Levels Regarding Its Impact on the Field, Work Processes, Creative Value, Authenticity, and the Role of Designers (Source authors).

A1: It is profoundly changing the field; A2: It is accelerating the work process; A3: It will change our relationship with images.; A4: It will devalue the profession in its creative aspect.; A5: AI will become an indispensable technical partner.; A6: AI will become an indispensable creative partner.; A7: It will annihilate the work of illustrators; A8: Anyone will be able to do design work.; A9: AI is a 'good colleague' in the context of the Creative Process.; A10: One may feel less creative because AI plagiarizes other artists.; A11: Does the use of these tools compromise the authenticity of the work?

For all other statements concerning AI's positive impact, acceleration of work, changes in the relationship with images, and its role as a technical or creative partner, no significant differences were found between curricular years. This suggests that overall perceptions of AI's benefits remain stable throughout the curriculum.

Taken together, these findings highlight that while students consistently value the practical and creative benefits of AI, ethical and creative concerns—particularly related to creativity and authenticity—tend to diminish with academic progression. This pattern reinforces the idea that experience and familiarity promote a more confident, strategic, and informed use of AI in design.

**Table 5.** Frequency of perceptions of AI's impact in design – Descriptive Statistics by Curricular Year and Group Differences (Kruskal-Wallis Test) (1-Strongly disagree to 5-Strongly agree). (Source Authors).

	Curricular Year	n(%)	Mean	SD	Min	Max	p
One may feel less creative because AI plagiarizes other artists.	1 <sup>st</sup>	142(58)	3.43	1.21	1	5	0.018
	2 <sup>nd</sup>	68(28)	3.18	1.06	1	5	
	3 <sup>rd</sup>	33(14)	2.79	1.41	1	5	
Does the use of these tools compromise the authenticity of the work?	1 <sup>st</sup>	142(58)	3.61	1.12	1	5	0.014
	2 <sup>nd</sup>	68(28)	3.13	1.12	1	5	
	3 <sup>rd</sup>	33(14)	3.30	1.31	1	5	

SD – Standard deviation; Min–Minimum ; Max– Maximum

Students were asked about their perceptions of how generative image AI might change their professional area, how they see their future as designers in relation to AI development, and whether they feel optimistic or intimidated by these technological advances. The responses reveal a spectrum of attitudes, ranging from enthusiasm and curiosity to concern and skepticism, providing a rich insight into emerging professional perspectives in design.

The analysis of students' responses reveals a complex and ambivalent view regarding the impact of generative image AI on their future professional roles as designers. A significant portion of respondents perceive AI as a supportive tool, capable of accelerating repetitive processes, facilitating idea exploration, and increasing productivity, thereby allowing them to focus on more creative and strategic tasks. Some students highlight that AI can expand creativity, quickly transform concepts into reality, and function as an ally in the creative process, especially in technical or initial production tasks such as sketches, mockups, or graphic adjustments.

On the other hand, there is a consistent concern about the devaluation of human work and the potential loss of design authenticity. Many express fear that intensive AI use could lead to the replacement of less experienced designers or even reduce job opportunities, particularly in areas where basic tasks may be automated. Some students emphasize that, although AI efficiently generates images, it cannot replace human creativity, emotional interpretation, and aesthetic judgment, elements that define authentic professional practice. Others show uncertainty or resistance, preferring to maintain a manual process or feeling uncomfortable relying on technology for artistic creation.

Critically reflecting, the responses indicate that adapting to AI in design is not only a technical challenge but also an ethical and strategic one. Balancing the use of AI as a supportive tool while preserving human creative authorship emerges as central. Students recognize both the transformative potential of technology and the challenges related to competitiveness, ethical use of automated tools, and career sustainability in design. This set of perceptions reflects an emerging dialogue on the need for continuous training in digital skills, generative AI literacy, and applied creativity, aligning with recent literature highlighting the co-evolution of human designers and generative AI systems.

#### 4.5. In-Class Pedagogical Activity

The classroom activity provided exploratory insights into the integration of generative AI in design practice. Projects that incorporated AI from the early stages exhibited greater visual diversity and faster iteration, while those using AI solely as a supplementary tool demonstrated more selective and controlled experimentation. Discussions revealed a nuanced student perspective: recognition of AI's potential to enhance creativity and accelerate processes, alongside concerns about originality and reliance on automated solutions. Most students engaged actively and explored the tools with curiosity, though the depth of critical reflection varied, with some considering ethical implications in detail and others focusing mainly on technical aspects. Overall, the activity not only fostered experimentation and reflective dialogue but also generated several concrete works, presented in the following section, that exemplify the outcomes and learning achieved.

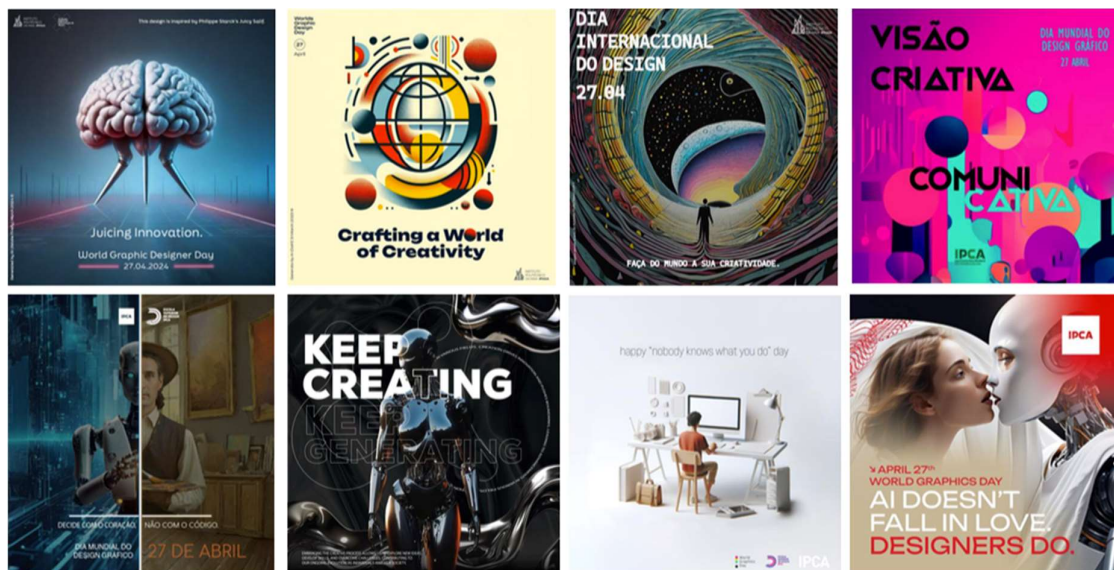


Fig. 4 - Work students examples: process and presentation of results (source: authors)

## 5. Conclusion - Final considerations

This exploratory study reveals that generative Artificial Intelligence constitutes a true "Pandora's box" in creative education: a technology of enormous potential, yet one that poses considerable risks if employed without critical reflection, ethical awareness, and pedagogical mediation. Its value as a collaborator in the creative process is evident, enabling inspiration, rapid iteration, brainstorming, and the efficient exploration of visual alternatives. At the same time, students express concerns regarding trivialization, the devaluation of human effort, and threats to authenticity and professional identity.

Taken together, the findings suggest that generative AI can be meaningfully integrated into design education, provided that its use is critically framed, ethically supported, and guided by educators. Such integration may stimulate innovation and broaden creative exploration while ensuring that the human dimension of design learning is preserved.

This study nonetheless presents several limitations. The sample, composed of 243 students from higher education institutions in the northern coastal region of Portugal, restricts the generalizability of results, as cultural, institutional, and curricular variations in other contexts may produce different perceptions. Moreover, the pedagogical activity was limited in duration and scope, which did not allow for the assessment of long-term impacts on skill development or professional identity. Finally, the reliance on self-reported data raises the possibility of discrepancies between declared perceptions and actual practices. Future research should expand to additional institutions, both nationally and internationally, in order to capture cultural and curricular diversity. Longitudinal studies are particularly needed to evaluate the sustained effects of AI use on creative capacity, professional identity, and employability. Further work should also focus on the development and testing of integrated pedagogical models, encompassing AI ethics, digital literacy, prompt engineering, and hybrid approaches to project assessment. Equally important is the advancement of evaluation methods that acknowledge not only final outcomes but also the creative, reflective, and conceptual processes, thereby valuing effort, risk-taking, and authenticity. Finally, interdisciplinary inquiries that bridge design, technology, and ethics will be essential for preparing students to navigate increasingly complex professional realities.

In sum, in an era defined by rapid digital transformation, design education must cultivate adaptability and openness to new creative languages while safeguarding the reflective, critical, and human essence of creativity. This study highlights the urgency of integrating generative AI into curricula consciously and responsibly, ensuring that innovation is balanced with the preservation of human creative agency.

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