

Human–AI co-creation in art, design and architecture education: a nature-inspired minimalist design approach

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Abstract:

The widespread use of AI technologies in education necessitates the development of new pedagogical approaches in creative disciplines. This study presents an innovative educational model for second-year students at the Faculty of Art, Design and Architecture to integrate generative artificial intelligence (GAI) tools into their creative design processes. Various text- and image-based generative artificial intelligence tools, such as DALL-E, Midjourney, ChatGPT, Gemini, Deep Dream Generator, Bing Image Creator, Stable Diffusion, Gencraft, and Adobe Firefly, were used in the course. Over a 14-week period, students developed nature-inspired minimalist designs through text-to-image (T2I) and image-to-image (I2I) generative models. The course structure offered a multi-stage learning experience, including the transmission of theoretical concepts, prompt engineering, conceptual analysis, visual production, and digital interpretation. The pre-test and post-test data showed significant improvements in students' knowledge and attitudes towards artificial intelligence tools. The practices carried out by interdisciplinary groups revealed that each department interprets AI differently, in line with its own aesthetic and production dynamics. In this context, the study proposes a unique and replicable teaching model that integrates generative artificial intelligence technologies with art and design education and strengthens the role of digital literacy in creative education.

Keywords:

generative artificial intelligence, art and design education, digital design, prompt literacy, text-to-image model, image-to-image model

1. Introduction

In recent years, rapid advances in artificial intelligence (AI) have brought about radical transformations across creative fields such as education, design, art, and architecture. AI-based tools have the potential to transform users' design processes, especially through generative models [1]. In this context, text-to-image (T2I) models have offered innovative insights into design and art practices with their ability to produce complex visual outputs from written descriptions [2]. However, with the recent development of image-to-image (I2I) models, artificial intelligence is no longer just a tool that initiates conceptual production. I2I has also evolved into a multi-layered creative environment that allows for the reworking and reformatting of visual material [3]. Providing designers with new conceptual frameworks and creative support tools, AI technologies have the potential to reshape the representational forms, aesthetic priorities, and thinking practices of design [4]. Accordingly, the role of AI in design processes has become an increasingly debated topic at both the academic and practical levels [5-7]. In addition, artificial intelligence (AI)-based tools - platforms such as ChatGPT, DALL-E, Midjourney, Leonardo AI, Playground AI, and Stable Diffusion - are gradually increasing their impact on art and design disciplines by radically transforming the way designers produce content based on written descriptions or visuals [1]. These tools are widely used across many fields, such as creative content production, educational materials, and assistive design technologies [8]. In particular, text-to-image

(T2I) generative models generate high-quality images from textual descriptions, enabling designers to quickly develop ideas and experiment with visuals. However, image-to-image (I2I) production models have enabled multi-layered creative processes by allowing users to transform existing images through style, composition, or form [9]. The combined use of T2I and I2I models offers a powerful AI-assisted design environment that deepens the creative process both in idea generation and in the formal transformation of these ideas. In this context, it is critical for designers to learn to use emerging artificial intelligence (AI) tools effectively to adapt to the future of design. Although AI is rapidly becoming widespread across many creative applications, understanding of the potential uses of these tools, especially in idea generation processes, remains limited in both academic and practical contexts [10]. While text-to-image (T2I) models can provide intellectual triggers by offering a visual starting point for the design process through images generated from natural language inputs, image-to-image (I2I) models create a transformation space for stylising, elaborating, and reinterpreting existing sketches or design ideas [9]. These tools enrich the creative process by helping both experienced and novice designers navigate the idea-generation process. Text-to-image (T2I) generative models have found applications in various fields, including educational tools, creative content production, and assistive technologies [8]. In this context, in studies on the use of these models with a focus on Architecture and Design Education, Paananen et al. (2024) conducted questionnaires and group interviews with 17 architecture

students in a laboratory setting using Midjourney, Stable Diffusion and DALL-E in order to examine how T2I tools support creativity in the design process of architecture students [2]. Kalenderoğlu & Demiröz (2024) evaluated the effect of T2I tools on design thinking in a third-year architecture studio by analysing projects created with these tools and examining students' creative thinking processes [11]. Thampanichwat et al. (2025) investigated how the concept of “mindful architecture” can be visualised with T2I tools and analysed the characteristics of architectural visuals generated with DALL-E, Midjourney, and Stable Diffusion [12]. Albaghajati et al. (2023) conducted semi-structured interviews with 16 experienced architects to identify the potential and limitations of T2I models in the architectural design process using SWOT analysis [13]. Iranmanesh & Lotfabadi (2024) evaluated the pedagogical effects of T2I tools by observing five different design studio juries [14]. Mancini & Menconero (2023) examined the integration of visualisations created with these tools into the design process to explore how T2I processes can be used in architectural design [7]. Furthermore, Lee et al. (2024) demonstrated that these technologies can increase the speed, quality, and customisation capacity of early architectural visualisations in the production process by using T2I models trained according to architects' personal styles [15]. In addition, various studies address the potential of I2I and T2I-I2I hybrid generative models in architecture and design education. Horvath and Pouliou (2024) adopted a design-through-research methodology encompassing text-to-text, text-to-image, and image-to-image generative tools and evaluated the role of these tools in conceptual design processes [9]. Marsault (2025), using structural and interpretive image-to-image artificial intelligence approaches, proposed proposals for restructuring the architectural production process and discussed the pedagogical implications of these approaches [16]. Fareed et al. (2024) aimed to enhance the effective transmission of historical content through visual representation by combining artificial intelligence-supported T2I and I2I generative models in architectural history education [17]. Turchi et al. (2023) examined the effects of human-artificial intelligence co-creation processes on creativity through interactive design workshops using large-scale generative models (e.g. Stable Diffusion) [18]. Lee et al. (2024) showed that hybrid models trained on local, identity-specific data enable photorealistic early visualisation of building facades, thereby increasing context sensitivity and personalisation in student projects [15]. Finally, Liao et al. (2022) demonstrated how intelligent manufacturing processes can be optimised in shear wall design with a “fused text-to-image-to-image” architecture model [19]. When the studies focused on Art and Design Education are examined, Ringvold et al. (2024) analysed the learning potentials and interaction problems through experimental studies with different T2I tools and online ethnography to investigate the contribution of T2I tools to creative learning processes in art and design education [20]. In the study conducted by Yıldırım (2022), in order to examine the effect of T2I tools on students' abstract thinking skills in basic design studios, students were asked to quote from their favourite books and visualise these texts with T2I tools, and the results were evaluated [21]. Vartiainen and Tedre (2023) examined the role of T2I tools in learning environments in the context of craft education, analysed how students participate in the creative process, and revealed how these tools are used in the production of digital materials [10]. Hutson et al. (2023) aimed to increase student productivity through I2I processes (inpainting, outpainting) with models such as Stable Diffusion in visual

communication and composition courses and emphasised the value of I2I processes, especially in digital art applications [22]. Tao et al. (2025) digitised traditional handicrafts with AIFiligrée, a hybrid framework on artificial intelligence-supported ornament design, and tested the interactive potential of text and image generation processes in the context of ceramic and jewellery design [23]. Samagaio (2023) demonstrated the role of I2I models in artistic style transfer processes by focusing on AI-assisted brushstroke and visual motif generation for use on ceramic surfaces [24]. Braghis & Liu (2024) presented a new pedagogical interface for sketch-based visual search systems, developed with ControlNet-based I2I models, and examined how art students' visual inquiry skills improve [25]. Ahmet et al. (2023) used GAN-based I2I transformations to stylise fabric sketches in textile and fashion design and observed that students' ability to generate visual variations improved [26]. These studies present the use of T2I and I2I models in education as a multidimensional transformation process with both opportunities and challenges. The authors state that T2I models support creative ideation, add visual richness to learning processes and diversify design thinking. On the other hand, it is emphasised that I2I models deepen students' experimental production processes and increase their opportunities to explore design variations by offering style, form and composition transformations based on existing visual data. Both types of models are becoming key components of innovative approaches that support student-centred, experiential, and visual-based learning environments.

Although the number of studies examining the use of generative AI tools in design education is increasing, research on the combined use of text-to-image (T2I) and image-to-image (I2I) models in an interdisciplinary learning environment that brings together different design disciplines remains limited. There is a particular need for application-based educational models that enable students to simultaneously engage in AI-assisted idea generation, visual experimentation, and interpretation. Therefore, this study aims to develop and implement an interdisciplinary educational application that enables undergraduate students in the Faculty of Art, Design, and Architecture to integrate generative AI tools into their design processes.

Therefore, unlike the studies examined in the literature, this study aims to encourage undergraduate students of the Faculty of Art, Design and Architecture to integrate productive artificial intelligence tools (T2I and I2I) into their design processes. Another important difference from the studies in the literature is that it focuses on a specific group of students (undergraduate students of the Faculty of Art, Design and Architecture), bringing together different departments related to art and design, and presents a unique methodological framework that aims to simultaneously activate the aesthetic, conceptual and technological competencies of these students. This study aims not only to observe the effects of artificial intelligence tools but also to build an applied, interdisciplinary learning environment that allows students to actively experience the processes of being inspired by nature, generating original ideas, and developing individual interpretations by identifying themes appropriate to their disciplines. Moreover, the study's use of second-year students makes an innovative contribution to the literature by not only discussing the potential of the tools but also presenting a direct, student-centred, experience-based design and learning practice. The hypothesis of the study is that second-year students of the Faculty of Art, Design and Architecture will significantly improve their creative thinking, visual production and design skills by combining their basic design knowledge and traditional

practice experiences with generative artificial intelligence (T2I and I2I) tools.

In order to test this hypothesis and to evaluate the educational contributions of generative artificial intelligence tools in a multidimensional way, the following research questions were formulated: Q1: How does the combined use of T2I and I2I generative AI tools affect students' creative ideation processes? Q2: How do students link T2I and I2I outputs to create original designs specific to their discipline? Q3: What impact do these generative models have on students' aesthetic, conceptual, and technical competences? Q4: How does the study process transform students' attitudes towards AI tools and their motivation to learn?

This study contributes to both design education and computational creativity research by proposing an interdisciplinary framework that integrates generative AI tools into creative design processes. From an educational perspective, it offers a structured pedagogical model for incorporating AI-assisted visual production processes into art, design, and architecture curricula. From a computational perspective, the study demonstrates how human-AI collaborative production can be systematically integrated into idea generation and conceptual design in the early stages of design.

2. Methodology

This research is based on discipline-specific thematic projects conducted by undergraduate students of the Faculty of Art, Design and Architecture as part of the university's common compulsory course "Artificial Intelligence and Productivity". The course was conducted for second-year students, and students were encouraged to integrate artificial intelligence tools into their design processes with approaches specific to their academic fields. Students at this level have completed the basic art and design education they received in the first year and have a sufficient background in perspective, composition, material knowledge, and basic design principles. They are also developing skills such as conceptual thinking, critical questioning, and creative problem-solving. Therefore, the project offered students the opportunity to develop original ideas, produce designs inspired by nature, and incorporate tools supported by artificial intelligence. Students identified themes appropriate to their

disciplines through research and developed their individual interpretations through digital design, sketching, and visualisation techniques. In this context, the methodological framework was structured to simultaneously mobilise students' intellectual, aesthetic, and technological capacities.

This study is modelled around a research-based five-stage construct. First, the research problem is defined by the question of how students studying in design-based disciplines can be supported by productive artificial intelligence tools in developing minimalist designs inspired by nature. The hypothesis developed based on this problem predicts that artificial intelligence-supported tools can improve students' creative design skills by supporting their conceptual thinking and visual production processes. Accordingly, the theoretical content course was structured on the basis of the concept of generative artificial intelligence, its applications in the fields of art and design, and information about the tools to be used. In the implementation process, students were guided in line with the theoretical knowledge by integrating generative artificial intelligence tools into their project processes. At the end of the process, the course outcomes were evaluated by analysing students' skills in defining the design problem, developing production strategies, and transforming their designs using artificial intelligence tools; thus, the validity of the hypothesis put forward was discussed (Fig. 1).

This study, which integrates theoretical background with practical production and whose final output is an artificial intelligence-supported design project, involves second-year undergraduate students from the Architecture, Visual Communication Design, Traditional Turkish Arts, Painting, Ceramics and Glass departments of the Faculty of Art, Design and Architecture (Fig. 2). Within the scope of the course, within the framework of the theme of "minimalist design inspired by nature", students were organised into homogeneous groups of 6 to 8 students from their departments only. In this structure, 25 groups participated in the project's production process, interpreting the theme using discipline-specific methods and approaches. The applied structure enabled each department to carry out the conceptual analysis, visualisation, and production stages through its own pedagogical principles, aesthetic understanding and design language, making it possible to address the theme in a multifaceted and disciplinary depth.

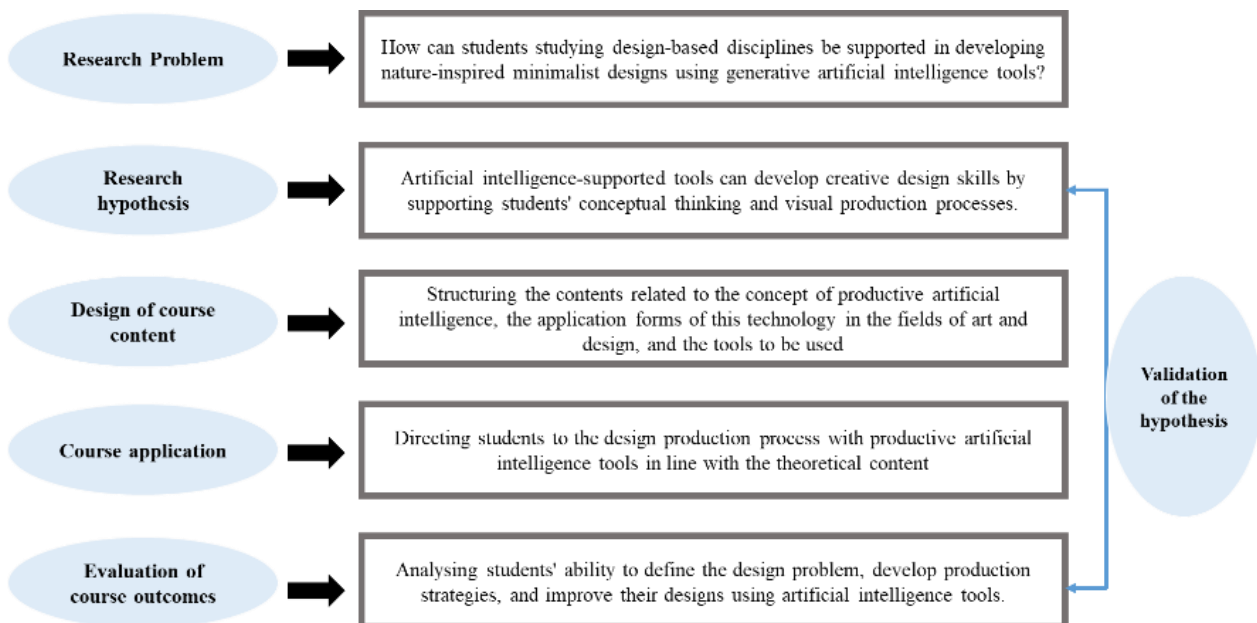


Fig. 1. Methodology of the research

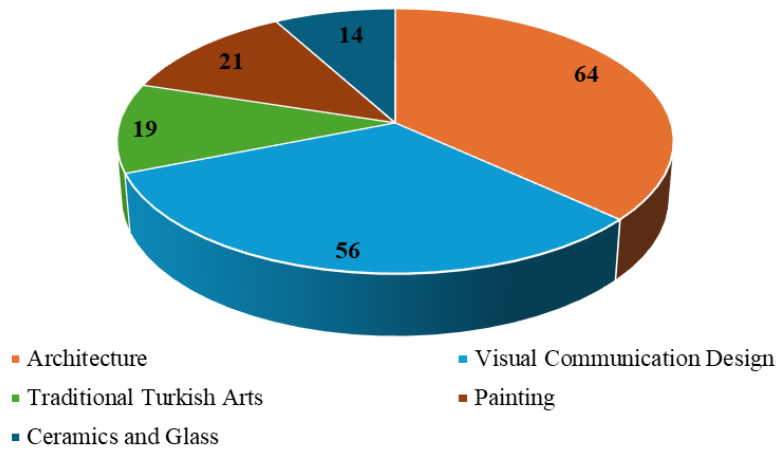


Fig. 2. Distribution of AI and productivity course participants according to departments

Before the theoretical and practical phases of the course began, a pre-test was administered to assess students' knowledge and motivation regarding UIC. This test provided important data for determining the level of theoretical expression and project level, and analysing the project outputs. Accordingly, it was observed that the majority of the students (85.88%) had a “very low” level of knowledge about artificial intelligence. Similarly,

67.06% had a “very low” level of experience with artificial intelligence, even once. This situation reveals that students have a very limited knowledge and experience of productive artificial intelligence tools at the beginner level. However, the students' motivation to use AI and their “moderate” level of artistic and educational contributions to AI indicate a potential willingness to learn (Fig. 3).

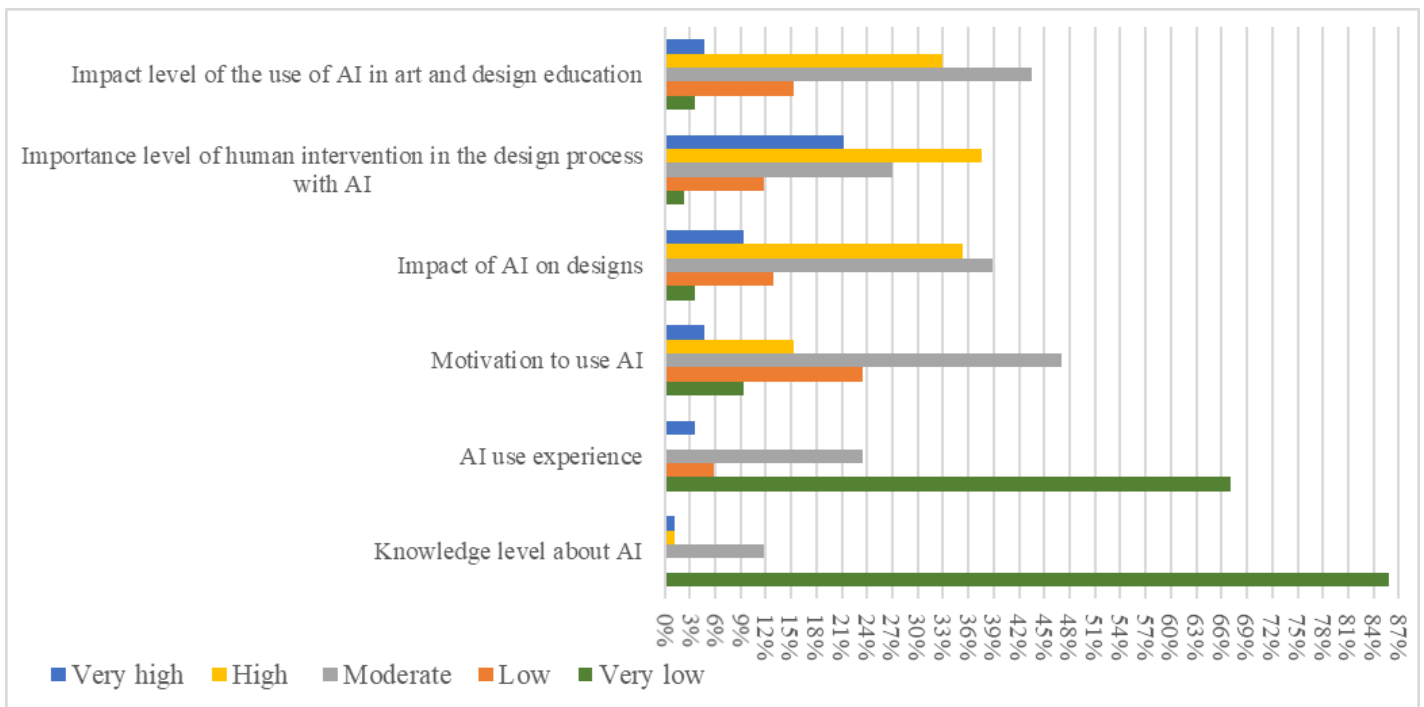


Fig. 3. Pre-test results regarding students' knowledge, experience, and motivation toward AI

2.1. Preparation phase and objectives

The main objective of this course is to provide undergraduate students with a theoretical framework for generative artificial intelligence (GAI) technologies and to create practical experience in integrating these technologies into artistic, design, and architectural production processes. Students are encouraged to critically evaluate the social, ethical, and cultural dimensions of these technologies as they learn the basic concepts, history, and current uses of URM. In the practical part of the course, students who participate in project/prototype development processes with URM tools enrich their own discipline-specific forms of production with digital and creative methods. In this

context, the course aims to develop both literacy in the productive technologies of the digital age and the competence to use these technologies in aesthetic, functional, and critical contexts. In the first weeks of the course (Weeks 1-4), students gained theoretical knowledge by learning the basic concepts, history, algorithmic infrastructure and productivity-oriented techniques such as prompt engineering. Then, the social, ethical, and cultural dimensions of UIC (Weeks 6-7) are presented in a critical framework. In the practical part of the course (Weeks 9-14), students who participated in project development processes with URM tools were expected to enrich their discipline-specific forms of production with digital and creative methods (Table 1).

Table 1. Weekly structure of the artificial intelligence and productivity course

Week	Topic Title	Subheadings / Summary of Content
1	Introduction to Artificial Intelligence	Definition, history, types of artificial intelligence, and uses in daily life
2	Artificial Intelligence Types and Algorithms	Basic algorithms, working principles, and natural language processing (NLP)
3	Generative Artificial Intelligence and Basic Concepts	Definition, examples, available tools and platforms, usage demos
4	Prompt Engineering	Prompt concept, strategies, and effective prompt creation techniques
5	Productive AI applications	Examples of UIC applications and projects in areas such as health, finance, education, and transportation
6	Ethical and Responsible Use	Ethical principles, data privacy, AI bias, transparency, regulations and policies
7	Social and Economic Impacts	Impact on the labour force, social inequalities and socioeconomic considerations of artificial intelligence
8	Current Developments and Future Forecasts	New technologies, innovations, trends and possible future scenarios in generative AI
9–14	Project Presentations and Evaluation	Presentation of student projects, feedback, evaluator comments, and analysis of outputs

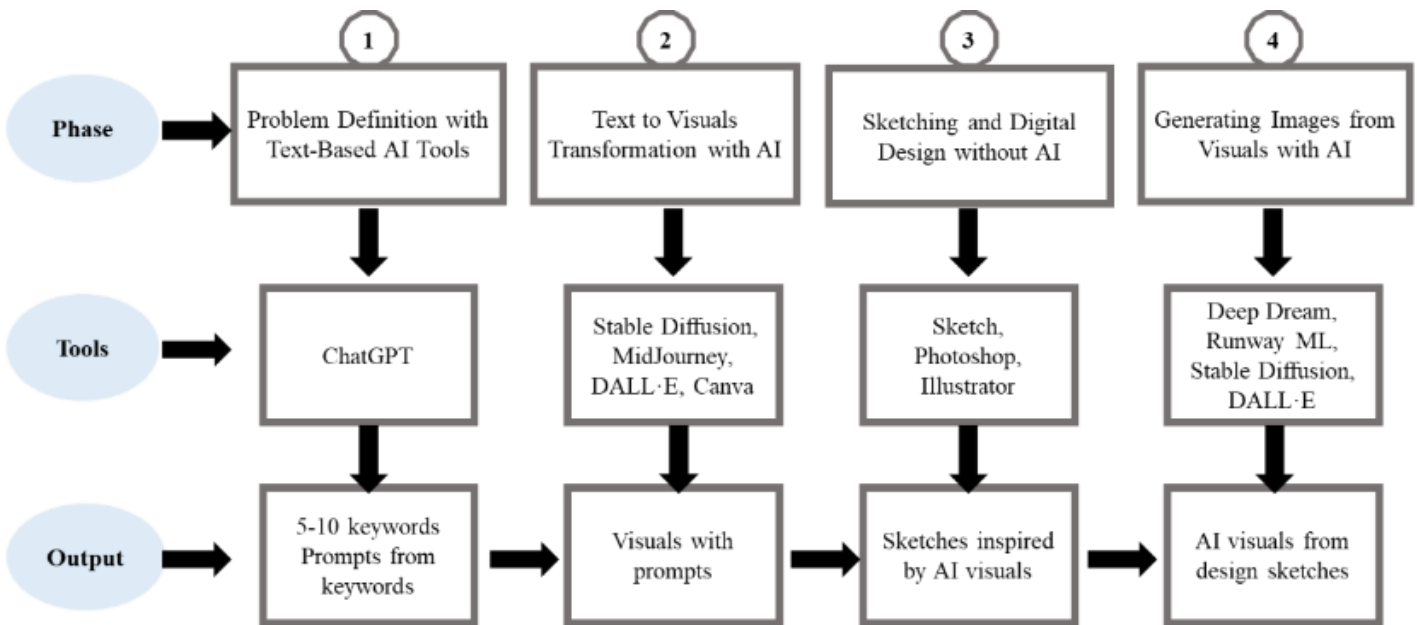


Fig. 4. Stages of visual production processes and tools used

Following the theoretical content transfer in the first eight weeks of the course, the learning process continued with a project-based practice model between weeks 9 and 14. In the projects, the aim is for students to develop discipline-specific creative designs aligned with the theme of “nature-inspired minimalist design” using productive URM tools. The project theme has the potential to address the aesthetic, conceptual and functional production dynamics of departments in the fields of art, design and architecture. Combining minimalist and nature-learning approaches, the theme allowed students to use UIC technologies in a creative, meaningful, and critical way specific to their fields. The course implementation was planned around a four-stage structure to make the most efficient use of design integrity with AI-supported tools (Fig. 4). In the first stage, students utilised their prompt-writing skills with ChatGPT, a text-based artificial intelligence tool, and identified problem areas specific to their disciplines that align with the theme of “minimalist design inspired by nature”. Accordingly, they created keywords by analysing concepts inspired by nature and

conceptually elaborated their design problems within the framework of these words.

In the second stage, the T2I production process was realised using these keywords. Using generative visual tools such as Stable Diffusion, Midjourney, Bing Image Creator, and DALL-E, nature-themed minimalist design ideas were transformed into powerful, effective visual outputs aligned with prompts generated with ChatGPT and Gemini. In the third stage, students analysed these AI-generated visuals and enhanced the design process by bringing their own creativity to the fore. At this stage, without using artificial intelligence, original sketches and visual interpretations were produced with freehand drawings and department-based digital design programs (Adobe Illustrator, Procreate, etc.) inspired by the images obtained. Thus, each department blended its own aesthetic approach with ideas derived from artificial intelligence.

In the fourth and final stage, the students' sketches and digital designs were reworked using algorithms that enable I2I production. Using Deep Dream, Stable Diffusion, and DALL-E tools, these designs were interpreted in new ways by artificial

intelligence and transformed in form, texture, colour, and style. At the end of the process, students critically analysed the contributions, limitations, and effects of artificial intelligence on the creative process by comparing the outputs from three production phases (T2I, original sketch-digital design, and I2I).

Ten visual works were selected for detailed analysis based on the following criteria:

- (1) originality of the visual concept,
- (2) effective integration of generative AI tools,
- (3) representation of different disciplinary perspectives, and
- (4) visual diversity in the design outputs.

In total, 25 groups were formed during the workshop, and their visual productions were analysed in this study. A total of 174 undergraduate students from the Faculty of Art, Design and Architecture participated in the course activities. Among them, 103 students voluntarily completed the survey, and their responses were included in the data analysis.

3. Findings

At every stage of the project, the students' production practices, the tools they used, and the problems they encountered were closely monitored and evaluated in line with the visual outputs they produced and how they interpreted them. In particular, the relationship between the outputs produced by visual production tools and the sketches and reinterpreted designs derived from these outputs revealed each group's problem-solving approach and adaptation to these tools. Accordingly, the processes of all groups were considered; however, only the 10 groups that demonstrated unity in problem definition, conceptual depth, and effective use of tools were analysed in detail. Below, observations of the production processes of these groups are presented in terms of visual qualities and methodological efficiency (Figs 5-14).

*Group-1:
Traditional
Turkish Arts
Department*

Optical harmony with zebra patterns: "The project aimed to synthesise cultural and contemporary elements in a minimalist framework by combining the mathematical order of zebra patterns in nature with the aesthetic structure of traditional Turkish motifs. In the first stage, visuals were produced using DALL-E and Midjourney, with prompts generated with ChatGPT's support. However, the initial outputs were quite static, and the perception of movement was not adequately conveyed. Accordingly, the prompts were revised, and additional experiments were conducted. In this way, stronger results were achieved in terms of the sense of optical movement and the balanced use of traditional motifs. At the end of the process, artificial intelligence tools abstracted traditional patterns, giving them a contemporary interpretation and supporting creative thinking in different ways. This experience can therefore be interpreted as both an aesthetic production process and an intellectual transformation." (Fig. 5)

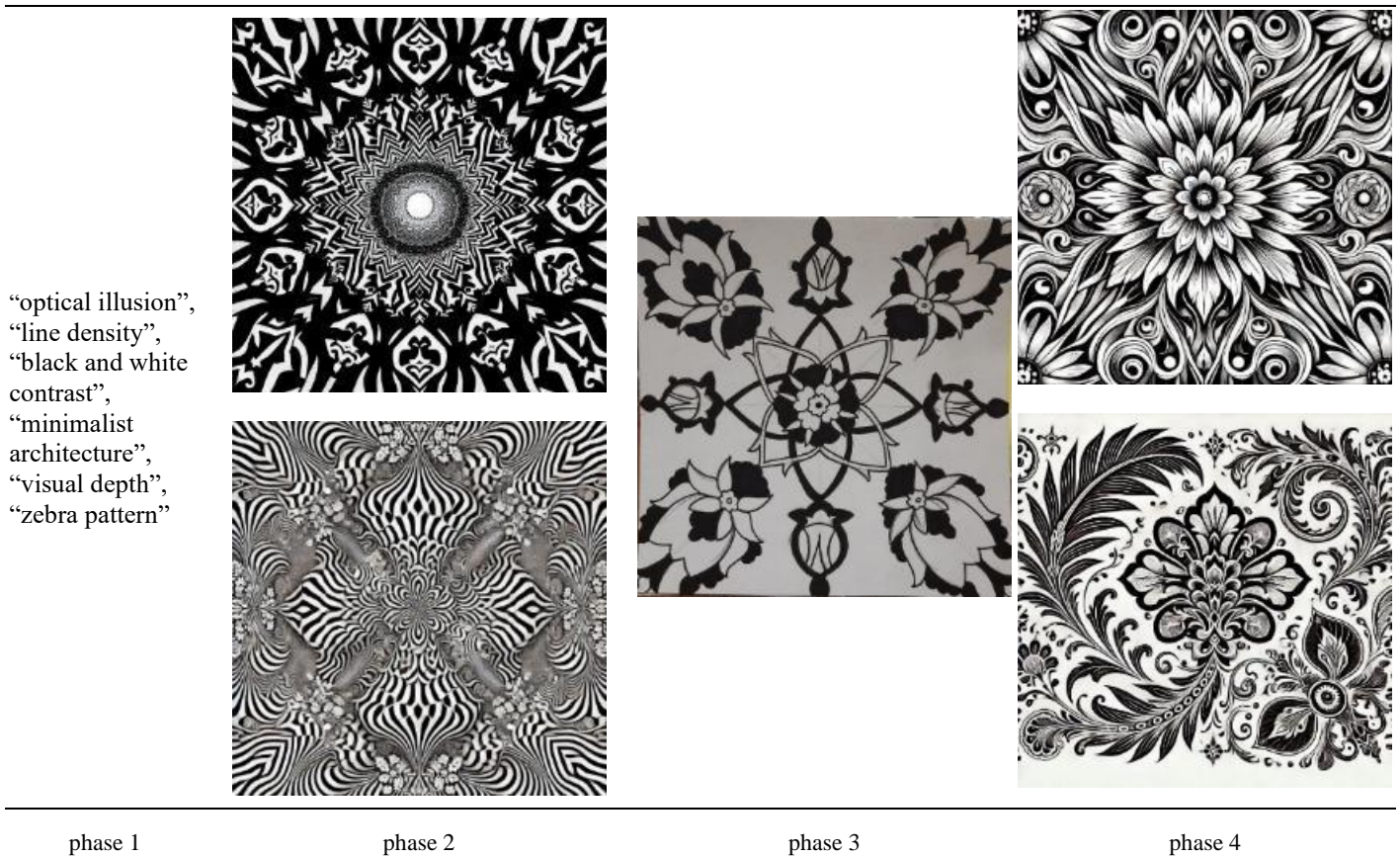


Fig. 5.

Group-2:
Traditional
Turkish Arts
Department

Accessory Design from Tradition to Contemporary: "In this project, the aim was to adapt the aesthetic elements of tile, illumination, and calligraphy arts specific to traditional Turkish art to contemporary accessory design. The prompts based on simplified natural motifs identified through ChatGPT were converted into visuals using DALL-E and Deep Dream Generator. The first image generated by artificial intelligence featured stylised floral motifs that reflected nature's rhythmic, balanced structure. Inspired by this image, sketches of bags and hats were prepared. In each design, an attempt was made to combine both traditional and functional lines. Artificial intelligence made significant contributions to enriching details and generating realistic forms. This process enabled the reinterpretation of the traditional understanding of art through innovative design aesthetics." (Fig. 6).

"flowers and leaves", "natural motifs", "minimalist natural patterns", "simple decorations with nature themes", "illumination, simple and elegant color transitions"



phase 1

phase 2

phase 3

phase 4

Fig. 6.

Group-3:
Painting
Department

Creative Interpretations from Nature to Pattern: "In the field of painting, blockages may occasionally occur in the creative process. The project aimed to revitalise this process by using artificial intelligence as a tool inspired by natural patterns. ChatGPT and Bing visual tools were used, with prompts developed from concepts such as natural inspiration, aesthetic patterns, and fractal algorithms. However, the artificial-intelligence-generated image from the first stage did not directly contribute to the creative process because it did not sufficiently overlap with the nature-themed focal points identified during the design phase. For this reason, line compositions were developed in the following stages, particularly based on butterfly and leaf forms. The colour palettes were customised according to the textural characteristics of the selected forms. This process demonstrated both the limitations and the stimulating potential of artificial intelligence in the transformation of natural forms into a visual composition." (Fig. 7).

"Natural motifs",
"color palettes
and natural light",
"organic forms",
"nature-art
relationship",
"fractal
geometry",
"butterfly
pattern"



phase 1

phase 2

phase 3

phase 4

Fig. 7.

Group-4: Painting Department *Public Art Redefined with Digital Screens: "In this project, artificial intelligence-supported digital screens were explored as potential alternatives to wall paintings that have faded over time or lost their relationship with their surroundings. The goal was for these screens to offer self-renewing, variable visual content that responds to environmental factors (weather, light, human movement). In line with the key concepts identified in the first phase, DALL-E and Gemini were used to generate visuals suggesting dynamic digital patterns in harmony with the environment. These ideas were then interpreted through drawings and enriched with organic forms and fluid surfaces. In the last phase, the drawings were digitally stylised. Throughout the process, the textures found in nature, leaf folds, and the effects of stone surfaces contributed to an impressive yet straightforward aesthetic in the designs, both formally and conceptually." (Fig. 8).*

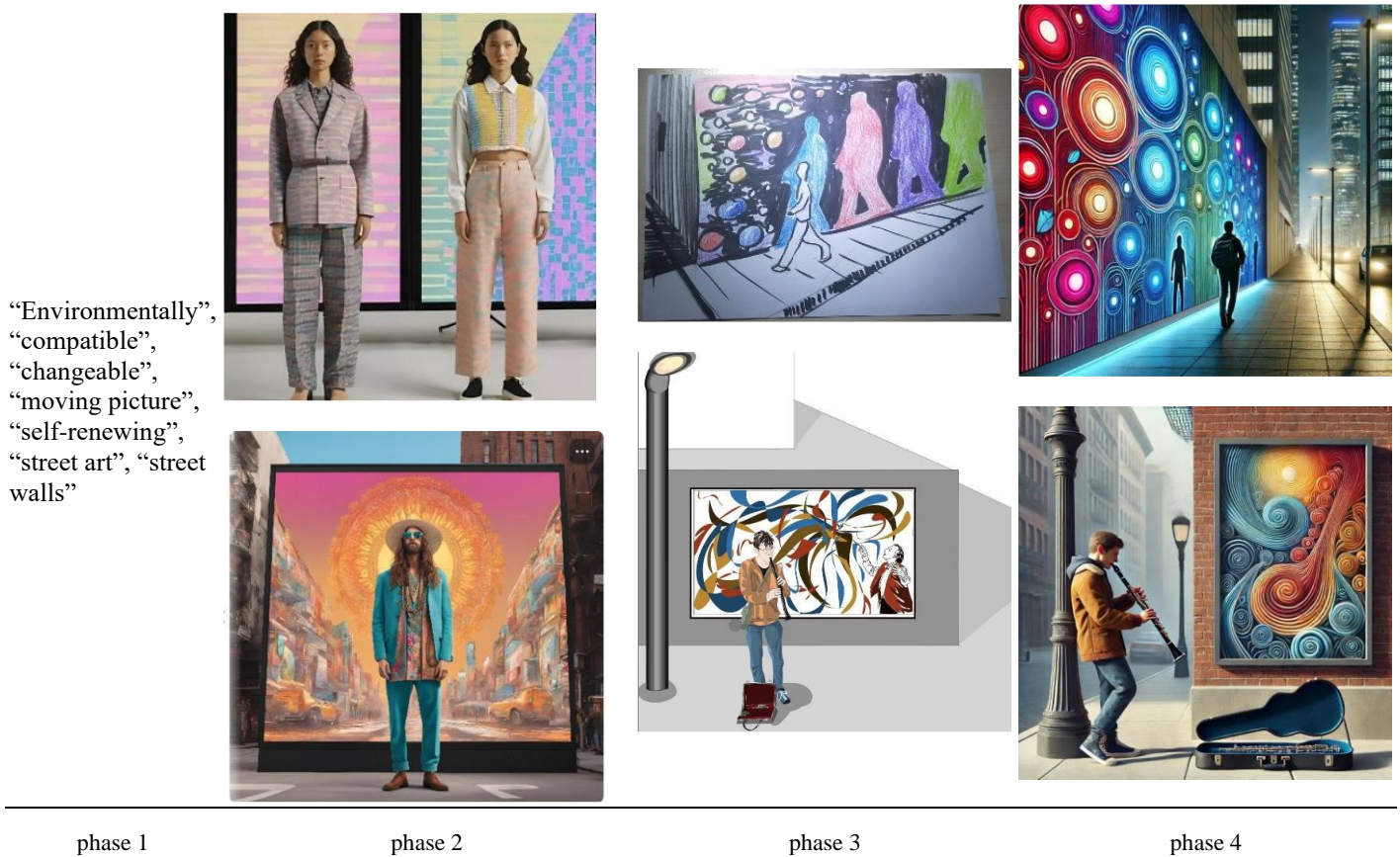


Fig. 8.

Group-5: Ceramics and Glass Department *Rhyton design from the spiral form of the snail: “Based on the spiral form of the snail, the project aimed to reinterpret the aesthetic and functional aspects of the rhyton, a traditional drinking vessel. In line with the keywords generated by ChatGPT, the first visual outputs were produced using Gemini, Midjourney, and Stable Diffusion. However, artificial intelligence generally produces the spiral form in a direct, literal manner; it cannot adequately capture layers of abstraction and symbolic meaning. For this reason, in the third stage, the generated forms were re-evaluated according to minimalist design principles (simplicity, clarity, proportion) and hand sketches were developed. In the final stage, these designs were re-digitised using tools such as Artbreeder and Runway ML. Although artificial intelligence provided advantages in prototyping, it was observed to be limited in generating artistic abstraction and depth of meaning” (Fig. 9).*

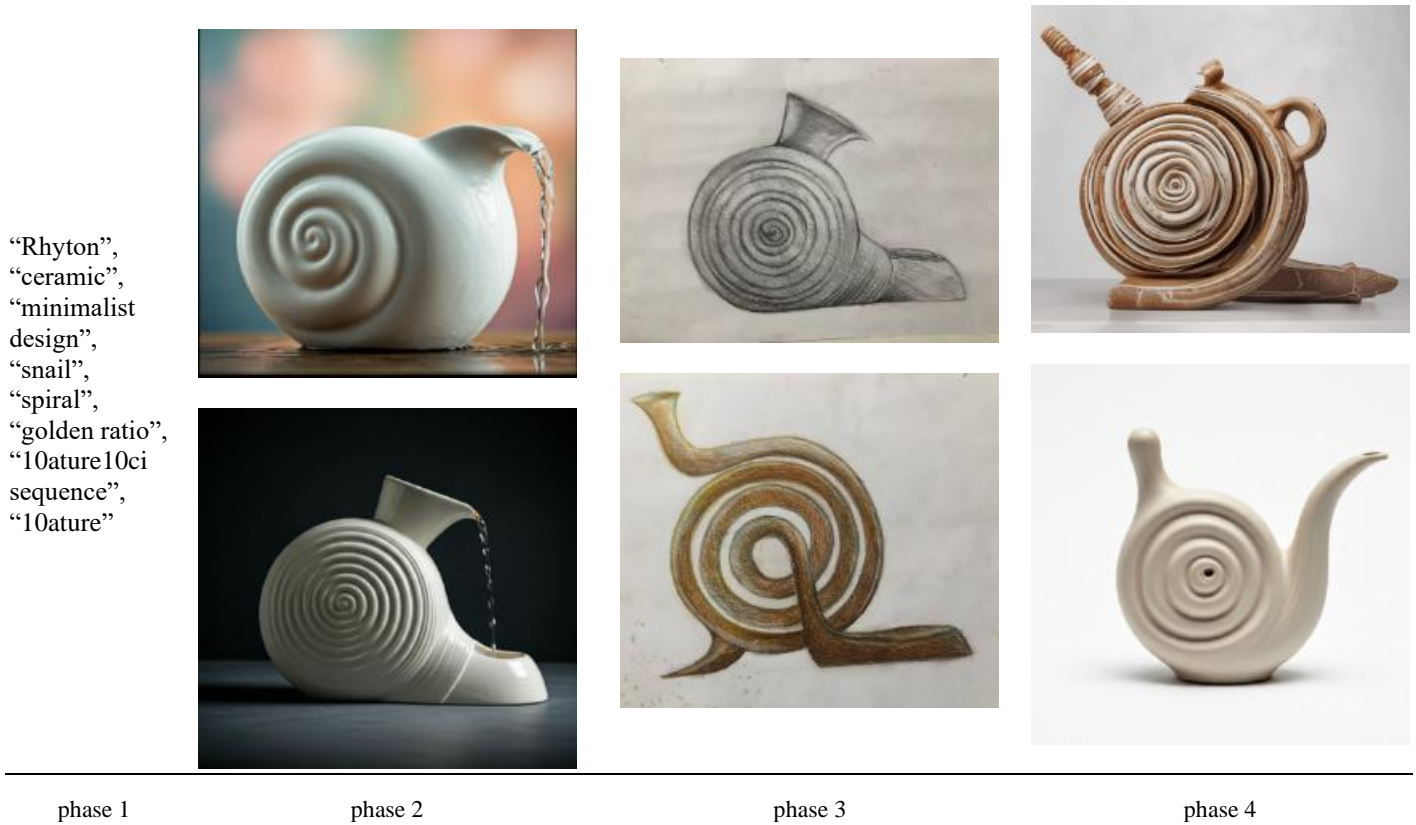


Fig. 9.

Group-6: *Drought-themed poster design: “The project aimed to design a poster to draw attention to drought, a global environmental problem. In line with the key concepts identified through ChatGPT (cracked soil, ecosystem, emotional impact, etc.), the first visuals were generated using artificial intelligence tools such as Gemini, Gencraft, and Adobe Firefly. Although visually impressive, the desert- and labyrinth-themed scene created in the first stage did not adequately reflect the intended conceptual meaning. For this reason, in the second and third stages of the design process, the focus was on enhancing the poster’s symbolic and emotional impact through the water-sphere metaphor. The final visual presents an ideal ecosystem where green nature and water are combined, creating a space of hope against drought. In this process, artificial intelligence was effectively employed as a creative tool for generating powerful visual metaphors.” (Fig. 10).*

“aesthetics”,
“drought”,
“cracked soil,
ecosystem”,
“symbolism”,
“social
awareness”,
“emotional
impact”,
“environmental
factors”



phase 1

phase 2

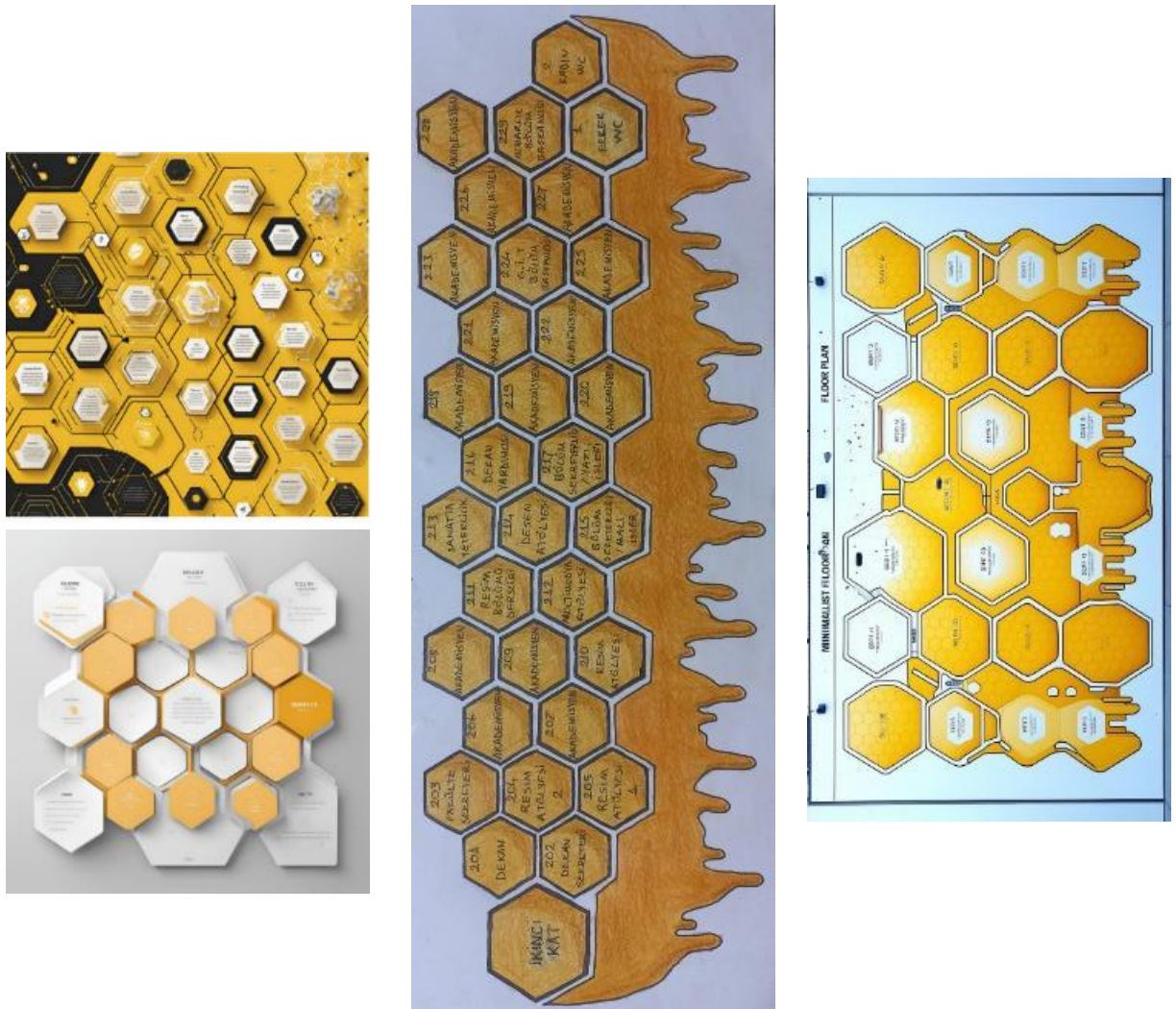
phase 3

phase 4

Fig. 10.

Group-7: *User guide inspired by the beehive: “At the beginning of the project, inspiration was drawn from the hexagonal layout of beehives and their natural function. This structure was considered adaptable, both visually and functionally, for the user guide map. The design concepts were clarified with ChatGPT’s support, and the keywords identified during this process helped shape the design. In the second phase, visuals were generated using Adobe Firefly and Canva tools. Although these visuals evoked the beehive in terms of colour and form, the desired level of minimalism was not achieved. In the third phase, the school building’s floor plan was redesigned using a hexagonal honeycomb structure, which made wayfinding and spatial organisation easier to understand. In the final stage, more advanced versions were explored by uploading the developed sketches to artificial intelligence tools. However, certain limitations were encountered at this stage; although artificial intelligence proved helpful, it sometimes failed to capture the intended design idea precisely.” (Fig. 11).*

“Minimalist design”,
 “beehive”,
 “user guide”,
 “hexagonal cells”,
 “navigation flow”,
 “smooth transitions”



phase 1

phase 2

phase 3

phase 4

Fig. 11.

Group-8: *An ethical and visual narrative against plagiarism: “The project aimed to draw attention to a common problem in the design world: idea theft. With ChatGPT’s support, keywords were identified through discussions of concepts such as ethics, originality, and creativity. Inspired by nature, the metaphor of a tree split in two was adopted: one side is alive, leafy, and productive, while the other side is dry, meaningless, and soulless. This visual distinction helped illustrate how much value an idea loses when it is stolen. A minimalist approach was adopted, using simple backgrounds and clear lines, allowing the viewer to focus directly on the tree and the message. Artificial intelligence provided an effective starting point for visualising the concepts, and these initial outputs were further developed into drawings and designs, which in the final stage resulted in a more distinctive design outcome” (Fig. 12).*

“Creativity”,
“labor”,
“copyright and ethics”,
“plagiarism”,
“tree”, “tree split in two”



phase 1



phase 2



phase 3

phase 4

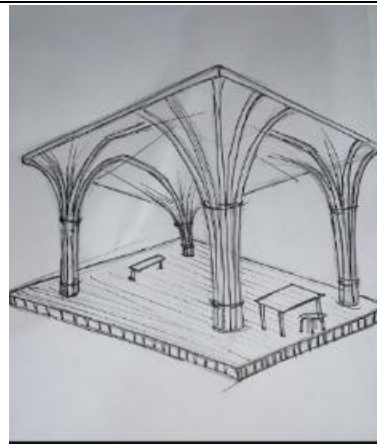
Fig. 12.

Group-9: *Bamboo top cover design: “At the beginning of the project, inspiration was drawn from the nature-compatible, flexible, and lightweight structure of bamboo material. The project aimed to develop structurally robust, ecologically and aesthetically sound covers for use primarily at the urban scale. Nature-based, organic-form structures were generated using artificial intelligence-supported visualisation tools (Stable Diffusion, Copilot) through keywords developed with the support of ChatGPT. The visuals produced in the first stage provided guidance regarding material behaviour and form language. Subsequently, the generated outputs were interpreted through drawings, and the natural fibre structure was modelled to establish relationships among columns, beams, and covers. In the final stage, the sketches were reinterpreted with the help of artificial intelligence and transformed into interior proposals. This process enabled the development of design proposals introducing new ideas beyond the traditional building language” (Fig. 13).*

“bamboo”,
“flexibility”,
“lightness”,
“renewable material”,
“natural fiber”,
“structure”,
“modular design”, “top cover”



phase 1



phase 2



phase 3

phase 4

Fig. 13.

Group-10: *Sustainable façade design inspired by the lotus flower: The project aimed to develop nature-inspired solutions to the increasing environmental pollution in modern cities. Inspired by the water-repellent and self-cleaning structure of the lotus flower, the design process focused on the façade. Keywords and a conceptual framework were developed through ChatGPT, and various visual alternatives were generated using DALL-E. The first visual outputs strongly reflected the metaphor of opening flower petals. These forms demonstrated both aesthetic and functional potential, allowing them to be transformed into seating and socialising spaces. In the third phase, the necessity of self-cleaning systems for polluted urban facades was emphasised, and these ideas were translated into sketches. In the final stage, natural materials and passive systems were integrated into digital models. The incorporation of the elegant form of the flower into the architectural design resulted in a solution that is both environmentally responsive and visually distinctive.” (Fig. 14).*

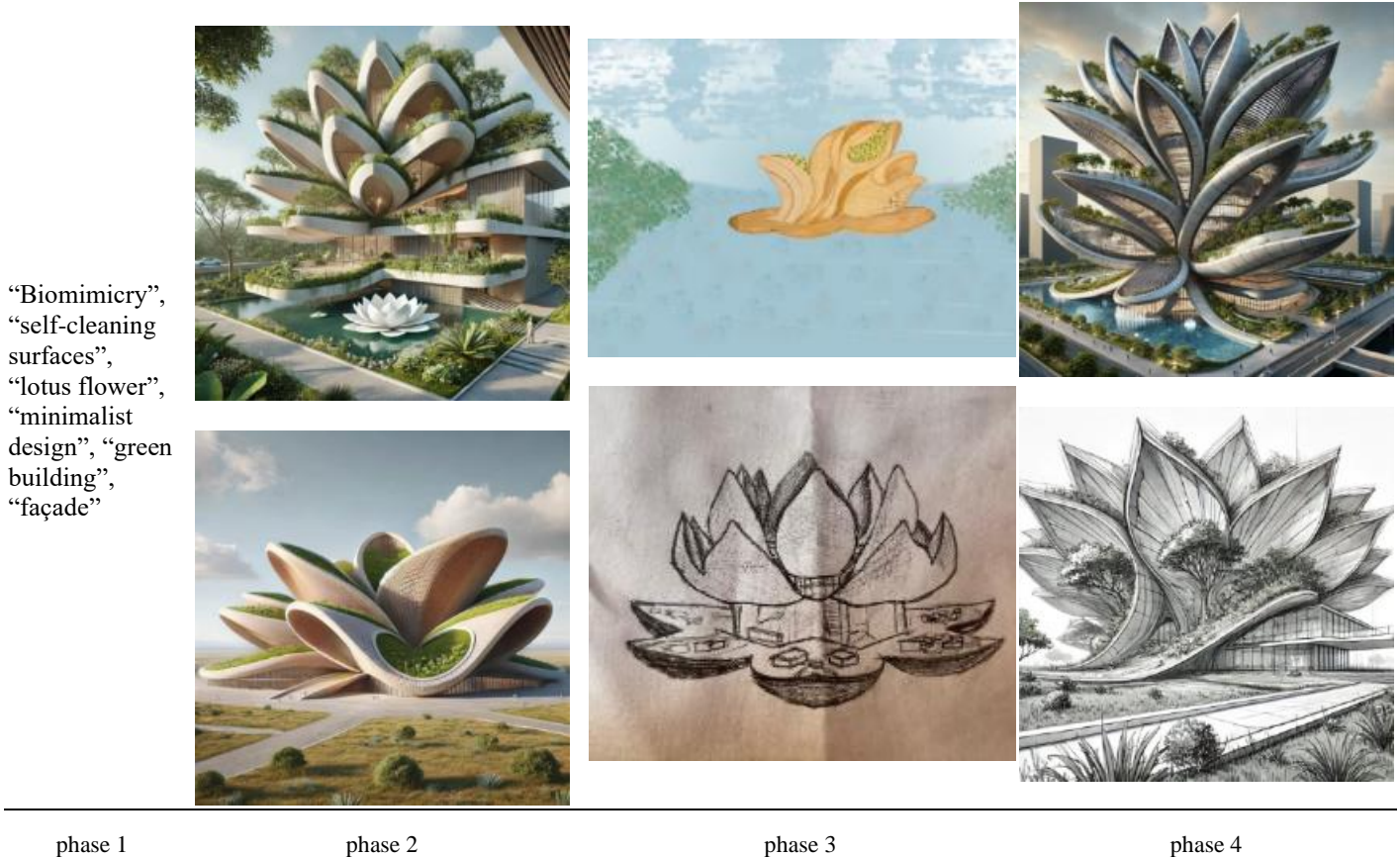


Fig. 14.

To provide a clearer overview of the studies analysed, [Table 2](#) presents the selected projects along with their recurring elements and discipline-specific characteristics. [Table 2](#) reveals that although all projects were developed within the common framework of nature-inspired minimalist design, the integration of generative AI tools differed significantly across disciplines. Traditional Turkish Arts students primarily used AI to reinterpret patterns derived from natural geometries, while painting students employed AI outputs as triggers for abstract visual compositions. In contrast, ceramics and glass students focused on the biomorphic formation of objects inspired by natural structures. In

contrast, visual communication design students used AI to construct symbolic narratives and information design systems that address social and environmental themes. Architecture students, on the other hand, explored biomimetic spatial and facade systems by translating natural structural logics into architectural form. Overall, these differences indicate that generative AI tools function not as uniform design generators but as adaptable creative mediators, interpreted and reshaped according to the epistemological frameworks and design methodologies of each discipline.

Table 2. Comparison of student projects based on AI tools, recurring design elements, and unique design strategies

Group	Discipline	AI Tools	Recurring Elements	Unique Elements
1	Traditional Turkish Arts	ChatGPT, DALL-E, Midjourney	Pattern geometry, Optical illusion, Black-white contrast	Reinterpretation of traditional Turkish ornament motifs through zebra-pattern geometry
2	Traditional Turkish Arts	ChatGPT, DALL-E, Deep Dream Generator	Floral motifs, Ornament patterns, Symmetrical composition	Transformation of traditional ornament motifs into contemporary accessory design
3	Painting	ChatGPT, Bing Image Creator	Organic forms, Natural motifs, Fractal-inspired patterns	Transformation of butterfly and leaf forms into abstract visual compositions
4	Painting	DALL-E Gemini	Dynamic digital patterns, Environmental interaction, Fluid organic surfaces	The transformation of static murals into motion-sensitive digital screens
5	Ceramic and Glass	ChatGPT, Midjourney, Stable Diffusion, Gemini	Spiral geometry, Biomorphic forms	Reinterpretation of the rhyton vessel through snail-inspired spiral geometry
6	Visual Communication Design	ChatGPT, Gemini, Gencraft, Adobe Firefly	Soil imagery, Environmental symbolism, Emotional visual narrative	Visual metaphor of a water sphere representing ecological hope against drought
7	Visual Communication Design	ChatGPT, Adobe Firefly, Canva	Hexagonal honeycomb geometry, Modular grid layout, Navigation flow	Honeycomb-based wayfinding map for organising spatial navigation in a campus environment
8	Visual Communication Design	ChatGPT,	Tree metaphor, Duality symbolism, Visual composition	Split-tree metaphor representing the loss of creative value through plagiarism
9	Architecture	ChatGPT, Stable Diffusion, Copilot	Structural forms, Organic geometry, Biomimetic forms,	Biomimetic canopy structures inspired by bamboo fibre geometry
10	Architecture	ChatGPT, DALL-E	Lotus flower geometry, Biomimetic forms, Green architecture	Biomimetic facade system inspired by the self-cleaning properties of the lotus flower

4. Discussion

The Findings section presents empirical observations from student projects and production processes, while the Discussion section evaluates these findings in the context of the research questions and the existing literature. This section interprets the effects of generative artificial intelligence tools on students' creative thinking processes, visual experiences, and interdisciplinary design approaches.

This study presented an innovative educational approach to support second-year students in the Faculty of Art, Design and Architecture in participating in creative design processes using generative artificial intelligence (GAI) tools (T2I and I2I). In the first eight weeks, the educational process provided students with theoretical knowledge of the basic concepts of artificial intelligence, generative artificial intelligence tools, prompt engineering, ethical use, and societal impacts; in the last six weeks, an application phase was initiated in which this knowledge was reinforced through individual project work. Students produced visual solutions to their own design problems using different UI tools and received feedback by presenting their outputs in the workshop environment. The pre-test and post-test results showed significant improvements in both students' knowledge levels and their attitudes towards the use of artificial intelligence. This development revealed that the students transformed their initially limited knowledge of AI into functional skills during implementation. In the projects carried

out within the scope of the four-stage production model, it was observed that artificial intelligence tools triggered the creative process, provided visual diversity and deepened individual interpretations. Thanks to the visual production tools, students concretised concepts inspired by nature, and then turned to freehand drawing and digital design applications based on these visuals. The I2I transformations in the final stage enhanced the designs' formal dimensions and increased creative experimentation. This process shows that students began to position generative artificial intelligence tools not only as tools but also as conceptual and aesthetic partners. Interdisciplinary observations revealed that each department interpreted artificial intelligence differently. While the Traditional Turkish Arts department reinterpreted cultural motifs in a contemporary context, the Architecture department developed sustainable urban proposals with biomimicry-based buildings. Visual Communication Design students designed posters and user guides with social messages; Painting students produced abstract compositions by using artificial intelligence as a creative trigger. Ceramics and Glass students reinterpreted traditional forms and used artificial intelligence tools to inform form research and aesthetic prototyping. This diversity reveals the flexibility of generative artificial intelligence to integrate with different artistic and design languages. At the same time, it shows that each discipline repositions AI technology in line with its own production dynamics. This suggests that student profiles,

educational backgrounds, traditional approaches, and digital literacy levels may be effective in this differentiation. For example, the algorithmic thinking habits of architecture students established a more technical link between AI and spatial modelling, while art students evaluated these tools in an intuitive and experimental way. These differences point to the need to personalise AI-based education in interdisciplinary teaching environments. However, some groups experienced limitations at certain stages of the process. Especially in cases requiring abstraction, symbolic meaning generation, and conceptual depth, it was observed that artificial intelligence produced limited outputs, necessitating student intervention. This situation shows that productive artificial intelligence tools should be considered as a supportive element in the educational context, and that the human remains at the centre of the creative process. In this context, the study succeeded in creating an environment that transforms human-AI interaction into a holistic learning experience. Significant improvements were observed in the post-test results after the course implementation was completed. The increase in the knowledge level of the students is clearly visible; while the rate of “very low” knowledge level completely disappeared, the rate of participants who stated that they had a “high” and “very high” level of knowledge increased significantly. It is seen that the “high” and “very high” options are concentrated especially in the titles of “the impact of AI on design” and “the contribution of the use of artificial intelligence to art and design education”. This shows that the course positively improved students' perceptions and skills (Fig. 15).

According to the pre-test and post-test results, the productive artificial intelligence-based education module significantly improved students' knowledge, experience, and attitudes towards artificial intelligence. Students began to evaluate the contributions of artificial intelligence tools to the design process in a conscious and functional way; they made significant progress toward using these tools strategically in creative production.

The results obtained are in line with the findings emphasised in the literature. In particular, studies such as Ringvold et al. (2024) [20], Yıldırım (2022) [21], and Vartiainen & Tedre (2023) [10] have shown that generative artificial intelligence tools add visual richness and creative diversity to learning. Moreover, studies such as Marsault (2025) [16] and Fareed et al. (2024) [17] highlight the artistic interpretations and pedagogical contributions of I2I processes. Similarly, Hutson et al. (2023) [22] point out that generative artificial intelligence models increase student productivity in visual communication and digital arts; Tao et al. (2025) [23] point out that the combined use of T2I and I2I models in the digitisation of traditional crafts provides pedagogical and cultural openings. While Lee et al. (2024) [15] state that students achieve personalised design outputs using local context-sensitive AI models in architecture studios, Turchi et al. (2023) [18] show that generative models increase the speed of idea generation and the richness of variation in the context of human-AI co-creation. In this context, the current study makes unique contributions to the literature by focusing on an interdisciplinary group of students and by combining a project-based learning approach with production processes.

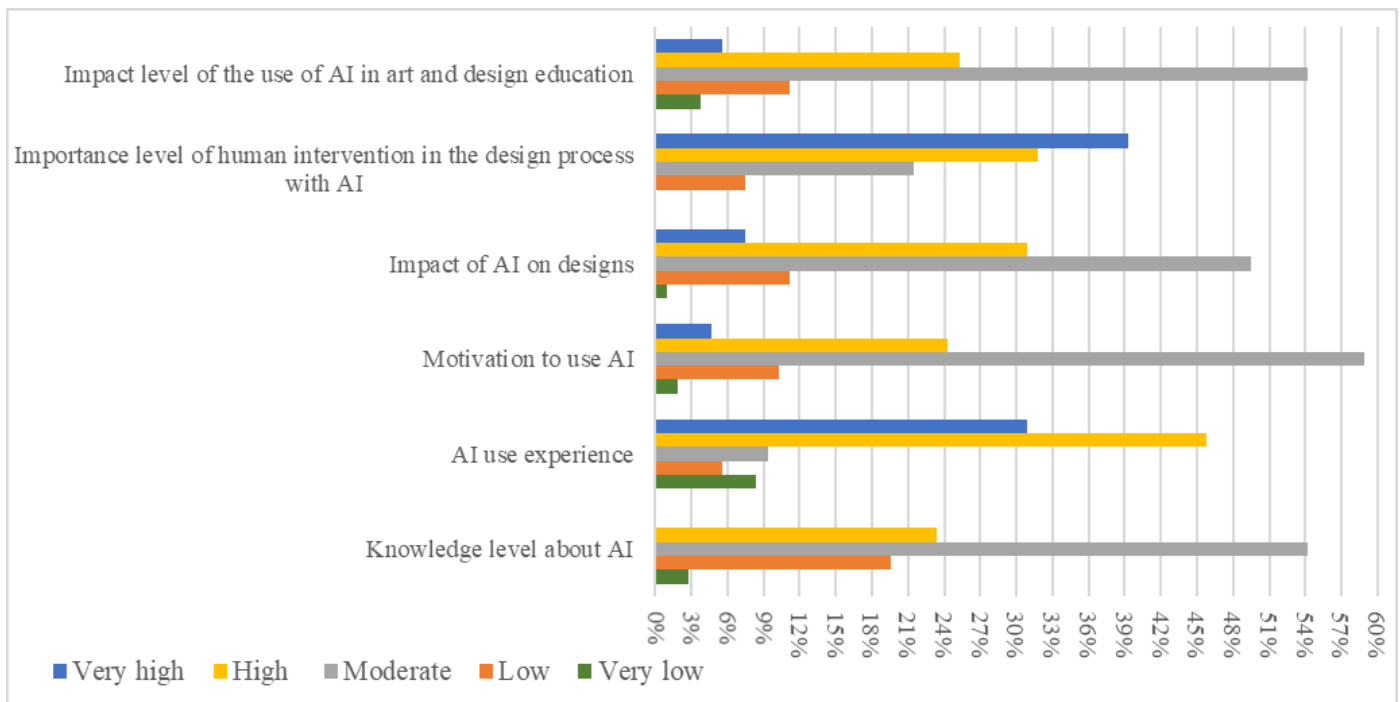


Fig. 15. Post-test results regarding students' knowledge, experience, and attitudes toward AI

5. Conclusion

This study presents a holistic teaching model that integrates generative artificial intelligence (GAI) tools into the creative design processes of art, design, and architecture students. The model is structured around a progressive learning experience that combines theoretical literacy, prompt development, conceptual abstraction, and AI-assisted visual production. This approach, which integrates theoretical and applied content, goes beyond a tool-based teaching model, aiming to develop students'

conceptual thinking, aesthetic evaluation, and critical interpretation skills simultaneously.

Over the course of 14 weeks, students from 5 departments, guided by the theme of "nature-inspired minimalist design," used generative AI tools with an exploratory and critical approach to produce design outputs tailored to their disciplines. The project outputs demonstrated that students not only used AI as a tool for initial visual production but also reinterpreted these outputs through hand drawings, digital illustrations, and iterative design

processes. A four-stage workflow – prompt development, text-to-image production (T2I), manual reinterpretation, and image-to-image conversion (I2I) – systematically structured the integration of AI into student design processes while simultaneously creating significant space for human creativity and design guidance. In this context, AI was not treated as a tool that replaced artistic intention, but rather as a catalyst that supported the processes of idea generation, variation production, and formal experimentation.

Although generative AI technologies continue to develop rapidly, the proposed four-stage workflow offers a conceptually strong and sustainable framework because it centres on human-centred interpretation, iterative design thinking, and critical evaluation processes rather than relying on a specific tool. Therefore, even if more advanced and autonomous AI systems emerge in the future, the model's pedagogical validity can be preserved.

The quantitative and qualitative data obtained indicate that this educational approach has led to significant improvements in students' knowledge and attitudes towards the use of artificial intelligence. Students have begun to view generative AI tools not only as a means of production but also as creative partners in idea generation, formal transformation, and conceptual exploration processes. This transformation is particularly important in the context of rapidly evolving artificial intelligence technologies, as it encourages students to position themselves not merely as passive users of automated systems, but as critical designers who guide, evaluate, and reinterpret algorithmic outputs.

In conclusion, this study presents a scalable and interdisciplinary pedagogical framework for integrating generative AI tools into art, design, and architecture education. The proposed model not only enhances students' technical competencies but also strengthens their critical thinking and aesthetic evaluation skills in algorithmically supported creative environments. Furthermore, given the rapid development of generative artificial intelligence technologies, the sustainability of the proposed pedagogical model is a significant area of debate. The approach developed in this study has a flexible structure based on conceptual thinking, iterative design processes, and human-centred interpretation skills, rather than relying on a specific AI tool. Therefore, even if more advanced and autonomous AI systems emerge in the future, the model's fundamental pedagogical principles may remain valid. Even as technological tools change, human creative guidance, critical evaluation skills, and aesthetic interpretive capacity will remain central to design education.

Future studies could evaluate the impact of this model on long-term learning outcomes, examine its adaptability to different creative disciplines, or explore its integration with new generative technologies such as multimodal AI systems and domain-specific trained models. In this context, design education could transform from a field that teaches only tool use into a learning environment that cultivates designers who can think critically, adapt, and act with ethical responsibility in the age of generative AI.

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