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USE OF ARTIFICIAL INTELLIGENCE AND PROMPT LITERACY IN ARCHITECTURAL EDUCATION

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Abstract. Generative artificial intelligence (GenAI) models are mostly text prompt tools trained with natural language models and can produce fast visuals. This article includes applications designed to investigate the role and contributions of GenAI models, which have become widespread in many fields of design applications. The designer's role in the visual production process made with these tools differs from traditional production techniques. The study is designed to discuss the role of GenAI models in design processes, their contributions and their disadvantages. A master-level course, "Principles of Digital Design and Fabrication in Architecture" (PDDFA), offered by the Gazi University Architecture Program, was examined as a teaching experiment. A total number of six graduate students have participated in the course. During a semester, texts selected from the novel "Alice in Wonderland" were visualized using three different methods: analog collage, digital collage and AI-assisted design. While visual products provided quantitative data for evaluation, experiences were listed and the study's qualitative data was created. Following this two-stage data accumulation, student experiences were measured with a survey. Student experiences were measured with visual data and parameters that are effective in production, such as size, style, AI model, prompt content, prompt guidance and survey questions. It was concluded that product quality depends on criteria such as writing skill, abstract/concrete prompt content and competence of the AI tool.

1.   Introduction

The technological advancement of design and production tools has played a significant role in design throughout history (Kopuz, 2022). Technology is developing unpredictably; advancements in this field are not linear or constant (Erten & Göktepeliler, 2022). Computers and digital tools are now significant auxiliary tools in the design process, along with the development of digital design tools and technological advancements, as higher education models evolve in tandem with these developments (Gül *et al*., 2013). Today, computers are widely used as a representation tool (Akipek & Inceoğlu, 2007). Computer-aided drawing (CAD) programs have been utilized in architectural education for the past twenty to twenty-five years and they have many beneficial aspects for the design process (Mıhlayanlar & Tachir, 2019). However, over the past ten years, computer technology and digital tools have found a more specialized

and advanced application in architecture. However, using technological tools in design is not limited to this only. With the quick advancement of technology, terms like artificial intelligence, artificial neural networks, machine learning, data mining, parametric design and computational design have become commonplace. As artificial intelligence technologies have advanced, various fields use computer-aided tools to comprehend, interpret and generate solutions like humans (Topuz & Alp, 2023).

In addition, with the development of artificial intelligence applications and digital tools, applications such as coding, conceptual design creation and composition production make evaluating existing graphic designs possible. According to Norvig Russell (2010), artificial intelligence is a technological advancement that endows machines with human-specific capabilities like language analysis, learning and decision-making. Atalay and Çelik (2017) define artificial intelligence as "Mainly techniques such as expert systems, genetic algorithms, fuzzy logic, artificial neural networks, machine learning and artificial intelligence technologies in general". Therefore, discussing artificial intelligence's ability to reflect ideas and its potential contributions to the idea-generation process and creativity is essential. Creativity can be defined as new possible combinations of existing ideas (Hakak *et al.*, 2014). Productivity in the architectural design process correlates directly with the idea's ability to be represented (Bayram *et al.*, 2023). "Revealing problems in an area that is not fully defined and then finding solutions to these problems by using cognitive mechanisms" is how innovation is defined in architectural design (Önal, 2011). The definition of creativity is also evolving with digital developments such as artificial intelligence applications and computational design (Kavakoğlu *et al.*, 2022).

Apart from the studies referenced in the literature, there exists a multitude of research on the application of artificial intelligence in domains like engineering and healthcare. However, the number of studies concerning the possibilities of AI models that generate visual content from textual data is restricted (Lee *et al.*, 2023). Liu and his colleagues combined ChatGpt, DALL-E and CLIP software to create images that are impossible to develop with CAD software. Lee focuses on the connection between prompt and visual creation when using generative artificial intelligence models and language proficiency. Uzun and Çolakoğlu (2019) aimed to train artificial neural networks using a pixel-based dataset containing architectural plans and sections and stated that the results were 80% accurate. Sorguç et al. (2022) integrated machine learning into an architecture course and planned a course program on experiencing actions such as structural areas like sunlight optimization, two-three-dimensional drawing and visualizing data with Varinlioglu et al. (2016) conducted a pilot study on integrating a course curriculum consisting of a series of workshops based on computational thinking into undergraduate architecture education. Although artificial intelligence has positive features like innovation, creativity and accessibility in visual design and architectural design processes, it also addresses concerns like limited references and lack of ethical compliance, according to Radhakrishnan (2023). Tong et al. (2023) carried out an application in which three-dimensional productions made in the physical environment in a basic design studio were transferred to the virtual environment and visualized with spatial features using Midjourney, one of the artificial intelligence tools, artificial intelligence tools have served as an aid in this work. Başarır (2022) proposes a course content for integrating artificial intelligence into architectural education. Mazonne and Elgammal (2019) discuss the functioning of generative adversarial networks (GAN) and their potential, propose a generative designer artificial

intelligence model called "AICAN" and offer an artistic approach to productions made with artificial intelligence.

Unlike the studies mentioned in this study, methods for prompt development were researched. The collage technique, used in various art branches, was integrated with artificial intelligence tools. Artificial intelligence tools with the "text to image" principle, working with GPT language models, produce easily accessible, fast and editable visuals (Kasneci *et al.*, 2023). For this reason, GenAI models with the "text to image" principle were used as tools in this study.

Schmitt (1997) considered that computers will take part in design processes in the future as working partners rather than auxiliary tools. Based on this assumption and current concerns, this study examined the designer-productive artificial intelligence relationship. As an auxiliary tool in the early stages of design, what are the potential applications of artificial intelligence tools that allow the production of images from text? Can tools for artificial intelligence enhance creative thinking? We looked for answers to these queries. For this reason, a group of graduate students were asked to create collage works and artificial intelligence-supported visual productions concerning a chosen fictional text during a course in the Principles of Digital Design and Fabrication in Architecture course offered at the Gazi University Architecture Program. Visual productions were executed in three stages: digital collage, analog collage and artificial intelligence studies. The latter two stages involved the advancement of the former two in different ways. The function of artificial intelligence in the design process was examined by contrasting the images generated by these stages with manual production. The images were also compared both internally and with other production methods from different perspectives.
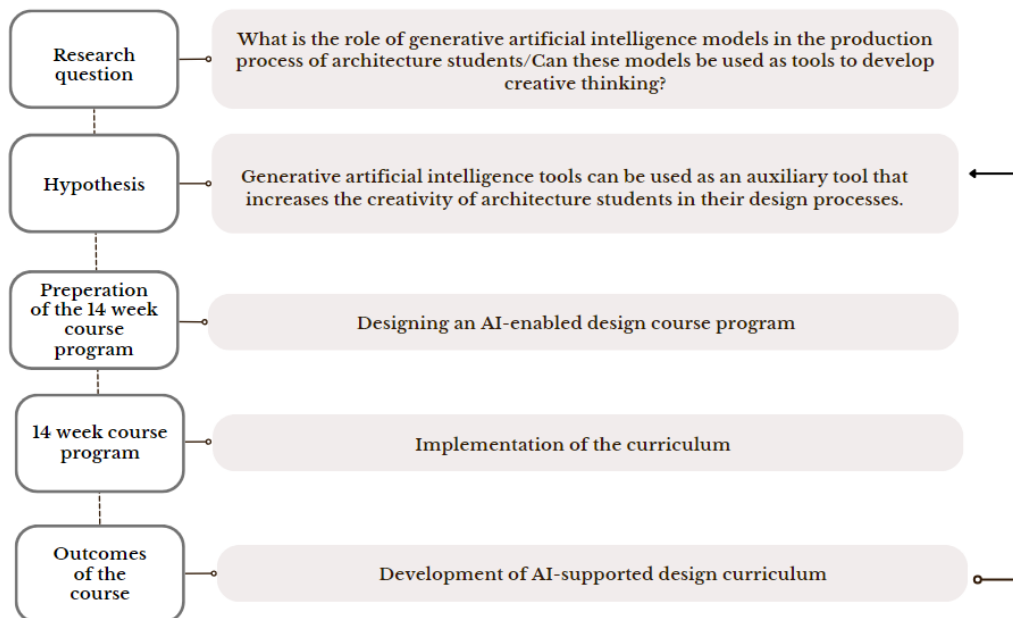

Figure 1. Flow chart of the study

Students' design experiences and the results of workshops and online courses are presented in this paper. The study's primary goals are to explore the role of language- and visual-based artificial intelligence models in design, to create an example of how

creatively architecture students use AI-supported visual production tools and to develop a creative, inquiry-based learning process. The work and flow chart shown in Figure 1 was followed during the process.

2.   Methodology

Six students participated in artificial intelligence-supported visual design exercises in the Principles of Digital Design and Fabrication in Architecture course Gazi University Department of Architecture Master's program. The exercises were based on a chosen fictional text. The children's book "Alice in Wonderland" was selected as a work of fiction because it combines abstract ideas like chaos and serenity with concrete concepts like scale and size changes in space. After reading the book, students were to select a passage and using their own words, recreate a scene from it. The participants were students whose native language was Turkish, yet the program was English. Students were asked to read the novel from the original English version and write prompts in English with the word groups they obtained from this text. While writing the prompts in English, the aim is to increase the visual quality by using the images in the productive artificial intelligence tools database. Three stages of the design process-analog collage, digital tool collage and AI-supported digital production-have been planned for after text production is finished.

Collage is a method of visual production that combines disparate pictorial elements to convey new ideas within a single work (Shields, 2014). Ergün defines collage as "a new concept obtained by using all kinds of organic or inorganic ready-made materials, printed, drawn or photographic materials (images) by separating them from their previously known life context and pasting them on a surface with a new concern for fictionality to serve in a new context". The "diffusion" process carried out by artificial intelligence models founded on the "text to image" principle is comparable to the procedure outlined here. Language models are trained and replicated to respond to the desired texts visually while existing image sets are distorted (Cao *et al*., 2023). Text prompts replicate the manual fragmentation of pre-made images during the collage process, which is then fragmented using a similar logic during the artificial intelligence-driven diffusion process.

Collage is considered appropriate for the visual expression of fictional text because it is based on basic cutting and pasting processes and allows for quick visual production. After finishing their analog collage studies, the students were asked to reconsider the texts they had created using the passages and a digital collage study was conducted using the newly created texts as a guide. For digital collage, students could select from recommended programs like Canva, Illustrator, Photoshop and others.

After completing their college studies, the students were introduced to the principles of several text-based artificial intelligence tools, including;
- Adobe Firefly;
- DALL-E 2;
- Leonardo AI;
- Prome AI;
- Playground AI;
- Recraft AI.

In the first phase, students were required to conduct basic experiments using a specific model. They were expected to request visual productions with varying styles,

prompts and image sizes from the same artificial intelligence tool and to encounter the same prompts in various genAI tools over the next few weeks. It has been noted that prompt changes are directly correlated with the visual product's quality in most cases. Another significant factor is the ability to customize the appearance of AI tools, such as effect and style, through plugins. When given the same prompt, different styles-such as comic book, sketch and papercut-were employed and it was found that some produced better results than others. Experiments conducted with a fixed number of variables provided insights into the factors influencing the quality of output produced using AI technologies. Furthermore, it has been noted that specific experiment images, including images of humans and animals with anatomical problems, have a variety of flaws. At this point, one production step involved improving the visuals' consistency across different edits.

These trials allowed the processing of the model, prompt, style, prompt guidance parameters and the models and prompts used in the editing phase into an evaluation table. This allowed for examining the relationship between visual product quality and production processes (Figure 2).
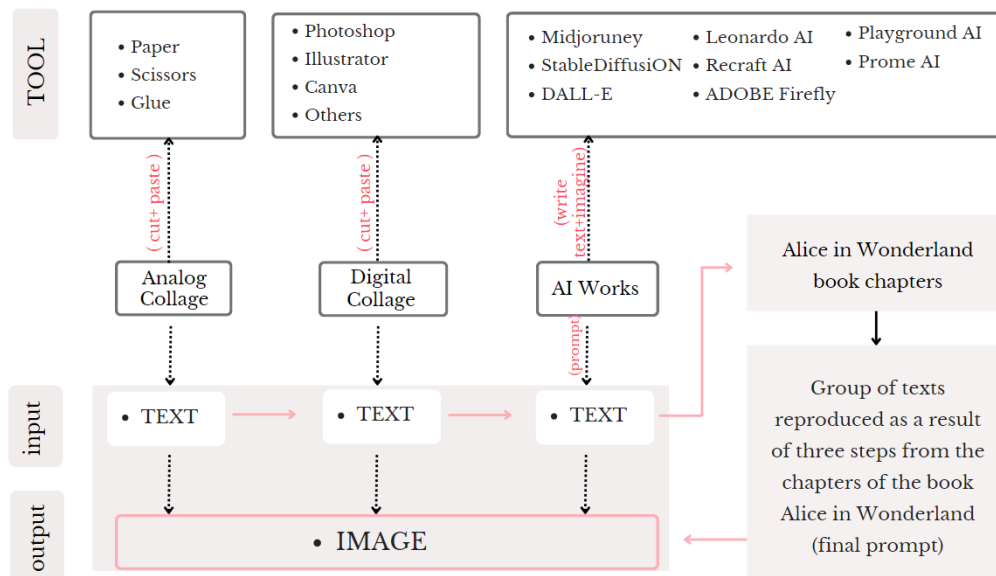

Figure 2. Working principles of selected "text to image" visual production tools

To help students better grasp the theoretical and practical aspects of the subject, the course material has been updated in line with the study's research question and enhanced with reading lists, in-class workshops and homework assignments (Table 1).

Student practices were examined using a two-stage hybrid method, qualitative and quantitative. Students were asked to evaluate the prompts they used in the early stages of the study, the prompts they used during the process and the prompts they used at the end of the semester, together with their visual results. Then, five visuals that best reflected the words in the prompt were selected from the visual productions and the reflections on this production process were taken as qualitative data. The words that gave the most successful results during this production and those that needed the most changes were listed in the second stage. After these two data groups were evaluated, a survey was made and a quantitative evaluation of the process was provided.

Table 1. The weekly program of the course

Week	Content	Hour
1	General information about the lecture	3
2	Readings on collage works in architecture /Student representations and reflections	3
3	Student reproduction of passages from Alice's Adventures in Wonderland/ Collage workshop	3
4	Transformation of fictional texts /Digital collage workshop	3
5	Artificial Intelligence- Principles of generative AI tools- text-to-image concept	3
6	Information about artificial intelligence tools, student suggestions	3
7	Visual production experiments via productive artificial intelligence tools/	3
8	Presentations/discussion of artificial intelligence-supported visual productions	3
9	Discussing visual designs produced by different artificial intelligence tools	3
10	Practices on plugins (editing/ out zoom/ zoom/ edit in canvas/ painting/ outpainting/ styles)	3
11	Student works on combining multiple genAI tools in one visual design	3
12	Student works on combining multiple genAI tools in one visual design	3
13	Editing selected images with the help of editing tools	3
14	Discussion on the evaluation criteria for the production process with artificial intelligence and the parameters affecting the quality of the final product	3
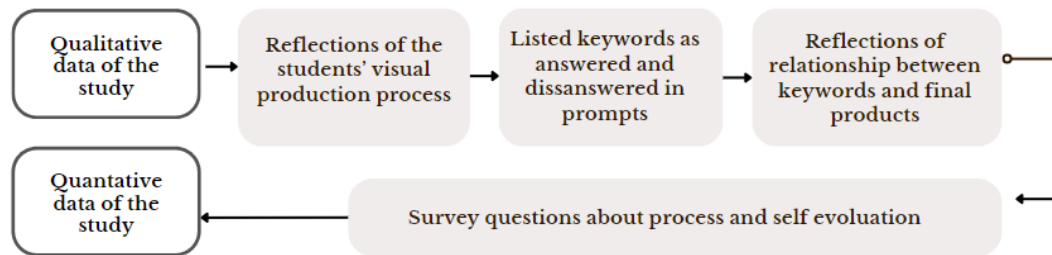
Figure 3. Flow chart of hybrid research method

3. Findings

The collage works made by the students, AI-supported visual productions, were examined in two tables, including the method, input, effect, prompt guidance value, size and editing stages and the final products. Student experiences were measured with survey questions consisting of a 5-point Likert scale and open-ended questions.

Students were asked to experiment with visual production during the seventh week of the course using the texts from their collage pieces and the artificial intelligence software covered in class. It has been reported that some sentence structures and words in the prompts need an equivalent in visual productions, even though the texts in the prompts are clearly defined and concise. At this point, students were asked to select visual products from the written prompts that produced exciting results and then discuss the connection between the prompt and the visual.

Student B intended to produce a scene from the passage "Advice from a Caterpillar" where Alice talks to the caterpillar and there are mushrooms of different sizes (Table 2).

The 1st picture gave the result most relevant to the entered prompt. The second picture has no caterpillar and Alice is quite large. In the 3rd picture, the phrase "two sides of the mushroom" caused the page to be divided into two.

Table 2. Artificial intelligence experiences and prompt development of Student B

Student B	Works	AI Tool /Model	Prompt	Self-reporting
1		Prome AI	A whimsical scene of a giant Alice towering over a forest of tiny trees on the left, while on the right, a Miniature. Alice sits atop a mushroom with a curious caterpillar. A winding path leads through the middle, inviting you to explore this fantastical world.	More clearly explaining both sides resulted in a closer result to the desired result. What was still wrong here was the presence of too many mushrooms.
2		Prome AI	In the world where the caterpillar sits on a mushroom, Alice sets foot in a world where there is no normal. She loses her identity, copes with change, and discovers the importance of adaptation as she reaches different dimensions.	While I wanted a caterpillar sitting on a mushroom, Alice was drawn sitting on a mushroom. At the same time, many mushrooms were added as we wanted to emphasize the differences in size. Therefore, it was aimed to eliminate situations that confuse.
3		Prome AI	Two sides of the mushroom, a growing and shrinking Alice, and a wise caterpillar	When the two sides of the mushroom were mentioned, the page was divided into two, and a mushroom was drawn on each side. Since this is not a desired situation, it was intended to be explained more clearly.

Student F (Table 3) stated that the physical description features of Alice in the prompt found a response in visual production. However, some limb problems are not explicitly mentioned in the prompts. While the human face and anatomy issues could be

solved thanks to the undo command, the changed prompts and styles did not provide successful results for the animal figure.

Table 3. Artificial intelligence experiences and prompt development of Student F

Student F	Works	AI Tool /Model	Prompt	Self-reporting
1		Leonardo AI	Alice pushes the boundaries of the space she is in, and her body begins to spill out; the small animals outside are thrown into fear and chaos as Alice grows to a gigantic size; they start throwing stones at Alice, and the stones turn to cake, forest background.	The expression "a house, a girl in front of the house" provided more precise, realistic, and successful visuals than the expression "the girl is leaving the house." The visuals found no response for expressions such as "Push the limit, spill, reach gigantic sizes, start throwing." Nouns such as "Alice, stones, forest" were removed from the text to create the image.
2		Leonardo AI	a worried little girl, jamming, distorted body scale, a house, small forest animals, abstract style, forest background	Commas separate the adjectives used. Subjective adjectives and the absence of a specific object render the request insufficient. Objective statements such as "blonde, flying, standing on the ground" generally gave positive results. Relative expressions such as "big, small, too much" and "small as a matchstick girl" did not produce satisfactory results with the AI.
3		Prome AI	A destroyed small village house, a scared girl running away, dense forest background, big trees around, tiny cupcakes on the ground, pieces of rock flying in the air, a crowd of animals, an atmosphere dominated by feelings of fear, chaos, anxiety, and anger	It has been found that the characteristics of some words in the prompt affect the reflection of other words in the result. Negative connotations such as "chaos, anxiety, anger" prevented positive expressions such as "cupcake" from being included in the visual. However, when models and effects that create a more positive perception are selected in production, both expressions find visual equivalents.

Student E (Table 4) stated that he could not obtain meaningful results when he separated adjectives and nouns with commas and that interpretable and relative adjectives did not express their meaning in the text in the visual output. In addition, it has been stated that concepts such as chaos and anxiety, which indicate negative emotional states, prevent the visibility of concepts that contain relative contrasts and colors, such as cupcakes. It has been observed that providing the desired situations, such as chaotic and dark atmosphere in the visual with the image style instead of the prompt, provides a more accurate representation of other concepts in the prompt.

Table 4. Artificial intelligence experiences and prompt development of Student E

Student E	Works	AI Tool /Model	Prompt	Self-reporting
1		Leonardo AI	Beautiful Alice with wet and blonde hair, confused, running with many animals, a race, next to the forest, shining sun.	It was found that by specifying the defining 'characteristics of people' (blond and wet hair, beautiful, etc.), more successful visuals were obtained in line with these characteristics. However, the following image has problems with the limbs without descriptive features. In addition, the artificial intelligence that emphasized the word race reflected this in Alice's outfit.
2		Leonardo AI	Imagine a scene with Alice in Wonderland, Alice with wet and blonde hair, back turned, running various animals in front of Alice, Mobius strip, collage style.	It was found that more effective visual production was achieved with commands such as 'imagine.' In addition, more visual results were obtained with 'keywords' such as 'Mobius strip.' In order to hide the errors in the human faces and limbs, the 'back turned' command was used. However, it was not determined how to correct the errors in animals.
3		Leonardo AI	Imagine a scene with Alice in Wonderland, Alice with wet and blonde hair, back turned, running various animals in front of Alice, Mobius strip, cut paper style.	Adding 'style' to the prompts increased the effect of the visual. However, no solution was found for the problems related to animals. It is thought that this problem will be solved in the editing phase.

3.1. Development Stages of Production Made with GenAI Models

Productivity in artificial intelligence research began with attaining the level indicated by the prompt development tables. Nevertheless, as noted in the student statements, these products' final products cannot be approved regarding color, image quality, object scale relationships or any other aspect. Because of this, methods for enhancing the image generated by one or more artificial intelligence tools-either the same or different tools-have been researched. The tools used here, Prome AI, Leonardo AI, DALL-E 3, Playground AI and Adobe Firefly, have different editing interfaces and plug-ins. After investigating these interfaces, students were instructed to make changes to the portions of the images on canvas that they felt needed improvement. While all the plug-

ins operate essentially on the same principle, some tools have been found to yield more successful editing outcomes than others. The "AI work process" table was used to analyze the procedure.

Table 5. AI work process of Student E

Although the students produced many works, only those they deemed successful in scale, the relationship between prompt and result, visual quality and composition were included in the evaluation, along with their production methods. The table consists of editing stages, tools, prompts and styles used, as well as the prompt text that displays the first output, the AI model used, style/effect options and prompt guidance value. The style/effect discussed here can be conceptualized as a visual effect that gives the image a distinctive color scheme, drawing language and lines. Conversely, students are free to

choose how to use prompt guidance, which numerically indicates the degree of development of the prompt that they wrote with the assistance of artificial intelligence.

In Table 5, Student E produced a scene from the passage "A Caucas-Race and A Long Tale" from Alice in Wonderland. In this scene, the animals and Alice try to dry themselves by constantly running around a circle in a pool of tears. This cycle is expressed in a circular form. Student evaluation at the end of the process is as follows: *"The biggest problem of the image obtained in Prome AI is that there is only one kind of animal. Accordingly, animals were deleted in Recraft AI and rabbits and cats were added to Prome AI. However, although the added animals were asked to stand with their backs turned, it was unsuccessful. Finally, Leonardo AI continued the loop around the image".*

Table 6. AI work process of Student A

In Table 6, Student A produced a scene from the "Down the Rabbit Hole" passage. In this scene, Alice changes size while falling down the rabbit hole and becomes aware

of this as she falls. The rabbit hole is treated like a black hole due to this. Student evaluation at the end of the process: *"The thematic diversity and high-quality visual elements of Adobe Firefly, combined with the capabilities of my preferred AI tool, offer a wide range of creative possibilities. A notable challenge surfaced in Adobe Firefly's difficulty generating realistic human faces. Despite this limitation, the combined strengths of these AI tools provide a promising platform for creative expression and design".*

Table 7. AI work process of Student C

Student C	Final Product		AI Tool : Prome AI
			AI Model: Leonardo AI
			Effect 1: Paper Cut-01
			Effect 2: -
			Effect 3: -
			Guidance: 35
			Resolution: 512 x 512 px

Prompt: Alice in Wonderland, looking at the distant shore, Pool of Tears, water collecting, abstract visualization, border, despair, offshore, animals in the water.

Steps and Prompts of Editing

| 1 Leonardo | Draw skyline. | 2 Leonardo | Futuristic mountain. | 3 Leonardo | Mountain from tears. |
| 4 Leonardo | Snowy Mountain. | 5 Leonardo | black hole picture | | |

In Table 7, Student C produced a scene from the "Pool of Tears" passage. Alice remains in a pool of tears in this scene and cannot escape. This inability to move away is expressed by the differences in scale of the pool and Alice and the paper-cut style that gives the appearance of stained glass. Student evaluation at the end of the process is as

follows: *"As routing increases, AI appears to become more involved in the image production process. When there are too many referrals, the distance to the referrals increases. The visual begins to become abstract. The editing process reminded me of collage work from the beginning of the work".*

3.2. Final Submissions

Tables 8, 9 and 10 contain the images produced in three different production steps, the method used in these production steps and the personal evaluations made by the students for each step.

Table 8. Comparison of collage, digital collage and AI works processes of Student A

Analogue Collage	Method	By cutting and pasting appropriate visuals taken from some magazines, newspapers, etc.
	Prompt	After falling into the rabbit hole and reaching a new universe, I designed a collage of "Alice," who evolved into different variations of herself through the changes she underwent during this long journey. I depicted the rabbit hole as black, symbolizing Alice's dynamic journey by using two hands holding this black hole, through which Alice thrust herself.
	Self-evolution	I aimed to represent the infinite journey of our story's protagonist across two different periods and the transformations she underwent. I used various human visuals to symbolize our hero's differentiation. After this collage story, which I limited to a frame, I expressed the person Alice became in her real world after her journey and changes with different "Alice" images. The first of the difficulties I experienced was finding images suitable for the text I was preparing the story for from the magazines or newspapers I owned. Another challenge was to adapt the images I found to each other dimensionally.
Digital Collage	Method	By finding appropriate visuals on the Internet and combining them using a tool named Photoshop
	Prompt	I symbolized the transition to a long journey through falling down the rabbit hole and reaching a new universe with a particular frame. I used clock figures to show different temporal dimensions. I described the inside of the frame as a different universe and the outside as a different universe.
	Self-evolution	Since we can access unlimited images online, finding images that fit my story and provide a balanced collage combination was challenging. Apart from this, in my opinion, it is a more accessible and more balanced collage work than handmade collage work. The first reason is that the internet is an unlimited resource, and the second reason is that it is straightforward to adjust the size of the relevant images and edit them using Photoshop.
Aı Art	Method	By using an artificial intelligence tool named Adobe Firefly
	Prompt	Generate wide angle landscape scene of Alice in Wonderland, a detailed and intricate environment, illustrates eternity, transformation, a new universe, colorful roses and books in the black hole, and global illumination. Alice is looking into the colorful black holeshe has long blond hair.
	Self-evolution	The first of the positive aspects is that the resulting products can be edited with artificial intelligence tools, the second is the ability to produce unlimited products, and the other is to create visuals according to different styles. Besides this, I also experienced some difficulties. These are: When creating human or animal images, bodily parts such as hands, arms, legs, and eyes cannot be created properly; creating the appropriate prompt requires experience and practice, high quality in most artificial intelligence tools, and the application of all styles require premium membership or credit.

Table 9. Comparison of collage, digital collage and AI works processes of Student E
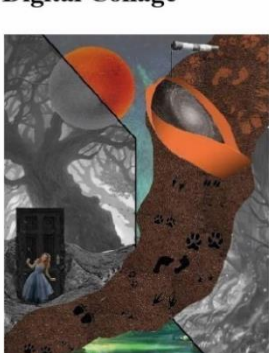
Analogue Collage	Method	By cutting and pasting appropriate visuals taken from magazines, newspapers, etc.
	Prompt	Freed from the pool of tears, Alice and the animals, large and small, ran to dry out in an endless cycle with no beginning and no end.
	Self-evolution	This study experienced a different experience with the cutting and pasting method. The most challenging part of the process was determining what would reflect and represent the things to be expressed and finding them in materials such as magazines and newspapers. For example, the most challenging thing in the final product was finding the textures to represent the animals. Another challenging thing was constructing the möbius strip to represent the cycle.
Digital Collage	Method	By finding appropriate visuals on the Internet and combining them using a tool named Photoshop
	Prompt	Wet in a pool of tears, Alice and the animals race with no winner to dry up.
	Self-evolution	Photoshop was used in digital production. Finding materials in this work was more accessible than the collage made by hand. For example, the Möbius strip itself could be used in the collage. This process made it easier to express oneself and show what one wants.
Aı Art	Method	By using an artificial intelligence tool named Leonardo, AI
	Prompt	imagine a scene with Alice in Wonderland, Alice with wet and blonde hair, back turned, running various animals in front of Alice, Mobius strip, cut paper style
	Self-evolution	Although image generation with artificial intelligence was fast, finding the right prompt was challenging. It took more work and trials to obtain the desired image than the other two methods. Although quite successful results were obtained, there are generally minor errors even in these successful images. For this reason, it was determined that using the images without editing was impossible. It was tough to achieve good results, especially with animal and human limbs.

261

Table 10. Comparison of collage, digital collage and AI works processes of Student E

Analogue Collage	Method	By cutting and pasting appropriate visuals taken from magazines, newspapers, etc.
	Prompt	Alice suddenly begins to grow up after finding a drink in the rabbit's house and drinking it. She begins to push the boundaries of her space, and her body begins to spill out. As Alice grows, her house ceases to be the place itself, and the forest becomes the central place. The house begins to become an element of the place with Alice.
	Self-evolution	The most significant advantage of this method, which is carried out using different materials and tools, is the ability to see and touch natural textures and materials—for instance, it is essential to be able to use the actual texture of the fabric in production instead of just its visual appearance or to visually attach a real tape for combining images. Despite the advantages of manual production, the limited and nonscalable nature of resources and materials, the difficulty of organization, and the time-consuming nature of the method have made it less preferred in today's context.
Digital Collage	Method	By finding appropriate visuals on the Internet and combining them using a tool named Photoshop
	Prompt	Meanwhile, the small animals outside are thrown into fear and chaos as Alice grows to gigantic sizes. They start throwing stones at Alice, but the stones they throw turn into cake. As Alice eats the cakes, she begins to shrink and become afraid of the animals, which she initially feared, and runs away as soon as she leaves the house.
	Self-evolution	This method produces visuals by combining materials and sources on the internet in the digital environment through human intelligence and perception. Having almost unlimited resources and the ability to edit materials much more quickly makes this method superior to manual production. In addition, the ability to make these edits according to the creator's desires and imagination is the most crucial feature that surpasses AI. While this method is currently the most preferred, it is believed that integrating it with AI will result in much faster and groundbreaking outcomes.
Aı Art	Method	By using an artificial intelligence tool named Prome AI
	Prompt	A destroyed small village house, a scared girl running away, broken pieces of wood on the ground, glass in the air, dense forest background, big trees around, tiny cupcakes on the ground, pieces of rock flying in the air, an atmosphere dominated by feelings of fear, chaos, anxiety, and anger
	Self-evolution	The graphic quality of AI, endless design options, and the ability to produce products in seconds are its most significant advantages, and they put it ahead of other methods. However, their perception, aesthetic understanding, and connection with reality are only as much as the combination of information and knowledge on the internet. The way it brings the components together and the visuals it creates sometimes differ from human perception regarding aesthetics, accuracy, scale, etc. It does not match the concepts. Therefore, although AI can produce images with high graphic quality, it is still thought to require human hands and minds.

The studies were examined individually and the expected outcomes of all studies were measured with a survey conducted at the end of the course period. Students were asked to answer some survey questions at the beginning of the course period to document their ideas/knowledge regarding the use of artificial intelligence in design and at the end of the semester to record their experiences regarding artificial intelligence practices carried out during the semester.

When the students were asked at the beginning of the course "whether they had any knowledge about the use of artificial intelligence in the field of design", 5 out of 6 students answered yes and one answered no (Figure 4).
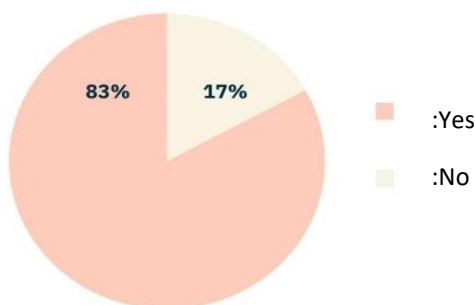
Figure 4. Students answer the question: I know the uses of artificial intelligence in design
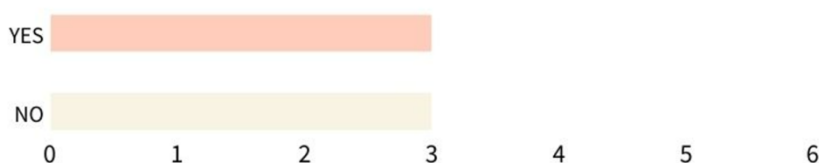
Figure 5. Students answer the questions: Have you used the prompt guidance option?
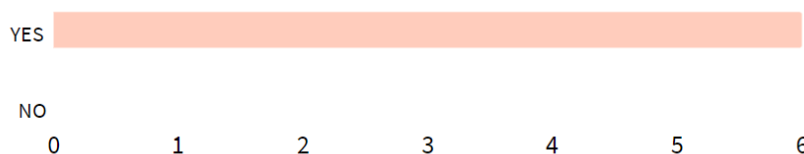
Figure 6. Students answer the question: Have you used multiple AI tools collaboratively?

Some artificial intelligence models, such as Leonardo AI and Prome AI, have a "prompt guidance" option that allows the prompt written by the user to be developed with artificial intelligence support. Students were asked whether they used the prompt guidance option in their completed artificial intelligence studies. To this question, 3 out of 6 students answered yes and three answered no (Figure 5). The artificial intelligence tools in question are tools that use not only texts but also existing images as input. In this way, editing an image produced in another artificial intelligence tool with another is possible. When students were asked whether they used these tools together, it was observed that all students answered that they used more than one artificial intelligence tool collaboratively (Figure 6). Based on these answers, a single artificial intelligence tool cannot achieve the desired result.

Table 11. Table of the words that cannot be answered adequately in prompts

STUDENT	Words that cannot be answered adequately in prompts
A	Colorful roses and books in the black hole
B	Alice
C	-
D	Duchess, baby, cat, colorful, Alice, cook.
E	Animals, pool of tears
F	House, tiny, extra, rabbit, animal, giant cupcakes

Table 12. The words most frequently used in prompts by six students

STUDENT	Words with the most successful results
A	Black Hole
B	Generate wide-angle landscape scene.
C	Keyhole, abstract, Alice style.
D	Mystical forest, kitchen, looking at the door, chaos
E	Möbius strip, back turned, running
F	House, little girl, trees, forest background
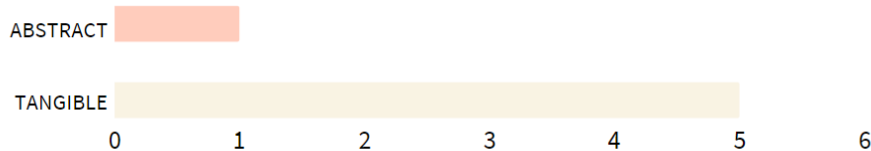
Figure 7. Students answer the question: Did you use abstract/concrete terms?

When artificial intelligence practices are observed, it is seen that the qualities and order of the words that make up the prompt directly affect the quality of the final product. Students were asked to write "the words you need to change most in the prompts", Table 11 lists the concepts that do not appear in the input when written. The words that respond best to the prompts are listed in Table 12.

There are various word groups in Table 12 (prompts that give successful results) and there are inputs consisting of at most two words in Table 11 (prompts that need to be changed). When asked about the usage rate of abstract and concrete concepts, 5 out of 6 students answered that they preferred concrete ideas and one said that they preferred abstract concepts (Figure 7).

At the end of the semester, when the students were asked about the artificial intelligence program in which they received the most successful results, four responded to Prome AI, one student to Leonardo AI and one student to Recraft AI program. The outputs obtained in the first stage were edited using them as input for another artificial intelligence tool in the second stage. Students were asked about the artificial intelligence programs with which they achieved the most successful results in the editing phase; the answers were Leonardo AI from 3 students, Prome AI from 2 students and Adobe Firefly from 1 student.

As a general result of these answers, it was observed that the most successful text prompt artificial intelligence program used during the course period was Prome AI and the program that gave the most successful results in the editing process was Leonardo AI.

Figure 8. Students answer the question: Were you able to achieve the results you aimed with artificial intelligence tools?

Students were asked: "Did you achieve the results you aimed with artificial intelligence tools?" The question was asked and it was seen that most students answered "no" (Figure 8).

4. Discussion

In evaluating the productions made with analog collage, digital collage and artificial intelligence-supported tools, students were asked to express their experiences in all three stages with explanations of the methods and visuals.

During the production phase with the analog collage method, students were asked to bring ready-made images to the workshop. Students were not asked to present the text they read visually but to create and express their compositions. Problems such as the images cut from magazines and newspapers needing to be more suitable for scaling and limited resources were the difficulties encountered during the study. In addition to these negative aspects, being able to feel the textures of the materials, unlike digital methods and experiencing the assembly of concrete pieces in a workshop environment by the collage principle are among the positive outcomes.

In the digital collage method, students can add all the images they can access from the internet to their works. While this was an opportunity for some of the students, it was a limiting factor in the decision-making process for others. Unlike artificial intelligence studies, the open-access images used here were selected through the designer's filter.

In studies conducted using artificial intelligence, six students produced many visuals using different artificial intelligence tools. While the fact that these visuals did not have the desired quality in the first place was considered a negative situation by the students, the fact that the visuals could be edited with AI tools was positive. While obtaining many outputs with a single text input was found positive regarding fast production, it was considered a disadvantage at the decision stage. While these quickly obtained images gave quality results with some prompts, images containing the human body, face and animal species were found insufficient and needed to be edited. In cases where the visual quality is inadequate, students have researched ways to improve the prompts. At this point, many factors, such as the words used, the language of expression and the level of detail of the qualifying words, have directly affected the visual quality. This situation suggests that at the stage of text-prompted visual production with artificial intelligence, the designer's visual design skills and the relationship he establishes with the text/prompt/concept should be adequate. Although it provides the opportunity to produce many images in seconds, the fact that these images cannot be accepted as absolute results by the artist and require various arrangements has been a common feature of the productions made with this method.

5. Conclusion

Within the scope of the study, various readings, workshops and student experiences were examined to examine the role of text-based artificial intelligence tools in the design field and their relationship with the designer during a 14-week course period. For the review, a three-stage process was designed using collage, digital collage and artificial intelligence tools. The methods, results and discussions of three different production steps are examined in the table titled "Comparison of collage, digital collage and AI works processes". Each student was asked to discuss an artificial intelligence and collage

work of their choice and the opportunities and challenges they encountered as designers in this table. Secondly, they were asked to discuss prompt developments during production with artificial intelligence in the table titled "Table of first artificial intelligence experiences and prompt development". In the final stage, the designers were asked to examine 5 AI studies that they thought were of the desired quality, along with their technical features. Since student activities related to this step are ongoing, not all outputs are included in the study, but the evaluation is based on completed productions. As a result of the assessments, it was seen that each student designed their own process and production style. However, the opinions regarding the three production methods are highly similar. Feeling the material texture and producing by hand encouraged students in analog collage works. However, there are some restrictions on transferring ready-made materials into the composition. These restrictions have been relatively eliminated in the digital collage method. While visual materials are becoming more accessible due to screen production, visual dimensions and working scale are not as controllable as in the analog collage method. Artificial intelligence tools, which are the research subject of the study, have produced products that can be made very quickly and whose quality can vary depending on many parameters. When examining these variables, it was concluded that prompts containing precise and concrete expressions, avoiding animal and human faces/bodies and containing fewer proper names or abstract concepts provided more qualified visual results. It is an accepted fact that artificial intelligence tools produce fast visual products. However, these visuals achieved the desired result after many adjustments. Here, with a general definition, "edit in canvas" stands out regarding its features. It has been observed that students prefer artificial intelligence tools such as Adobe Firefly and Prome AI.

In the next stage of the study, as a result of the evaluation survey conducted with the students who attended the course, visual product quality and prompt quality are linked, prompts containing concrete concepts give closer results to the desired results and all students obtain result products by using more than one artificial intelligence tool together, artificial intelligence tools such as Prome AI and Leonardo AI are more successful than others in the editing process. It has been concluded that the Paper Cut style used in more than one tool is more successful.

As seen in the study, realizing a measured and scaled architectural production with the text-to-image principle of artificial intelligence tools was impossible. For this reason, a professional designer can't accept these tools. However, in architectural education and professional architectural practices, these tools can meet the needs in stages such as rapid visualization and obtaining draft images using correct prompts.

References

Akipek, F.Ö., Inceoğlu, N. (2007). The uses of digital design and manufacturing techniques in architectural design process. *Megaron, YTÜ Arch. Fac. E-Journal, 2*(4), 237-253. (In Turkish).

As, I., Pal, S. & Basu, P. (2018). Artificial intelligence in architecture: Generating conceptual design via deep learning. *International Journal of Architectural Computing*, *16*(4), 306-327.

Atalay, M., Çelik, E. (2017). Artificial intelligence and machine learning applications in big data analysis. *Mehmet Akif Ersoy University Social Sciences Institute Journal, 9*(22), 155-172. (In Turkish).

Bayram, A.K.Ş., Güzelci, O.Z. & Alaçam, S. (2023). Informal learning in the context of digital design pedagogy in architecture. *Journal of Computational Design, 4*(1), 1-16. (In Turkish).

Başarır, L. (2022). Modelling AI in architectural education. *Gazi University Journal of Science, 35*(4), 1260-1278.

Cao, T., Wang, C., Liu, B., Wu, Z., Zhu, J. & Huang, J. (2023). Beautifulprompt: Towards automatic prompt engineering for text-to-image synthesis. In *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing: Industry Track*, 1-11. Singapore.

Ergün, C. (2012). Collage-photomontage in basic art education and contemporary art. *Art-Design Journal, 1*(3), 5-19. (In Turkish).

Erten, O., Göktepeliler, Ö. (2022). Artificial intelligence, machine and art. *Ankara University Journal of Social Sciences, 13*(2), 145-152. (In Turkish).

Genç, M. A., Danis, S. & Hamarta, H.K.Ö. (2023). A critical look at the use of artificial intelligence in the education of specially gifted individuals in the field of visual arts. *Necmettin Erbakan University Ereğli Faculty of Education*, 5, 497-519. https://doi.org/10.51119/ereegf.2023.53 (In Turkish).

Gül, L.F., Çağdaş, G., Çağlar, N., Gül, M., Sipahioğlu, I.R. & Balaban, Ö. (2013). Architectural education and information technologies in Turkey. *National Symposium on Digital Design in Architecture, Digital Design, Entropy, Creativity*, 11-16. (In Turkish).

Hakak, A.M., Biloria, N. & Venhari, A.A. (2014). Creativity in architecture review on effective parameters correlated with creativity in architectural design. *Journal of Civil Engineering and Architecture, 8*(1), 1372-1379.

Karabulut, B. (2021). In the context of artificial intelligence creativity and the future of visual design. *Electronic Journal of Social Sciences, 20*(79), 1304-0278. https://doi.org/10.17755/Esosder.844536 (In Turkish).

Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F. & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274.

Kavakoglu, A.A., Almaç, B., Eser, B. & Alaçam, S. (2022). AI-driven creativity in early design education. *Proceedings of the 40th International Conference on Education and Research in Computer Aided Architectural Design in Europe*, 133-142. Ghent, Belgium.

Kopuz, M.A. (2022). Artificial Intelligence Programs in The Future of Graphic Design. Master's Thesis, Institute of Social Sciences, 4-11. (In Turkish).

Lee, U., Han, A., Lee, J., Lee, E., Kim, J., Kim, H. & Lim, C. (2023). Prompt Aloud!: Incorporating image generative ai into steam class with learning analytics using prompt data. *Education and Information Technologies, 29*(8), 9575-9605.

Lim, J., Leinonen, T., Lipponen, L., Lee, H., DeVita, J. & Murray, D. (2023). Artificial intelligence as relational artifacts in creative learning. *Digital Creativity*, *34*(3), 192-210.

Liu, V., Vermeulen, J., Fitzmaurice, G. & Matejka, J. (2023, July). 3DALL-E: Integrating text-to-image AI in 3D design workflows. In *Proceedings of the 2023 ACM Designing Interactive Systems Conference*, 1955-1977.

Mazzone, M., Elgammal, A. (2019). Art, creativity and the potential of artificial intelligence. *Arts, 8*(1), 26.

Mıhlayanlar, E., Tachir, G. (2019). From computer aided design to building information in architecture education. *Artium, 7*(2), 167-179. (In Turkish).

Norvig, P., Russell, S.J. (2010). *Intelligenza artificiale*. Un approccio moderno.

Önal, G.K. (2011). Architectural design process in creativity and cultural schema context. *Uludağ University Journal of Engineering Faculty, 16*(1), 155-162. https://doi.org/10.17482/uujfe.87376 (In Turkish).

Oppenlaender, J., Visuri, A., Paananen, V., Linder, R. & Silvennoinen, J. (2023). Text-to-image generation: Perceptions and realities. https://doi.org/10.48550/arXiv.2303.13530

Paananen, V., Oppenlaender, J. & Visuri, A. (2024). Using text-to-image generation for architectural design ideation. *International Journal of Architectural Computing*, *22*(3), 458-474.

Radhakrishnan, A.M. (2023). Is Midjourney-AI a new anti-hero of architectural imagery and creativity. *GSJ*, *11*(1), 94-104.

Schmitt, G. (1997). Design Medium-Design Object. In *CAAD futures 1997: Proceedings of the 7th International Conference on Computer Aided Architectural Design Futures,* 3-13. Dordrecht: Springer Netherlands.

Shields, J. (2014). *Collage and Architecture*, 9-10. Routledge, New York.

Sorguç, A., Yemişçioğlu, M.K. & Yetkin, O. (2022). Demystifying machine learning for architecture students. *Eskişehir Technical University Journal of Science and Technology A-Applied Sciences and Engineering*, 23, 60-67.

Stoimenova, N., Price, R. (2020). Exploring the nuances of designing (with/for) artificial intelligence. *Design Issues*, *36*(4), 45-55.

Tong, H., Ülken, G., Türel, A., Şenkal, H., Ergün, F.Y., Güzelci, O.Z. & Alaçam, S. (2023). An attempt to integrate AI-based techniques into first year design representation course. *Connectivity and Creativity in times of Conflict*, 363.

Topuz, B., Alp, N.Ç. (2023). Machine learning in architecture. *Automation in Construction*, 154, 105012.

Uzun. C., Çolakoğlu. B. (2019). Architectural drawing recognition: A case study for training the learning algorithm with architectural plan and section drawing images. *Proceedings of the 37th Education and Research in Computer Aided Architectural Design in Europe and XXIII Iberoamerican Society of Digital Graphics, Joint Conference*, 1, 29-37.

Varinlioğlu, G., Halıcı, S.M. & Alacam, S. (2016). Computational thinking and the architectural curriculum simple to complex or complex to simple? *Ecaade 2016: Complexity and Simplicity*, 1, 253-259.