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Integration of artificial intelligence tools into interior architecture education: a study on textual and visual representations Integración de herramientas de inteligencia artificial en la educación de arquitectura de interiores: un estudio sobre representaciones textuales y visuales

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ÖZGE DEVAL
Fenerbahçe University, Turkey
ozge.deval@fbu.edu.tr

KAMILE ÖZTÜRK KÖSENCIĞ
Okan University, Turkey
kamile.ozturk@okan.edu.tr

ZEYNEP ACIRLI
Eskişehir Technical University, Turkey
zynp.acirli@gmail.com

ABSTRACT Despite numerous Artificial Intelligence (AI) applications in the field, there is currently a lack of empirical evidence supporting their integration into design education, as well as limitations due to the novelty of these applications. Therefore, this study proposes a workflow integrating AI-assisted ideation and visualization into interior architecture education. An empirical study was conducted with six interior architecture students. The design process has been researched in addition to capturing the functional limitations and difficulties encountered by students who experienced the suggested educational framework. The findings were analyzed using descriptive analysis, a qualitative research method. Findings revealed that AI tools can effectively support the early design phase with the recommended workflow. However, participants often struggled to apply it critically, relying heavily on AI suggestions. This study provides a novel perspective by elucidating the potential benefits, challenges and impacts of AI applications in interior architecture education.

KEYWORDS interior architecture, artificial intelligence, descriptive analysis, design process, design education

RESUMEN Aunque existen diversas aplicaciones de inteligencia artificial (IA) en el ámbito del diseño, aún falta evidencia empírica que respalde su integración en la educación, además de que muchas herramientas siguen en desarrollo. Este estudio propone un flujo de trabajo para la ideación y visualización colaborativa con IA, con el fin de incorporarla en la enseñanza de la arquitectura interior. Se realizó una investigación empírica con seis estudiantes del Departamento de Arquitectura Interior, analizando tanto el proceso de diseño como las limitaciones funcionales y dificultades encontradas al aplicar el enfoque propuesto. Los resultados, examinados mediante análisis descriptivo, mostraron que las herramientas de IA pueden apoyar de forma efectiva la fase inicial del diseño. Sin embargo, los estudiantes enfrentaron dificultades para utilizarlas críticamente, dependiendo en gran medida de las sugerencias generadas por IA. El estudio aporta una perspectiva novedosa sobre los beneficios, desafíos e impactos de la IA en la educación del diseño arquitectónico interior.

PALABRAS CLAVE arquitectura de interiores, inteligencia artificial, análisis descriptivo, proceso de diseño, educación en diseño

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1. Introduction

Artificial Intelligence (AI) is an essential part of the Fourth Industrial Revolution, along with the widespread use of digital technologies and the rapid development of machine learning. The rapid advancement of AI has penetrated various industries, revolutionizing tools and shaping the future of interior architecture. AI tools such as ChatGPT caxn potentially transform educational practices (Chan and Tsi, 2023). Many AI tools have the potential to be used in interior design education, such as Veras Evolve Lab, Midjourney (Tan and Luhrs, 2024), Microsoft Copilot and Stable Diffusion, in addition to ChatGPT. Midjourney is a popular tool. While using such AI tools enables designers to consider a wider range of design concepts from novel viewpoints (Hanafy, 2023), it also has many limitations (Sukkar et al., 2024). There are also applications such as Room Dreaming and Veras Evolve Lab that explicitly focus on the architectural process. While Veras EvolveLab aims to support the transformation of Architecture, Engineering, and Construction services by pioneering the shift towards data-centric design and construction (Evolvelab, n.d.), RoomDreaming aims to support interior architecture by enabling owners and designers to rapidly and effectively investigate a comprehensive range of AI-generated design alternatives (Wang et al., 2024). At the same time, ChatGPT is suitable for research (Hu et al., 2023) by textual prompts and can be used in many fields.

The design process requires effort, time and resources since it consists of many complex steps that require technical and creative skills and experience. However, artificial intelligence can be used to facilitate the design process, and it has become possible to simplify and shorten the design process. In addition to offering fast design solutions for the early design process (Ghoreishi and Happonen, 2020), these tools have potential regarding creativity, innovation, and user-centred design (Verganti et al., 2020). Designers can obtain and analyse data with the support of artificial intelligence, create 3D models and architectural layouts and generate 2D interior representations using textual and visual prompts. In summary, the Faltcooperation with AI in design has the potential for inspiration, efficiency, human-centred design, creativity and productivity.

In the literature, developing new tools such as RoomDreaming (Wang et al., 2024), theoretical discussions (Tan and Luhrs, 2024) to clarify the effects of these tools on the design process, and empirical studies to evaluate the role of AI Design Assistants (Zeytin et al., 2024) are carried out. These studies contribute to the transformation of using artificial intelligence in architecture. On the other hand, it is important to discuss and formulate a framework for the integration of artificial intelligence with the design process and evaluate its potential and limitations. However, the literature is lacking in exploration of the educational application of AI tools, specifically within the field of interior architecture. Therefore, this study proposes a structured framework based on empirical testing with design students, providing both qualitative and quantitative feedback to measure the effectiveness of AI-supported design processes.

It is evident that each space has distinctive conditions and design requirements that vary from one space to another. Interior design education is not solely confined to the design process; it also involves various factors related to novice designers' abilities and capacities, such as:

- The capacity to think and perceive,
- The capacity to utilise past experiences and apply them in novel contexts,
- The capacity to utilise trial and error to gain new insights,
- The capacity to respond swiftly to changing circumstances, and
- The capacity to visualise, create, comprehend and perceive visual subjects.

There are also tool limitations, such as their adaptability to special conditions in terms of functionality that should be considered. The present study investigates the direct application of AI to the interior architecture process within an educational context, focusing on functional constraint-driven design problems and student engagement. For this purpose an experimental process was designed and a workshop was conducted. The design processes, final outputs, and student prompts from this workshop were evaluated through descriptive analysis. The scope of the students' themes provided an assessment of the process regarding authorship and design contribution. The results will offer insights into how these tools can be effectively integrated into design education while acknowledging both their potential benefits and limitations.

The theoretical background outlines the context and significance of integrating AI into interior design education, highlighting the existing gap in the literature. The methodology section details the experimental process and workshop design, focusing on how AI tools were utilised and evaluated. The results are organised around the analysis of design processes, student prompts, and final outputs, offering insights into the implications of authorship and thematic development. The discussion and conclusion connect these findings to broader educational and design implications, concluding with recommendations for future research.

2. Theoretical background

Various generative design methodologies in architecture have emerged that use various mathematical models and algorithms to explore design possibilities and produce innovative solutions (Singh and Gu, 2012). These generative systems are based on rule-based methods (Azadi and Nourian, 2021) or AI-based (Chaillou, 2020). These AI-based generative methodologies are utilised in the literature to generate architectural plans or three-dimensional representations of interiors or facades to support the early design process. Yue and Yuan (2023) also introduced a method that comprehends indoor scene layouts and predicts the 3D spatial structure of a room. Some of these studies have an interface to obtain user needs, such as the plot area and the entrance of the building, to start the generative system for housing layout generation (Chaillou, 2020). On the other hand, spatial relationships as a graph can be requested from the tool's users to generate housing design alternatives (Nauata et al., 2021). These systems can generate architectural plans quickly by transforming the implicit knowledge in the data set that was used to train and develop these tools into new knowledge.

There are also studies that aims to accelerate the rendering process by suggesting appropriate materials and textures to designers (Chen et al., 2024a) and element recognition research (Kim et al., 2018). These studies might use text-to-image or image-to-image diffusion models. Image to image diffusion models create a new image variation based on an input image, and can make edits to existing designs or perform style transfers. In the literature, While some of the studies explored the image to image diffusion models to generate interior renders by giving interior sketches with furniture, Chen et al. (2024b) developed this workflow and achieved to generate interior renders without furniture input.

On the other hand, architectural designers can use tools such as Midjourney, Stable diffusion, and DALL-E to generate interior and exterior representations of the buildings. These tools can generate images with artificial intelligence support as a creative design exploration by implementing text-to-image diffusion models. These models generate visual content using given text descriptions. In the context of interior design, these models can create concept drawings or photorealistic images starting from text expressing specific design requirements. Many examples of the Midjourney tool are used in the architectural design process and accelerate the design process (Jaruga-Rozdolska, 2024). Users can generate high-quality visual representations by describing the desired result in text. DALL-E and Stable diffusion are other tools that can create representations from text like Midjourney, and it is reported in the literature that they have high potential in architecture (Ploennigs and Berger, 2023). These tools offer unique features by using different algorithms and techniques for designers. However, it is a developing field. There are studies which aims to achieve more realistic results by applying a new method and purposing a new loss function (Chen et al., 2023).

Moreover, there are specialised tools that architects can utilise, such as Veras Evolve Lab, which generates two-dimensional representations of the buildings. Some tools can be adapted to various CAD programs, such as Architechtures and Finch 3D, allowing the generation of architectural plans. Architects and designers can accelerate the design ideation and representation process with the support of artificial intelligence. The tools allow the creation of more efficient, sustainable, and creative solutions by providing creative design variations in a relatively shorter time than the conventional design process. On the other hand, these tools also have some limitations and application difficulties.

Jeong et al. (2024) reviewed the artificial intelligence utilisation in interior design and discussed the effectiveness of AI-supported representations. Similarly, there are tool-based studies investigating the impact of tools such as Midjourney, DALL E 2 and Stable Diffusion on interior design (Ploennigs and Berger, 2023). It highlights the challenges with complex prompts and the need for a deep semantic understanding of the image content. Machine learning was used to estimate the impact of building parameters on the design, and the effectiveness of artificial intelligence was discussed by comparing these estimates with simulation results in Arbab et al.'s study (2021). Furthermore, studies are investigating and comparing the effectiveness of applications involving artificial intelligence (Samuel et al., 2022).

Some of the studies in this field also discuss integrating artificial intelligence into interior design education (Almaz et al., 2024; Kahraman et al., 2024). Kahraman et al., (2024) emphasise the importance of incorporating artificial intelligence into the educational process, noting that while AI tools can assist designers, they cannot replace the expertise of human designers. Studies also investigate students' opinions on artificial intelligence assistance to contribute interior design education (Cao et al., 2023). Another study examines how artificial intelligence (AI) technologies can be used as a design assistant in the first-year design education within the scope of the Visual Communication I (VC-I) course given at Istanbul Technical University. This study evaluated how students combined orthographic projections they created with AI-generated images (Tong et al., 2023). Another study investigates the potential of neural networks such as Midjourney, Stable Diffusion and DALL-E to enhance the creative abilities of design students. Each of these tools has been examined for their effectiveness in different design tasks and how they can be integrated into the educational process (Derevyanko et al., 2023). Another study discusses how artificial intelligence can be integrated into interior design education and how this integration can affect different design styles and trends. It focuses on AI tools' contributions to contemporary design fields and their effects on traditional styles (Ma et al., 2001). These studies reveal the potential of artificial intelligence to support creative processes in design education and increase efficiency for novice designers. On the other hand, these studies within the framework of more specific questions and constraints should be considered to significantly contribute to these tools' development, integration into the design process, and utilisation for educational purposes.

Previous studies typically reveal significant advancements in efficiency and creativity but also have some limitations. One critical aspect in these studies is the reliance on the data-driven approach in AI applications. if the model structure, loss function, or training data are not meticulously designed, the outcomes may exhibit considerable bias or fail to address specific architectural nuances. For instance, ArchiGAN (Chaillou, 2020) employs a specific plan dataset to generate floor plans. Nevertheless, given the cultural implications inherent in floor plan organisation, the output may not align with these needs.

3. Methods

The study consists of two stages: experimental study and qualitative data analysis (Figure 1). The data collected from the experimental study were subjected to a descriptive analysis to employ qualitative data analysis. The sample of the experimental study consists of volunteer senior students enrolled in interior architecture programs at various universities. The participants are six students, 50% are male, 50% are female, with an average age of 23. In qualitative research approaches, different opinions are presented by researchers regarding the determination of the sample size. However, qualitative research prioritizes achieving a saturation level over focusing on the size of the study group. Conceptually, saturation is reached when further data collection does not yield deeper understanding or additional insights into the phenomenon being studied, allowing for the data collection process to be concluded (Akçay and Koca, 2024). In qualitative research, the depth and breadth of the data planned to be obtained from the individual or individuals included in the sample are generally inversely proportional to the sample size. In other words, as the amount of data to be collected from the participants in the research increases, the number of individuals to be included in the sample decreases (Yıldırım and Şimşek, 2018). Within the study's scope, students performed three different design tasks in two different artificial intelligence tools, obtaining more than one data set. In this context, considering the data diversity, research objectives, and saturation point of the study, it was deemed appropriate to limit the sample size to six people.

The experimental design workshops were structured based on the proposed AI-assisted interior design workflow. These workshops aimed to evaluate the workflow's applicability and effectiveness while identifying potential functional limitations of the AI tools utilized (Table 1). The students were asked to perform three different design tasks with a specified functional requirements regarding to user needs by using the AI tools; Microsoft Copilot and Evolvelab. These tools were selected for the study due to the availability of a free version, that they were specialized for the field of architecture or adaptable to the interior design process.

Tools	Text to image	Image to image	Text to text	Features
Midjourney	+			
DALL-E	+	+		Interior and architectural mass visualizations can be generated. These visualizations can subsequently be modified.
Stable Diffusion	+	+		
Veras Evolve Lab	+	+		The platform features a user interface and workflow specifically designed for architecture, allowing for the creation of interior and architectural mass visualizations, which can be later edited.
Architechtures	+	+		Architectural plans and furnishing layouts can be produced.
Finch 3D	+	+		Architectural plans and furnishing layouts can be generated, and three-dimensional model outputs can be provided.
Chat GPT	+		+	Questions regarding architectural topics can be posed for research purposes; however, it is known that it may occasionally provide misleading answers.
Co-Pilot	+		+	It can be utilized for generating architectural visuals or conducting research; it is important to note that it may yield misleading responses.

Table 1: AI tools specific functions for interior architecture. (2025)

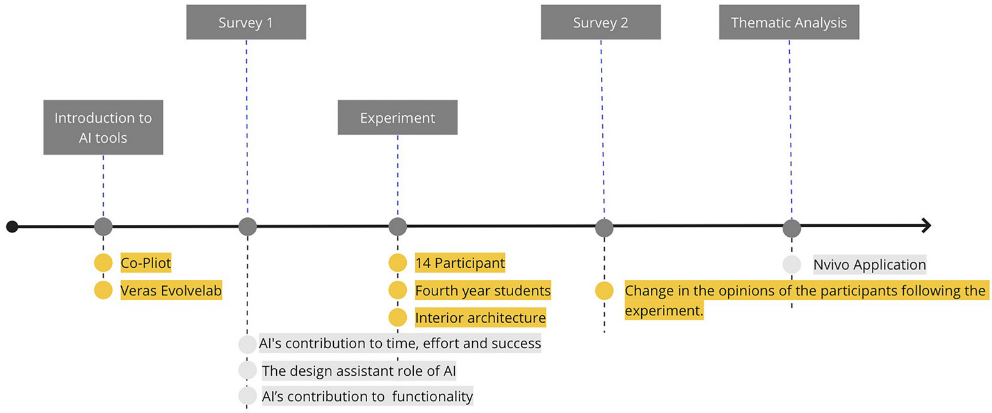

Figure 1: Methodological framework of the study. (2025)

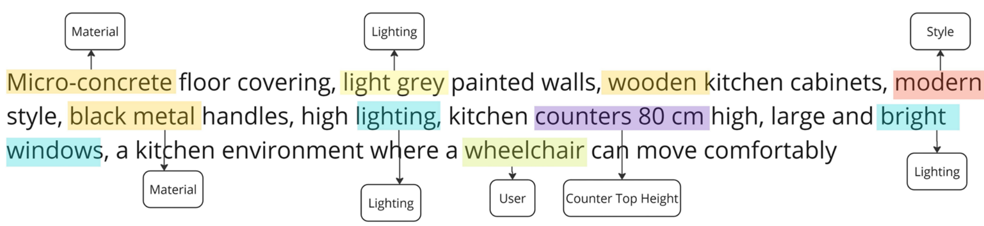

Figure 1: Prompt analysis methodology (P1-Prompt 1). (2025)

While the Microsoft Co-Pilot tool assists the student in the research and prompt generation phase for the design stage, Veras Evolve Lab was utilised as a unifying environment for the information obtained during the research and the architectural representation suggested by the researcher in the experiment.

During the experiment, students were given a user profile with certain qualifications and limitations. They were encouraged to design for these client profiles. Students were allowed to write three prompts in Microsoft Copilot and choose one of these prompts to apply it in Evolvelab. The prompt texts written by students for each task were examined using the descriptive analysis method (Figure 2). In the descriptive analysis approach, the data obtained are analysed according to the previously determined themes, and the aim is to present the obtained findings to the reader in an organized and interpreted form (Yıldırım and Şimşek, 2018). In descriptive analysis, the objective is to identify the patterns in the data in order to answer the questions such as who, where and when (Loeb et al., 2017). Thematic analyses were made with the Nvivo application and common themes such as functionality, lighting, style, material, acoustic, colour, atmosphere, form, pattern and user were revealed.

These themes (Figure 3) illustrate the criteria by which the designer directs the artificial intelligence in the design process. As these themes become narrower or more constrained, decision-making is increasingly delegated to the artificial intelligence system. Consequently, the designer's influence over the design diminishes, resulting in a reduced level of creative control and authorship.

The utilised tools in the experiment allows to generate images from text. Veras Evolve Lab has a user interface that specialized for architecture and allows image inputs in addition to text prompts. In Veras, users can cut only a part of an image with the crop tool and can transform this with AI support, or they can transform the entire image. This tool allows the user to define the spatial environment by selecting one of the expressions "interior, aerial view and turbo atmospheric". It also provides users to the ability to specify the geometry override and material override settings as percentages (Figure 4). AI learns how much the geometry and material in the given image can be transformed according to these preferences.

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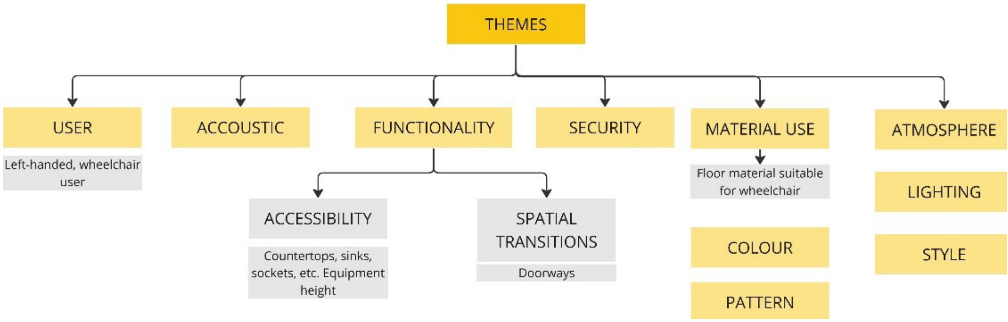

Figure 2: Determined Themes. (2025)

Experimental setup

This experimental design workshop explores the potential of artificial intelligence (AI) utilisation in the design process of a kitchen tailored for a left-handed user with mobility impairments. The workshop involves several steps, including research, design visualization, and iterative refinement using AI tools (Figure 5). The first and second stages of the experimental workshop were conceptualised as an iterative process, during which the designer engaged in extensive research on the subject matter and designed the prompt. This approach also entailed acquiring the necessary skills for prompt creation, facilitated by using an artificial intelligence tool for the first time. The third stage is conceived as an opportunity to exercise control over the design process in the absence of AI. Subsequently, the outputs from the third stage and the second stage were utilised as inputs to the final stage, thereby concluding the process.

The process focused on accessibility, functionality and aesthetic principles to integrate user-specific needs into the design. The design process was enrolled in online platforms and recorded. Without think-aloud protocol, the process was observed by the researchers and the data were analysed.

Step 1: Research with AI (Co-pilot)

Objective: To gather necessary information and insights regarding designing an accessible kitchen for a left-handed user with mobility impairments using AI assistance.

Procedure:

Utilise the AI assistant, Co-pilot, to ask questions and gather information about designing accessible kitchens, ergonomic considerations, and specific requirements for left-handed users.

Step 2: Initial design representation

Objective: To create initial design visualisations based on the information gathered and the participants' personal decisions.

Procedure:

- The participants were asked to use a Co-pilot Designer to generate visual representations of the kitchen interior according to the user needs defined in the design problem.
- They were encouraged to formulate several prompts describing the desired kitchen features. They were warned to generate a prompt as a single, comprehensive sentence.
- Designers were asked to save all the images generated on their laptops.

Step 3: Design section drawing

Objective: To create a detailed section/elevation drawing of the envisioned kitchen design.

Procedure:

- The designers were asked to manually draw a section/elevation of the kitchen suitable for the design problem. This step aims to guide the AI tool and control the design process. The participants were warned to complete the drawing within a 10-minute timeframe.

Step 4: Representation refinement

Objective: To refine and enhance the kitchen design visualisation using the Veras Evolvelab web application.

Procedure:

- Designers were asked to import the section drawing from Step 3 into the Veras Evolvelab environment.
- They were encouraged to choose one of the prompts from Step 2 for further visualisation. Adjust settings in Veras Evolvelab to explore different visual styles and refinements.
- Then they were asked to generate at least two different visualisations using the same prompt but varying the settings to compare the outcomes.
- Finally, the designers are asked to save all generated images to the desktop and select the best AI-generated image.

Step 5: Design selection

In the final phase of the experiment, the students were required to select the optimal design proposal they deemed to be the most suitable among all the visuals they had created. Subsequently, the design proposal and the design environment were subjected to analysis.

The experimental design workshop provides a structured approach to utilising AI tools to design a kitchen that meets the needs of a left-handed user with a walking disability. By integrating AI-assisted research, visualisation, and iterative design processes, participants can develop accessible, functional, and aesthetical kitchen interiors. This method enhances the design process and contributes valuable insights into the application of AI in personalised design solutions.

4. Results

This section presents the findings based on the observations and records made during the experimental study process, following a four-step workflow.

Step 1: Research with AI (Co-pilot)

In the research phase, students generally preferred to write their first prompt as the design problem given to them at Co-Pilot. In the second prompt, they requested more specific questions based on the first answers they received. For example, P4 first asked a general question such as "How should a kitchen design be for a left-handed user with walking disabilities?". He also inquired about the maximum and minimum height a wheelchair user can reach in the kitchen and the door width for a wheelchair. At this stage, the artificial intelligence tool was able to conduct adequate research on the design problem, supporting the novice designers to consider the counter height, stove and sink design principles, door width and manoeuvring area, materials and equipment accessibility when designing a kitchen for disabled and left-handed users.

Step 2: Initial design representation

In this step, participants determined functional criteria that they learned in the first step, such as counter height and manoeuvre space, and integrated them into their prompts and the designer's preferences, such as colour, pattern, atmosphere, lighting, form, material, and

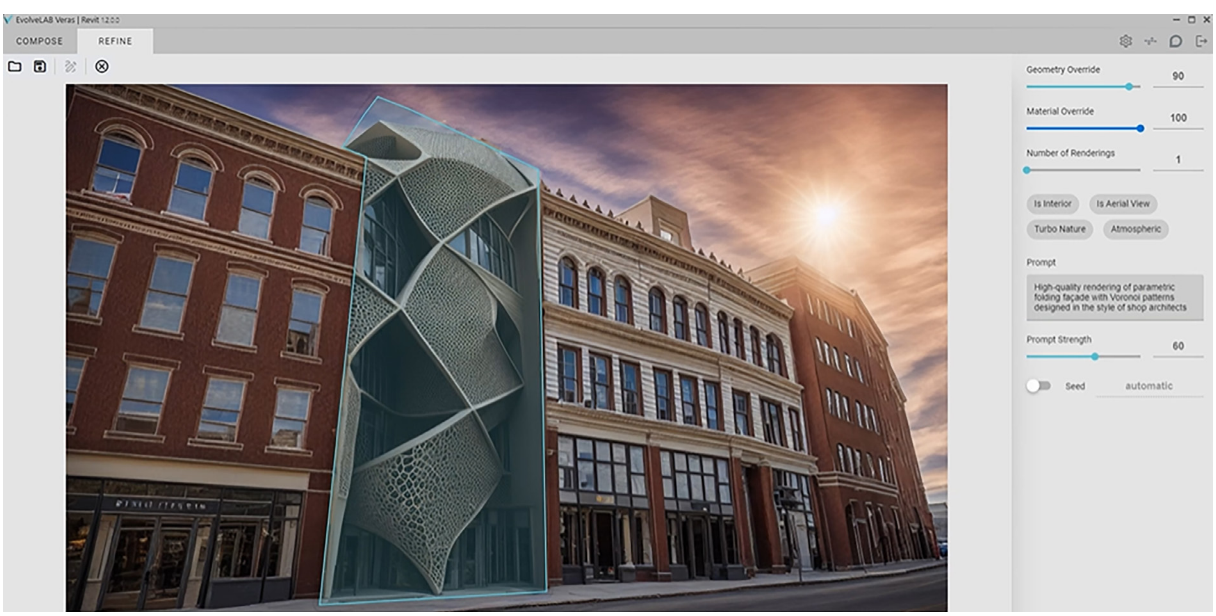

Figure 3: Veras Evolve Lab tool interface. (Evolvelab, n.d.)

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style. In addition, three participants defined the user as a disabled user in their prompts. It is observed that four of the participants transferred only the counter top height information they obtained in the research phase to the second stage (Table 2). While only one of the participants transferred the manoeuvre space criterion, only one of the participants transferred the emptiness criteria under the counter to the second stage In general, it is problematic for the participants to integrate the information they obtained in the first stage into the prompt in the second stage. In particular, it is seen that they tend to describe the user with a very general expression (a disabled user) and leave the determination of the design criteria to artificial intelligence. However, they already learned in the previous step. These results showed us that the students were not aware of the limitations of the tools.

Step 3: Design section drawing

In this step, the participants represented their imagined kitchen design with an interior section sketch. It is observed that all of the novice designers who participated in the experimental workshop depicted the lower portion of the countertops as empty, with the exception of P1. P2 represented the walking disabled user with a wheelchair in this section, While P1 preferred to draw a perspective instead of a section. Apart from countertop height, participants did not incorporate criteria such as maneuvering space, safe flooring materials, and cabinet height standards for specific user needs (Figure 6).

Step 4: Representation refinement

In this step, students are expected to translate the prompt they generated and developed in the second step into English and use it in Veras with the third step outputs: the section drawings. Four participants used translation interfaces and utilised their English prompts in the Veras environment without making the necessary language corrections after translation.

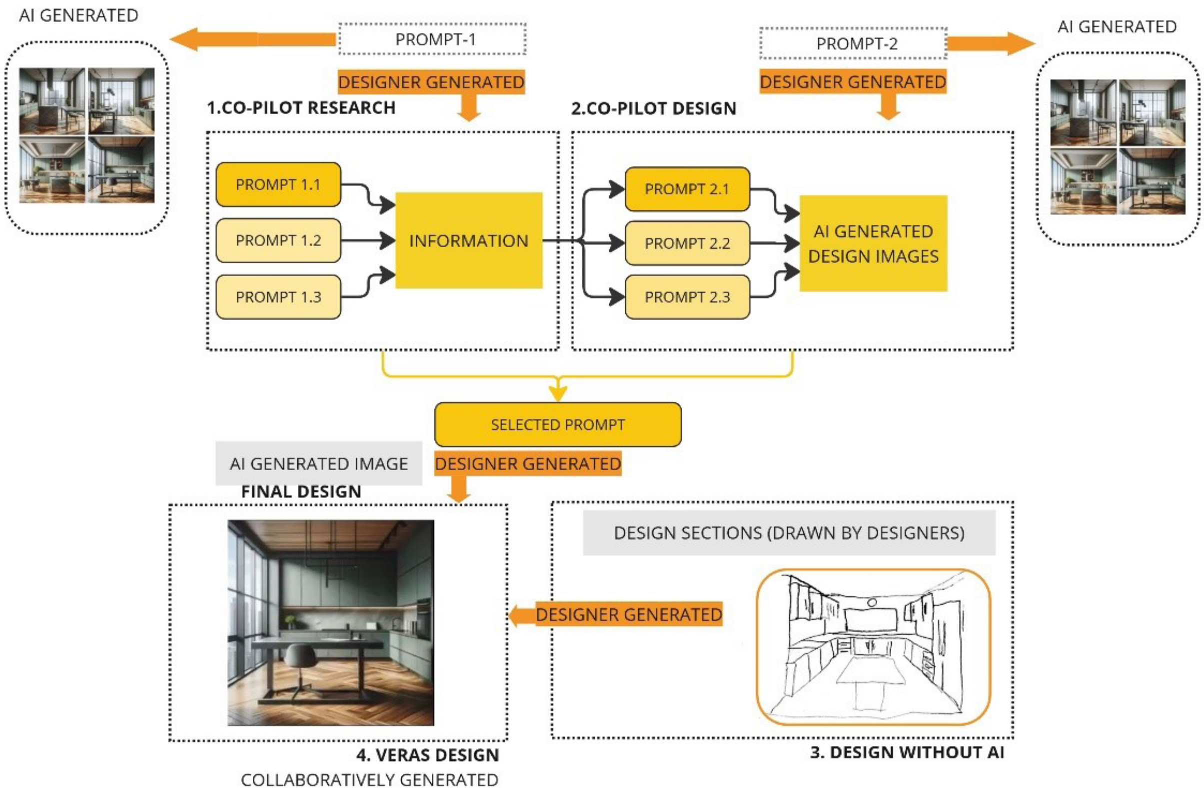

Figure 4: Suggested AI assisted design workflow. (2025)

Participant	Prompt ID	Design criteria
P1	Prompt1	Material, Colour, Style, Lighting, Functionality, Functionality
P2	Prompt1	User, Functionality, Colour, Pattern, Atmosphere, Lighting, Form, Material And Style
	Prompt2	User, Functionality, Colour, Pattern, Atmosphere, Lighting, Form, Material And Style
P3	Prompt1	Acoustic, Colour, Lighting
	Prompt2	Colour
P4	Prompt1	Functionality, Style, User
	Prompt2	Functionality, Style, User
	Prompt3	Material, Colour, Style
P5	Prompt1	Lighting, Colour, Material, Style, User
	Prompt2	Colour, Material, User
P6	Prompt1	Material, Atmosphere, Colour, Functionality
	Prompt2	Material, Colour, Style

Table 2: Design Criteria related to prompts. (2025)

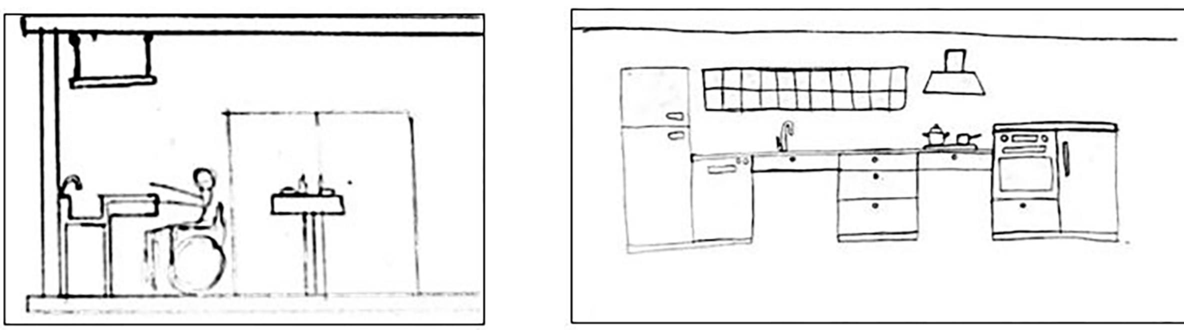

Figure 5: Section drawings of P2 (left) and P5 (right). (2025)

The participants' outputs were evaluated in terms of originality and the degree of similarity to the images they created in the sketch phase. The geometry and material settings in Veras's environment were also examined to ascertain whether novice designers would prefer a design solution similar to their initial sketch. Two participants elected to preserve the geometric properties of their drawings at 50% and 81%, while two others chose to do so at 10% and 17%. One student did not preserve any geometric data from their sketch (Selected 0%), and one preserved all of the geometric data (Selected 100%).

Most students (50%) benefited from the Veras application's suggestions regarding material selection. Two students benefited from the suggestions at a rate of 70%, and one utilised the materials suggested by the AI tool in their design.

Step 5: Design selection

In this step, 50% of the participants chose the images created by the Co-Pilot application for a user with walking disabilities, while 50% preferred the images created by the Veras application. While the preferred design proposal by two of the students included an image of a wheelchair, the other students' images did not contain any reference for the specific user requirement. On the other hand, this one proposal (Figure 7) that includes wheelchair reference does not include emptiness under the countertop. The results demonstrated that the one-design option deemed exceptional yielded no appropriate design outputs when the AI tool was utilised, even when prompted or when section drawings were involved as an input. Additionally, there was no prompt input for the left-handed user requirements, and consequently, no appropriate design solution was generated. When the students' sketches and the images they chose are compared, it is seen that 2 students preferred AI outputs which are very different from their sketches, and 4 students preferred the AI outputs similar to their sketches (Figure 7 and 8).

In the experimental phase of the study, each participant was asked to write three prompts. Thematic analysis of the prompts written by the participants was conducted using Nvivo software. During the experiment, 6 students wrote 3 prompts, and a total of 18 prompts with different word counts were defined as data in Nvivo software. The software revealed the main themes using text searches and word frequency scans in the defined data. The aim was to determine the common themes used in the prompts by the students while describing the designs they wanted to make, to reveal the relationships between the themes, and to measure their similarities. The data revealed as a result of the analysis was tabulated.

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Each central theme was divided into sub-themes. For example, the main theme of space use was divided into sub-themes of accessibility and spatial transitions, and the students included door opening information or socket height information that would allow a wheelchair user to pass in the prompts they wrote.

The designated design theme word counts of the participants are demonstrated alongside the prompts in Table 3. While P1, P2 and P3 do not specify the style of the image, thereby enabling an AI tool to predict it randomly, P4, P5 and P6 did not define the lighting of the space. P2 is a unique case in this regard, having registered 15 distinct functional criteria in their prompt. In contrast, P3's prompt is lacking in both material and style. These findings suggest that these students place considerable trust in AI tools and demonstrate a reluctance to specify the majority of the themes that are salient aspects of the design, such as lighting and the style/atmosphere of the space.

5. Discussion and conclusions

Today, artificial intelligence (AI) is considered one of the most critical contemporary technologies that deeply affects human life and can process and analyse a large amount of data in a short time. Artificial intelligence applications can help companies and lecturers increase efficiency for educational purposes if used in the design process. This study examined the use of artificial intelligence in education, its potential benefits and challenges, and its effects on students and educators while examining its functional challenges in the design process.

Artificial intelligence (AI) has the potential to open a new era in education by providing students with a personalised learning experience and automating learning processes. By analysing large amounts of data, artificial intelligence algorithms can adapt educational content and teaching methodologies to meet individual student needs, preferences and learning styles. Using these applications in education allows for increased

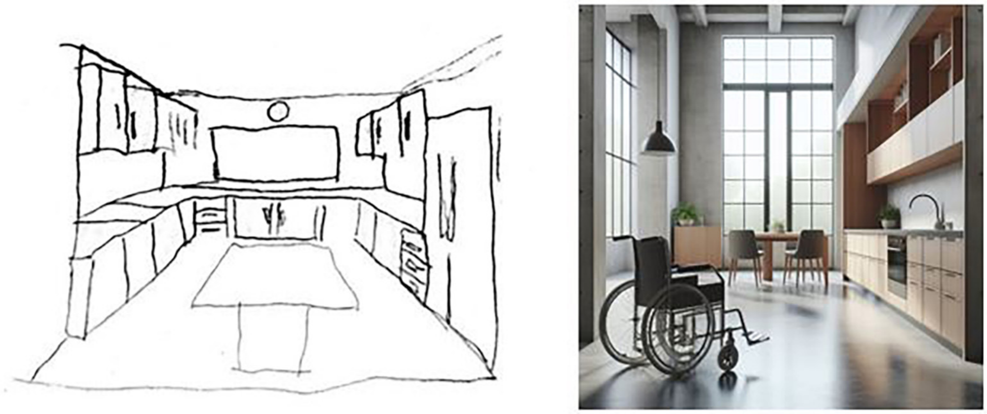

Figure 6: An example for the absence of any resemblance between the original sketch and the final design (sketch on the left, the selected AI output on the right). (2025)

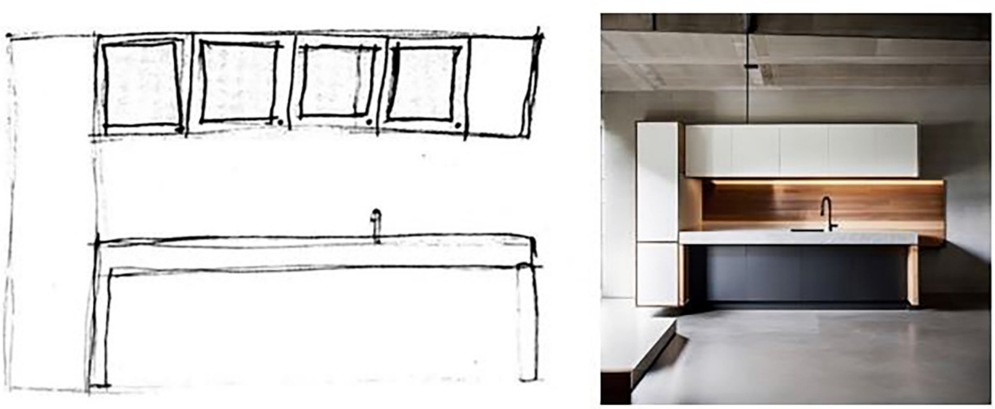

Figure 7: An example of a strong resemblance between the original sketch and the final design (sketch on the left, the selected AI output on the right). (2025)

Design Theme	P1	P2	P3	P4	P5	P6
Material	2	4	0	3	5	6
Colour	2	3	4	1	4	6
Style	0	0	0	4	1	3
Lighting	1	3	2	0	0	0
Functionality	2	15	5	6	4	3

Table 3: Design Theme usage counts related to participants' prompts. (2025)

student participation, improved learning outcomes and a deeper understanding of complex concepts. The workflow suggested in this study can contribute to the interior architecture education field as an AI-assisted design process guidance.

In this study, a comprehensive analysis was conducted on the final products of the students; consequently, the sample size was restricted to six individuals. This approach was deliberate, as it was intended to facilitate an in-depth examination of the proposed workflow, as opposed to generalising the results of the study. Consequently, the findings are presented on a limited sample, and it is anticipated that studies with a larger group of participants can enhance the validity and applicability of this workflow.

Shortening the design process is expected to increase efficiency, lower costs, and reduce energy consumption. In particular, it has been shown that artificial intelligence is a powerful support tool for pre-design research. However, it has been determined that participants need support in synthesising the information they obtain and interpreting it as a design parameter. They are not aware of the limitations of these tools. The transformation of artificial intelligence applications into frequently used resources at every stage of the design process may cause problems such as student addiction, inability to question and internalize information in depth, and lack of critical thinking. Since design is a social action that requires developing empathy with the user, a decrease in instructor and peer dialogue during the learning process may negatively affect the quality of the final products. In addition, the findings have revealed the limitations and potentials of the proposed AI-assisted design workflow and the tools used in the experiment.

This study demonstrates the functionality of the proposed workflow in facilitating collaborative design practices with AI, while also providing interior design students with a pathway to retain their authorship during the process. However, it also reveals a continued reliance on AI tools, even within this structured workflow. These findings highlight the necessity of educational frameworks that emphasise the thoughtful integration of AI into design practices. It is imperative to impart to students the ability to formulate effective prompts and to maintain oversight of pivotal design elements. This is essential for achieving a balance between leveraging the advantages offered by AI assistance and preserving creative authorship.

Furthermore, it has been observed that participants require the utilisation of multiple representations to facilitate the guidance of artificial intelligence within the Veras environment. Participants can submit disparate adjacent representations as input to the AI tools, including a manoeuvre area plan and design sections for design criteria. Therefore, it is recommended that these design tools should be developed in this context to assist the architectural design process more efficiently. These tools must be developed to accept multiple inputs, such as section drawings and the layout of the same space. It is necessary to understand the capabilities and constraints of artificial intelligence tools and to see the information obtained with the tools as a part of the learning process without evaluating it as the final product itself. Students must employ artificial intelligence tools conscientiously and ethically through their inquiries to ensure effective utilisation of these tools.

Conflict of Interest. The authors declare no conflict of interest.

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