

Architecture and Artificial Intelligence

In the last 20 years, the world has seen increasing use of Artificial Intelligence (AI) in many disciplines, one of these disciplines is Architecture. This book aims to study the effect of using AI in Architecture schools, especially design studios, in which phase, and in what percentage. The methodology of the research is applied for AI programs in four main design steps: The concept phase developing the design, coloring and developing the elevations, rendering phasing by using the AI, and distributing a survey to Design 7 students to register their responses using AI in Architecture design selected case studies from students work was selected to reflect the research works. The results from the survey show that the students achieved applying AI in concept development by 75%, in the development design process by 72.54%, in coloring by 50%, in rendering by 48%, sustainability by 70%, and in developing building form and structure by 72.3%. The conclusion of the research recommends applying AI in the whole design process including concept development, developing design process, coloring, rendering, form, and structure under the teacher's supervision, and recommends teaching AI in ARC.



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Scholars'
Press

Dr Hind Abdelmoneim Khogali

Architecture and Artificial Intelligence

AI in Architecture, AI in Interior Design

DEDICATION

In His HOLY Book, the Almighty Allah mentioned: **"And says (unto Act! Allah will behold your actions, and (so will) His messenger and the believers, and you will be brought back to the Knower of the Invisible and the Visible, and He will tell you what you used to do"** (Surat Al-Tawbah. 105). He mentioned: **"And We have enjoined Upon man concerning his parents - His mother beareth him in weakness Upon weakness, and his weaning is in two years - Give thanks unto Me and thy parents. Unto Me is the journey"** (Surat Luqman, 14). This dissertation is dedicated to my beloved mother Mrs. Al-Sareerah Mohammad Ata-Almanan. I cannot find more eloquent words than Prophet Mohmmad's words Peace Be Upon him as he mentioned: **"Who is the most worthy of your company? He mentioned: Your mother. Then, he added: Your mother and added: Your mother, then, your father"**. My dear father, Engineer Dr. Abdel Moneim Khogali, worked and struggled until his name flew up in the sky of Sudan. His plant has produced delicious fruits speaking. I pray Almighty Allah to watch over him, protect him, and bestow His blessings and bounties upon him. It is a great honor and source of ultimate happiness to me to dedicate this effort and dissertation to my beloved parents, in recognition of their love and care. I also dedicate this effort and dissertation to my respectable beloved husband, Dr. Al-Fatih Mohi Al Dein. I cannot forget, and I appreciate your endless and relentless support and love. I also dedicate this work and dissertation to my beloved children: Muhammad, Momen, Mazin and Noon. This work should be a guiding light for you to follow on the path of knowledge and learning



Bio:

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Table of Content

Chapter	Title
Chapter One	The Effect of Applying Artificial Intelligence in Architecture College Developing Design Process
Chapter Two	Saudi National Authority, Applying AI in Education, Case Study Architecture program
Chapter Three	Saudi Applying AI in Interior Design, Case Study Gaming Arena, With Focus on, Lighting, Materials, and Structure

Tables

Table No.	Table Title	Page No.
Table 1.1	Show the AI program applied by the students	
Table 1.2	The survey result	
Table 1.3	Comparing the results with the international level	
Table 2.1	The AI programs applied by the students	
Table 2.2	The survey result (Designed by author	
Table 2.3	Comparing the two types of research applied AI	
Table 3.1	Show the AI program applied by the students	
Table 3.2	The survey result	
Table 3.3	Compare the results between the three following research by AI	

Figures

Figure No.	Figure Title	Page No.
Figure 1.1	Shows the research process	
Figure1.2	The concept development by using AI	
Figure 1.3	The survey results	
Figure1.4	. Case study one develops the design process	
Figure 1.5	A case study two develops a design process	
Figure 1.6	Case study three develops the design process	
Figure 1.7	Case study four develops the design process	
Figure 1.8	Case study five develops the design process	
Figure1.9	Concept development of case study six	
Figure 1.10	Concept development of case study seven	
Figure 1.11	Concept development of case study eight	
Figure 1.12	Shows applying the AI in coloring the main elevation	
Figure 1.13	Applying the AI in rendering	
Figure 1.14	Shows the application of AI in rendering and sustainable solutions	
Figure 2.1	shows AI fields in SADAIA and AI Specialization	
Figure 2.2	Shows the research process plan	
Figure 2.3	The survey results	
Figure 2.4	Case Study one, earth morphology	
Figure 2.5	In Case Study 2, the center sphere represents the heritage	
Figure 2.6	Case Study 3, represents Najd style with the Sulmani style	
Figure 2.7	The AI shots were generated in case study one by using the Prome AI program.	
Figure 2.8	The AI shots were generated in case study two by using the Midjourney AI program	
Figure 2.9	The AI shots were generated in case study three by using the Prome AI program	
Figure 2.10	The AI shots were generated in case study three by using the Prome AI program	
Figure 2.11	The AI shots were generated in case study three by using the Prome AI program	
Figure 2.12	The Process of AI Tools	
Figure 3.1	Shows the research process plan	
Figure3.2	The survey results	

Figure 3.3	Case study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area	
Figure 3.4	In Case Study Figure 3: Case Study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area	
Figure 3.5	Case Study 3, Figure 3: Case study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area	

CHAPTER ONE

The Effect of Applying Artificial Intelligence in Architecture College

Developing Design Process

The Effect of Applying Artificial Intelligence in Architecture College Developing Design Process

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Abstract

In the last 20 years, the world has seen increasing use of Artificial intelligence (AI) in many disciplines, one of these disciplines is Architecture. This research aims to study the effect of using AI in Architecture schools, especially design studios, in which phase, and in what percentage.

The methodology of the research is applied for AI programs in four main design steps: The concept phase developing the design, coloring and developing the elevations, rendering phasing by using the AI, and distributing a survey to Design 7 students to register their responses using AI in Architecture design selected case studies from students work was selected to reflect the research works.

The results from the survey show that the students achieved applying AI in concept development by 75%, in the development design process by 72.54%, in coloring by 50%, in rendering by 48%, sustainability by 70%, and in developing building form and structure by 72.3%.

The conclusion of the research recommends applying AI in the whole design process including concept development, developing design process, coloring, rendering, form, and structure under the teacher's supervision, and recommends teaching AI as a course in architecture engineering colleges.

Keywords: artificial intelligence, AI in architecture programs, apply of AI in developing design processes

1. Introduction and Literature Review

Limited literature was found in the field of Artificial Intelligence (AI) in Architecture from 2017 to 2023 Here were classified into research five focus areas:

1.1 Definition of AI

Artificial intelligence (AI) is probably the defining technology of the last decade, and perhaps also the next future. The importance of artificial intelligence in GPS and she said 'What good of Artificial intelligence if we cannot summon authentic empathy with it? That's why to get the next 10 years right, we should do the right thing right now (Philip, 2020). (Rania, 2023). Also, this research highlighted two main points The study's findings indicate a growing interest in artificial intelligence in the field of architecture there is a need for novel research to be conducted in these areas using advanced technology and techniques (Bölek, 2023). Another research stated that the value proposition of our study lies in its novel methodology to envisage the ZEB research horizon. By leveraging R&D project data, we offer a holistic vantage point (Jin, 2023). This study provided a comprehensive review of how artificial intelligence has been applied during the period 2010 to 2021 the outcomes of the research provided the challenges for the teachers and students to use the AI (Zhai, 2021) . Another research provided creative problem-solving by AI in a system such as urban planning or adapting existing knowledge. It developed four criteria which are: knowledge, problem, method of knowledge formulation, and method to have innovative solutions (Gizzi, 2022)..

1.2 AI in Design Concept

Research stated that AI can creativity in visual design in the early stages of architectural design sketching and modeling and workflow of interior design and creating views for the exterior (Ploennigs, 2023).

1.3 AI in the Architecture Design Process

Chaillou stated that AI will soon massively empower architects in their day-to-day practice. This article gives a practical case study of applying AI in an architecture studio. (Rafsanjani, 2023) stated that the current level of AI is not able to deal with such human information and experience properly because the architecture design process is complicated (Chaillou, 2020)

1.4 AI in Building Form

Studies stated that most initial Artificial intelligence (AI) approaches were oriented toward finding innovative and creative forms, while the latest research focuses on optimizing architectural forms (Pena, 2021).

1.5 AI in Coloring the Elevation

(Khalid, 2023) discussed the future of AI in Architecture and stated that AI is useful in developing design concepts and coloring.

1.6 AI in Sustainability

(Khogali, 2019) discussed the application of smart solutions in indoor environments such as hospitals, in lighting, ecological materials, use of sunscreen, and green roofs. Also (Khogali, 2016) discussed the application of AI in Refinery smart screen follow-up the wastewater and gaseous by-products.

1.7 AI in 3D Rendering

Research is focused on text and voice learning by AI and three-dimensional space to generate conceptual design (Imdat, 2018). Another study stated that AI can creativity in visual design in the early stages of architectural design sketching and modeling and workflow of interior design and creating views for the exterior (Imdat, 2018). Following the provided research comprehensive study to develop heritage forms and morphological features in a renewal work in the region by using AI (Zou, 2023).

1.8 The Future of AI

Future research outcomes are Firstly, according to the current legislation of Ukraine and other countries, as well as scientific doctrine, only a human is a subject who can carry out intellectual, creative activity (Nikolaieva, 2023). Secondly, any activity in which artificial intelligence is used must be controlled by a responsible person for copyright. Also, this research outcomes that According to the analysis results, research trends of total chronology were growing

steadily and steeply growth (Kang, 2017). Another research stated that the application of AI in industries is a great risk and needs comprehensive study. It will also highlight the mitigation mechanisms needed for managing these risks (Alabdulkarim, 2023). Also, research exploring the collaborative opportunities of cyber resilience is crucial to building promising technologies in the future (Reisinger, 2023).

Hypothesis

- 1) To let the students take benefits from Artificial intelligence and new technology.
- 2) To be able to develop the design concept.
- 3) To be able to use AI in design development.
- 4) To be able to use AI to add coloring to the elevation of the project ‘Child and Mother Care Hospital.’
- 5) To be able to use the AI in final 3D rendering.

2. Method

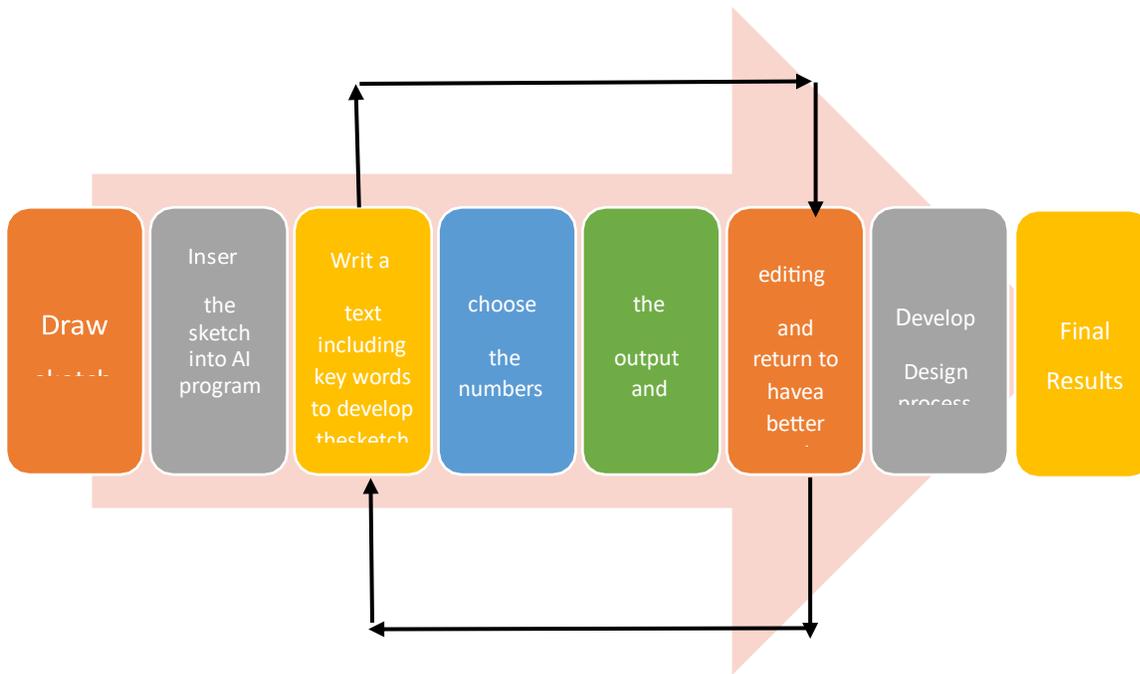


Figure 1.1 Shows the research process

The methodology of the research is passed through four steps.

- 1) Applying the AI program in the concept phase in Architecture Design Studio 7

Table 1.1 Show the AI program applied by the students

Case study No.	AI program	Advantages	Disadvantages
1	http://promelai.com/ website is a rendering concept.	Different development concepts.	AI changes its form.

2

LooX.AI.com.

Fast, form development. Image or
sketch - realistic photo
Fantasia color.

Need to set up.
System, limited credit
points,

2) Applying the AI program in four areas: concept development, design development, coloring the main elevation, and Rendering phase.

3) Distribute a survey to the students in Architecture Design Studio 7 to register their responses towards using AI in their design project 7 in the Concept development phase and Rendering phase. The survey was designed by Google Forms and distributed to all the students by email, the total number of students was 20. All the students answered the survey, the response was 100%.

4) Eight case studies from students' work in studio D7 were selected to reflect the research work.

3. Results

3.1 (AI) Results

The results of applying AI program in the concept phase. The selected six case studies are as follows.

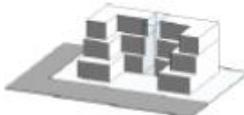
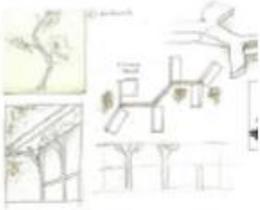
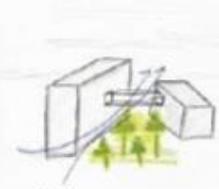
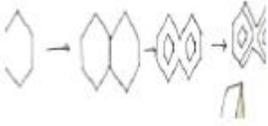
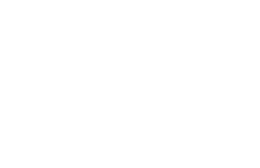
	Concept drawing	Sketch	Shot one	Shot two	Shot three
Case study one					
Case study two					
Case study three					
Case Study four					
Case Study five					
Case Study Six					
Case study Seven					
Case study eight					

Figure 1.2. The concept development by using AI

3.2 The Survey Results

Table 1.2. The survey result

	Questions	Totally Agree	Agree	Average	Disagree	Totally Disagree	Average
Q.1	Do you Apply Artificial Intelligence in Design concepts?	27.6%	34.5%	13.8%	13.8%	10.3%	75%
Q.2	Do you apply Artificial Intelligence (AI) in the Development Design Process?	17.2%	34.5%	20.7%	13.8%	13.8%	72%
Q.3	Do you apply Artificial Intelligence in applying coloring in the elevation?	13.3%	13.8%	24.1%	34.5%	17.2%	50%
Q.4	Do you apply Artificial Intelligence (AI) in Rendering and background?	6.9%	27.6%	13.8%	24.1%	27.8%	48%
Q.5	Do you apply artificial intelligence in sustainability solutions?	10.3%	17.2%	41.4%	10.3%	20.7%	70%
Q.6	Do you apply Artificial intelligence in developing the building form and structure?	13.8%	34.5%	24.1%	13.8%	13.8%	72%
Q.7	Tell us about your experience in using Artificial Intelligence in D7 or other projects						
		<p>I used artificial intelligence in the design to give me a visual idea of what would emerge from the project block and the distribution of spaces</p> <p>It helped a lot with developing the design and its ideas</p> <p>It was used in form-finding, material picking, post-production for renders, research, and concept statement generation, architectural and design solutions, as a way for inspiration, a method of summarizing brief documents, a content library for presentations to make u more able to imagine the project</p> <p>It was exciting and amazing</p> <p>It inspired me during the design concept process and gave me many creative ideas</p> <p>I consider myself new to AI, but I enjoyed my experience so far.</p> <p>It applies a new perspective to the design process.</p> <p>I used the http://promelai.com/ website in the rendering concept.</p> <p>It provides me with helpful inspiration in developing the beginning of the project at the level of building mass, also it is useful in developing the project in the advanced stages.</p> <p>It was interesting, and it gave me beautiful ideas.</p> <p>It's useful for the development of a project and helps me with ideas to improve my project</p> <p>IA gives more options and solutions in all design stages, especially at the concept development</p> <p>Very helpful in the initial stages</p>					

I once used an AI tool to generate a full concept statement with some words that describe the concept, I'm going for I don't use it.

I used AI in the concept to see how my project would look at the end.

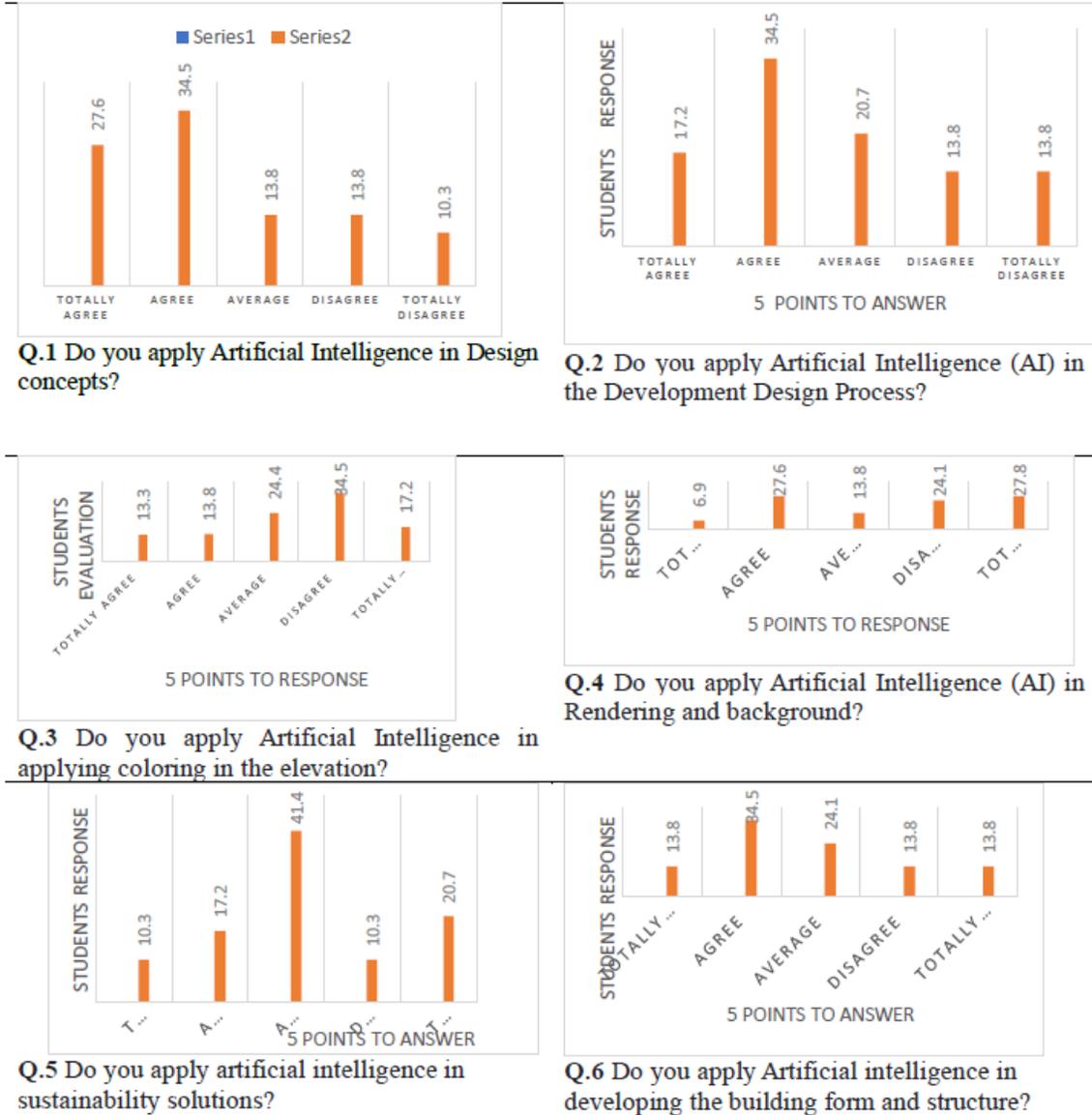


Figure 1.3. The survey results

4. Discussion

The discussion passes through five main research areas: concept development, design process, color system and rendering, and sustainability.

4.1 Concept Development

Case study one

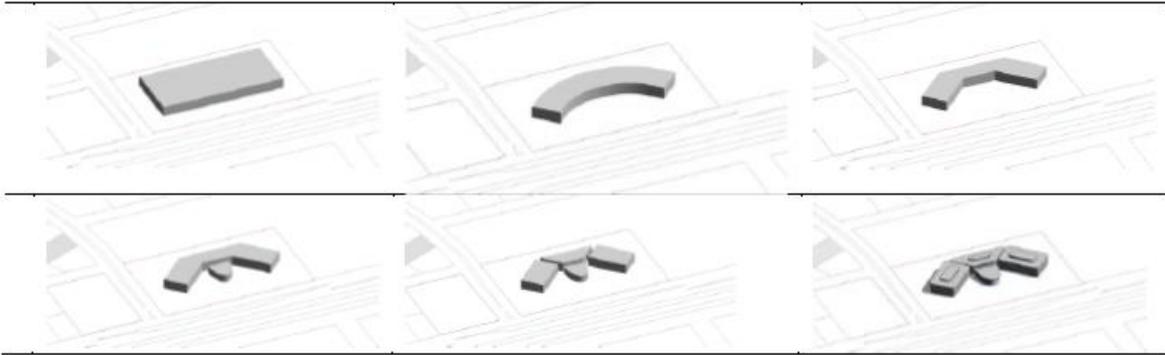


Figure 1.4. Case study one develops the design process

The Mother and Children Green Hospital is a healthcare facility that provides comprehensive and compassionate care for expectant mothers, newborns, and young children. This concept hospital focuses on creating a nurturing and supportive environment that promotes the health and well-being of both mothers and their children.

Case study two

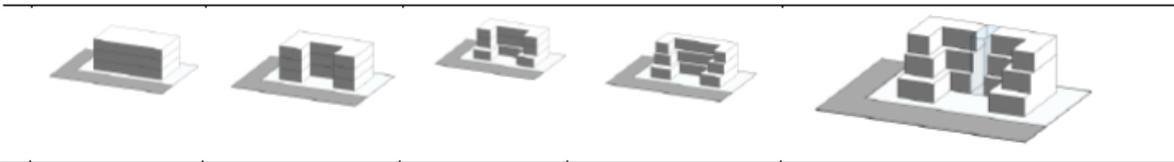


Figure 1.5. A case study two develop a design process

Case study three

The concept is about the power of healing with the sound of nature. The sounds of nature help with the environment and can impact patients' health and psychological well-being. Features such as bright rooms, access to natural daylight, and outdoor views can improve the healing process by giving patients a psychological and physical life healing, and psychological comfort, and this helps in the treatment process.

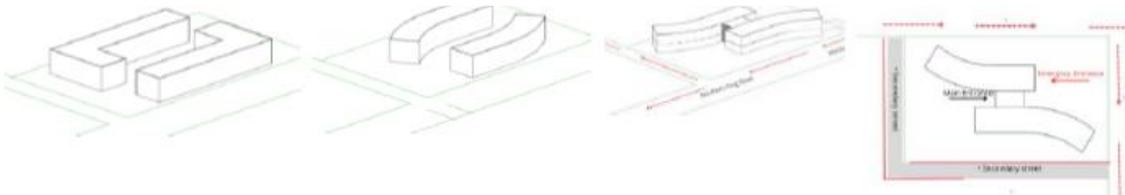


Figure 1.6. Case study three develops the design process

Case Study Four

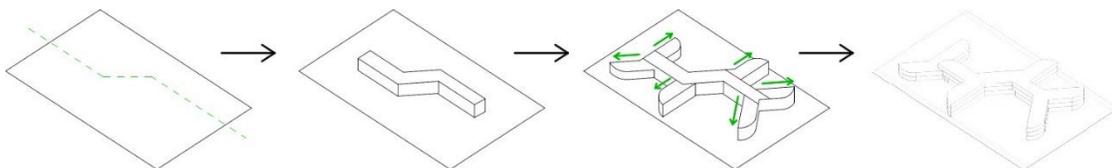


Figure 1.7. Case study four develops the design process

Create a unique and inspiring experience through the seamless integration of elements such as light, texture, views, and water. This would be reflected in the shapes of tree branches and s throughout the design.

Case study five

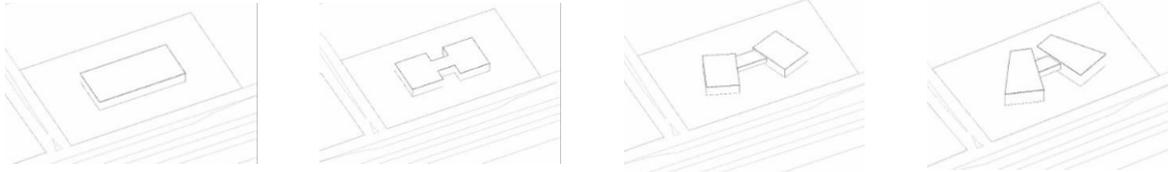


Figure 1.8. Case study five develops the design process

Inspired by the first letter in the word hospital, which is the letter “H” the environment can impact patients’ health and psychological well-being. Features such as bright rooms, access to natural daylight, and outdoor views can improve the healing process by giving patients a psychological and physical life.

All the students drew three sketches of the concept at the beginning of the project, the teacher helped them choose a suitable concept for their project and state how to develop the concept. Each student has six steps in concept development, a concept with the orientation of the 3D in the plot, a concept with the main entrances, a concept with the main requirements and made zoning, and a concept with the landscape.

Case Study Six

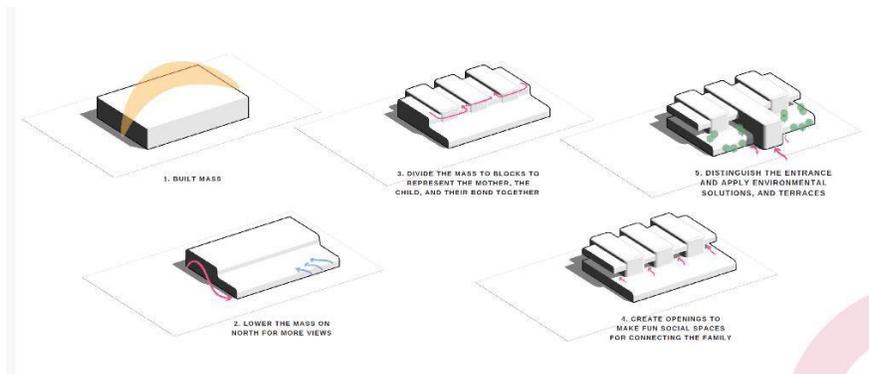


Figure 1.9. Concept development of case study six

Create an exciting and eye-catching environment for its young patients and their families, and craft an environment where children and expectant mothers feel nurtured and encouraged to explore their surroundings with a curious mind. blending playfulness with function and ensuring a seamless integration of elements. With an emphasis on accommodating the curious nature of children, incorporate areas that ignite their imagination and inspire wonder, inviting little ones to embark on a journey of discovery and learning.

Case Study Seven

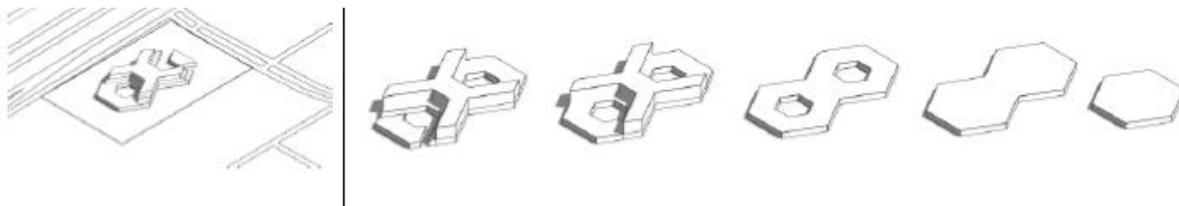


Figure 1.10. Concept development of case study seven

The concept is based on a Bee honey octagon shape, starting with one octagon form, then merging two with the courtyard.

Case Study eight

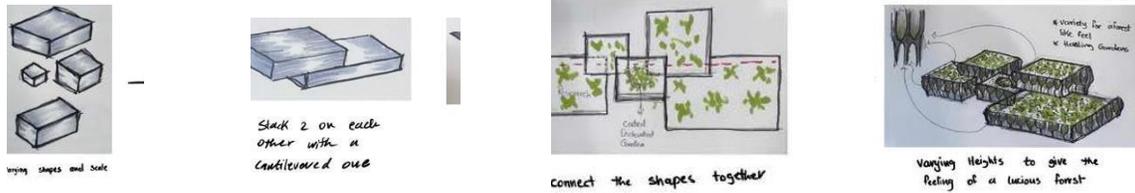


Figure 1.11. Concept development of case study eight

Nature's playful and religious sounds give the sense of healing and tranquility, Lifting the spirits of patients through optimistic feelings, providing healing and sanctuary to the patients, An Experience that mixes biophilia with a sense of wonder, Nature and wonder gives a sense of healing and escapism.

4.2 Coloring

Case Study Six

By Refit



By using AI



BY Using AI



Figure 1.12. Shows applying the AI in coloring the main elevation

Case study 9 applied the color concept in the main elevation, the Refit gave a limited color solution when she inserted the building form in the AI program it gave her unlimited solutions, with degraded, shaded devices.

4.3 Rendering

Case Study Seven.

By Refit



By AI



Figure 1.13. Applying the AI in rendering

Case study seven applied an octagonal design in the main elevation. The yellow color with degraded by the Refit computer program, and she found difficulties in designing the octagonal shape with the degraded color by the Refit

program, when she used the AI, it gave her eight shots according to the applied color, and the AI improved student innovation.

4.4 Sustainability

Case Study Eight



Figure1.14. Shows the application of AI in rendering and sustainable solutions

In case study eight, the student applied terraces in the 3D model, then she applied AI to develop the 3D model, she applied sustainable solutions, and AI gave her green roofs, a glass model, lighting effect.

4.5 Survey Results Discussion

The survey was distributed during November 2023, the total respondents were 20 female students, and 20/20 answered the survey questions. The results showed most of the students applied (AI) in developing their design concept as shown in Figure 2. Here the research agreed with (Ploennigs, 2023) that (AI) is useful in developing design concepts., about 25% of the students answered that they did not apply AI in concept development, those students had no idea how to use the AI program, they were involved in groups, helping them to apply AI, and helping them to improve their skills. In the second question, more than half of the students agreed that (AI) helped them to develop design processes and gave them more visualization to build form, here the research met with (Pena, 2021) that (AI) was oriented to have creative forms. In the third question, the Results showed that few students applied (AI) in developing the project's main elevation as shown in Figure 9 gives the solutions in coloring the elevation by AI gives fantasia and future colors here the research agreed with (Khalid, 2023) that AI is useful in applying color systems, the research showed that only 50% of the students applied coloring in their elevation it depends on their concept. In question, four quarters of respondents agreed that AI is useful in rendering and said that AI is fast and quick and gives rendering with different backgrounds. In question five the students agreed that they applied AI in sustainability solutions. The AI gave them solutions such as adding green roofs, terraces, more glass in elevations, and green terraces as shown in case studies 8,9, and 10. In question six the students agreed that AI helped them to develop building forms and structures, here the research agreed with (Zou, 2023) in developing different forms, only 48% of the students used AI to develop structure systems according to their concept. Question 7 was an open question, and the students were asked about their experience with applying AI in the design process they said it was an exciting experience, helped them to develop their projects in the initial process, gave more visualization to develop design forms, elevation color, design concept as shown in Table 2, Q.7. finally, the focus area to use AI was given by the teacher Still, the college needs to apply AI in all design studios to develop students' skills and increase the ILOs, the limit of ILOs is between (75%-100%), it was achieved in concept development, develop design process, and apply sustainability and the ILO not achieved in developing the structure and rendering by using the AI.

Table 1.3 Comparing the results with the international level

Focus area	(Ploennigs, 2023)	(Khalid, 2023)	(Pena, 2021) (Zou, 2023)	This research
Design concept	✓	x	x	✓
Develop design process	x	x	x	✓
coloring	x	✓	x	✓
sustainability				✓
Form and structure	x	x	✓	✓

This research is novel in discussing the whole design process including concept, and form coloring in elevation, and form, and provides novel solutions for sustainability.

5. Conclusion

- The novelty of this research lies in the application of Artificial Intelligence throughout the entire architectural design process. AI was utilized to develop the design concept, design process, color selection, and rendering on Design Studio 7. The methodology of the research involved applying AI programs in different stages of the design projects. Additionally, a survey was distributed to record the students' responses to AI.
- The outcomes of the research show that the students applied the AI concept development by 75%, in the development design process by 72.54%, in coloring by 50%, in rendering by 48%, sustainability by 70%, and in developing building form and structure by 72.3%. the limit should be 70% to 100% of the students should apply AI in developing design processes to achieve the ILOs
- The research recommends applying AI in architecture colleges; to develop the design process, more than fifty percent of the students apply AI in developing the concept, which gives the students great imagination for their projects. and fuel students' creativity for their projects.

- The AI assists students in designing building forms, more than fifty percent of students applied AI in developing building forms, adding canopies, and terraces, and developing the 3D dimensions.
- According to the research, using AI in the development of design concepts is recommended, more than fifty percent of students applied AI in the development of the concept, and the images proceed within a few seconds, AI can transform a sketch or image into a clear project image, which helps students visualize their project and its future appearance.
- The research recommends applying AI in coloring the elevation, fifty percent of the students applying AI in developing color concepts in elevation, The research recommends using AI to color elevations, providing a varied and fantastical color system, resulting in a visually striking elevation.
- The research suggests using AI for sustainable building designs, more than fifty percent of students applied AI in developing sustainability solutions, such as incorporating green roofs, terraces, natural lighting and ventilation, and elevating buildings on columns.
- The research recommends including AI as a course for architecture students. The course should cover syllabus and course specifications to teach the students about new AI technologies in the field.

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Authors contributions

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Obtained.

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Data sharing statement

No additional data are available.

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CHAPTER TWO

Saudi National Authority, Applying AI in Education, Case Study Architecture program

Saudi National Authority, Applying AI in Education, Case Study Architecture program

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Abstract

In November 2023, the Saudi Authority started applying Artificial intelligence (AI) in many disciplines, including Architectural Engineering. This research aims to study the effect of using AI in Architecture schools, especially design studios, in which phase, and in what percentage.

The methodology of the research is applied for AI programs in three main design steps: The primary research phase Form phase, rendering phasing by using the AI, and distributing a survey to Design 6 students to register their responses using AI in Architecture design selected case studies from students work was chosen to reflect the research works.

The results from the survey show that the students achieved applying AI in primary research by 99%, in the building form by 74%, and in rendering by 91.6%.

The conclusion of the research recommends applying AI in the primary research and analysis, building forms, and rendering, supervising by the teacher, and focusing on training AI in workshops, webinars, and competitions among the students in architecture engineering colleges.

Keywords: Saudi commission, artificial intelligence in architecture, application of AI in primary research, AI in developing building form, AI in Rendering.

1. Introduction and Literature Review

The Royal Order No established the National Center for AI. (A/471) dated 29/12/1440 AH and is organizationally linked to the Saudi Data & AI Authority. NCAI drives the national AI priorities in collaboration with its partners in the public and private sectors to support national research projects, strengthening research and innovation in the field of AI in the Saudi Kingdom, supporting the field with the needed capabilities for innovation, in addition to developing solutions that serve the national priorities in various sectors, and elevating the level of national cadres in data science, AI, and their supporting technologies.

Limited literature was found in the field of Artificial Intelligence (AI) in Architecture from 2022 to 2024 Here were classified into research five focus areas

1.1 Saudi Data & AI Authority (SDAIA)

The Saudi Data & AI Authority (SDAIA) is the competent authority in the Kingdom concerned with data and AI including big data. SDAIA is also the national reference in all matters related to the organization, development, and handling of data and AI; in addition, it has the original competence in all issues related to operation, research, and innovation in data and AI. (SDAIA, 2024)

1.2 SDAIA Academy

SDAIA Academy is one of the initiatives of the Saudi Data & AI Authority (SDAIA), which aims to support and develop national competencies in the field of data and artificial intelligence data Academy is one of the initiatives of the Saudi Data & AI. One of its aims is to Develop programs to raise national data and artificial intelligence capabilities. (Academy, 2024)

1.3 AI in Higher Education

SDAIA offers many courses. Dr. Hanan discussed a webinar on ‘ Saudi National Authority to Apply AI and its Applications.’ Many courses are offered in AI science, such as Data Science Engineering, AI Engineering, AI in Architecture Engineering, Data Science, Data Analysis, AI, and administration. (Naseejacademy, 2024).

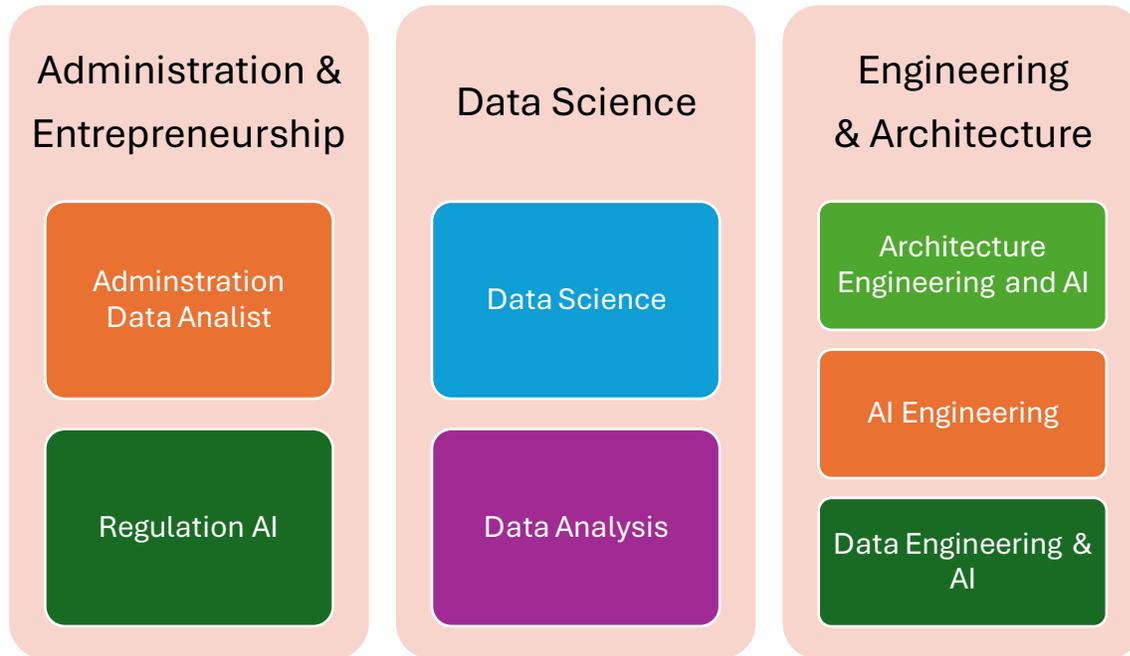


Figure 2. 1: shows AI fields in SADAIA and AI Specialization (Naseejacademy, 2024).

In addition, Dr. Hiba discussed the webinar on ‘ Using AI in Problem Solving in Architecture’’, The webinar presented by Naseej Academy, and explained three examples

- Zoom AI Companion and AI Summery, could be activated by the meeting host.
- Bing Chat experience from Microsoft, used by some universities.
- IBM Watson Education, teach the students according to their special needs.
- chat box, most of the university's websites use the chat box to contact the students
- Planning and Strategies
- SIS, students Information System, use of its information in analysis and problems solving
- LMS, a Learning and Management System, uses its information in analysis and problem-solving (Naseejacademy-2, 2024)

1.4 The Future of Architecture

The International Union of Architects (UIA) launched an online forum to discuss the future of architecture in the 21st century, (Atalay, 2024) Concluded the focus is on the capacity of architectural education to respond to these challenges while creating conditions for students and educators to engage as active citizens in their communities. In addition (Alsolaiman, 2024) Chair of the Art and Design Commission the program focuses on community engagement through workshops, Awards for excellent projects, forums, learning Café, cities and across the Kingdoms, Training programs, Summer Training, Architecture criticism workshops, and Urban transformation.

Also, (Devilliers, 2024) It was stated that universities and schools should embed changes, flexibility, and adaptation as part of their curriculum structure, design studio practices, and learning and teaching processes. She defined AI in three stages: Machine learning, machine intelligence such as computers, and machine consciousness. (Almadhoun, 2024) Discussed UNSDG goal number 17, encouraging the NGOs to collaborate with the education sector to sign agreements to improve students' skills to achieve sustainability goals.

1.5 AI in Research and Education

(Khogali, 2024) Discussed a research paper on the first application of AI in Design Studio 6 in the last semester 2023-2024-2 focusing on the design process in developing design concepts, building form, sustainability, and rendering the research outcomes showed less percentage in color and rendering application and development. (Rafsanjani, 2023) The research outcome is the main challenge, human-centered AI needs training to manage every user's expectation and input and be adaptable to unpredictable situations. (Osman, 2024) Dr Shahinaz presented a webinar at a conference that discussed using AI in education as reflecting the SDG number 4 quality of education, such as Language Learning In education, there are applications, LMS, SIS, Virtual Reality (VR), and Augmented Reality (AR). Also discussed were Ethical concerns related to AI-powered decision-making. (Lee, 2024) discussed in his research paper case study a model 3D used in the design process and developed by using AI and Chat GPT several times through discovering, defining, and delivering special cases to create the outcome of the research each step between 3times to nine times to reach a good result. (Almadhoun, 2024) highlighted the importance of creating research capability and capacity through innovation and knowledge involving the students in research and data collection, using new technologies and computer programs. (Zhang, 2023) This study underscores the promising potential of AI in the architectural domain, serving both as an educational tool and a creative design tool the outcome of the research stresses the need for a more personalized approach in the development and utilization of AI design. Also, (Nicenboim, 2023) discussed new methods of human signs such as noise from one person or noise from social speech to be added to AI and designers might use AI as a more-than-human agent in the design process. In addition, (Hoque, 2023) this research paper searched and answered the question: Does Artificial Intelligence have the Possibility of Taking Over Designers' Jobs in the Future? The answer is No. AI could help architects and designers to develop their designs. In addition, (Peuter, 2023) the researcher highlighted AI as a creative assistant for designers, the designer should create the model, Planning interaction, and problem-solving, the interaction with AI should be multiple, and the outcome will be excellent. In addition, (Chaillou2022 ,) published a book and discussed in this book Artificial intelligence in the field of architecture, with a focus on AI in form, context and model.

1.6 AI in Building Form

Pena highlighted the importance of using AI in innovative forms and ideas (Pena, 2021). for interior and exterior design, with the latter combining the strengths of the different platforms (Ploennigs, 2023).. In addition, (Peuter1, 2023) discussed in this paper applying AI in interior design helps designers in problem-solving, the research introduces a model that allows it to infer and adapt to designers' goals, reasoning, and capabilities. Also, (Li, 2024) this research focuses on introducing AI literature review in its application in Architecture, and introduces three 3D generative models, and foundation models, highlighting their recent developments and main application scenarios. Then, the paper explains how the abovementioned models could be utilized in architecture

1.7 AI in 3D Rendering

(Imdat, 2018) and (Zou, 2023) discussed the use of AI in interior and exterior 3D shots with different backgrounds.

Inanition, (Enjellina, 2023) discussed that AI in Architecture is becoming crucial, and providing more imaging in depth, it depends on the keywords provided to the AI box, and this tool good provides one step to the future image.

Hypothesis

- 6) To train the students in Artificial intelligence and new technology.
- 7) To be able to use AI in research
- 8) To be able to use AI in building form development.
- 9) To be able to use AI in rendering.

2. Method

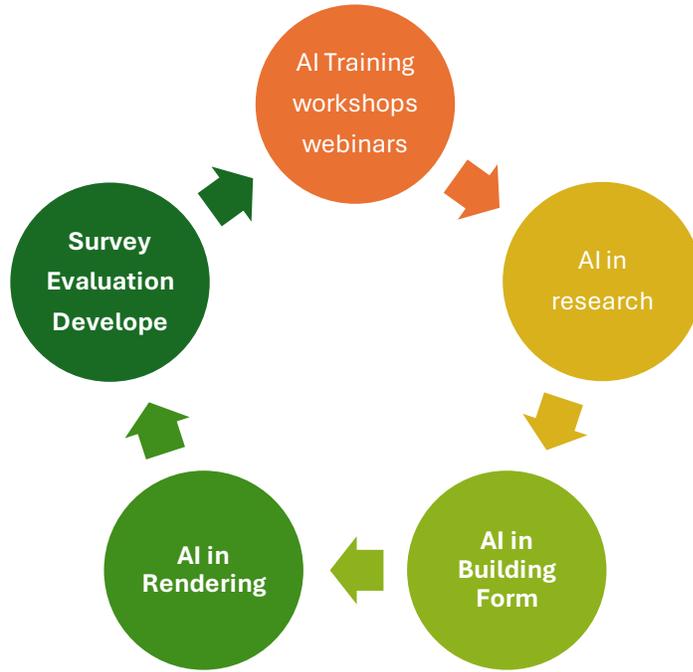


Figure 2. 2. Shows the research process plan

The methodology of the research is passed through four steps.

Applying the AI program in the concept phase in Architecture Design Studio 6

Many AI tools were used from 1991 to 2010 and new tools were generated from 2011 to 2020 (Hamza, 2021)

Table 2.1. Show the AI programs applied by the students

Case study No.	AI program	Advantages	Disadvantages
1	http://promeai.com/ website is a rendering concept.	Different development concepts.	AI changes its form.
2	Midjourney	Develop the form	Need training
3	Mnml.com	Develop the form	Need training
4	LooX.AI.com.	Fast, form development. Image or sketch - realistic photo Fantasia color.	Need to set up. System, limited credit points,
5	Chat Box	Use the website to answer student's questions	It is not working for 24 hours
6	Chat GPT	Help to develop the writing quality Help to provide the students with the case study	Need to be reviewed By Human

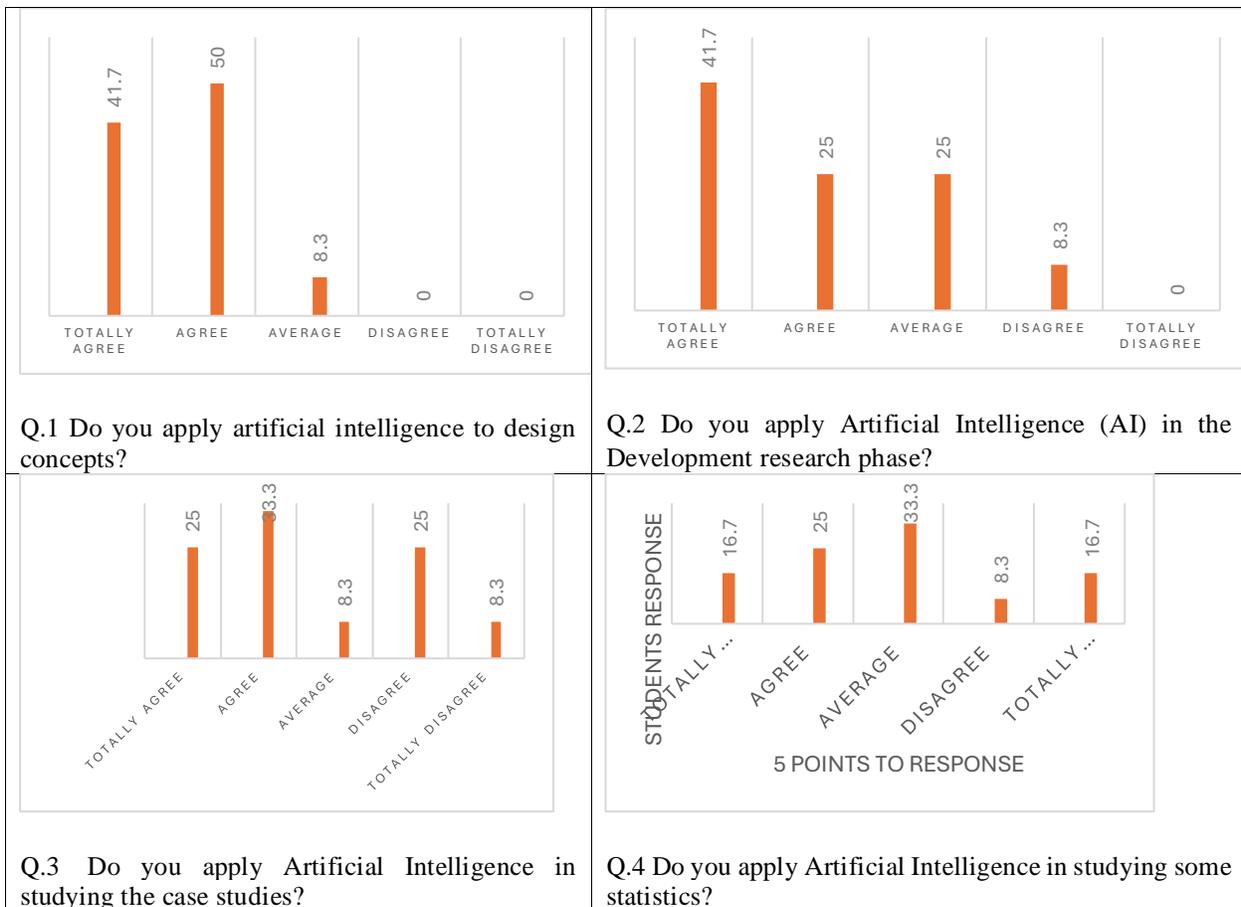
2) Applying the AI program in four areas: training the students, research phase, form development, and Rendering phase.

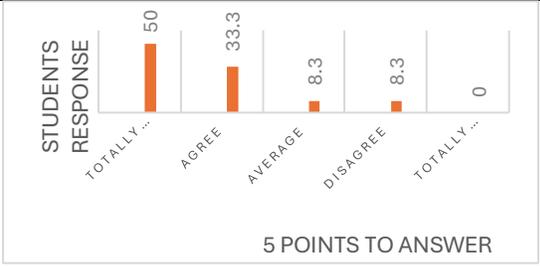
3) Distribute a survey to the students in Architecture Design Studio 6 to register their responses towards using AI in their design project 6 in their research, form development, and Rendering phases. The survey was designed by GoogleForms and distributed to all the students by email, the total number of students was 15. All the students answered the survey, the response was 100%.

4) Threest case studies from students' work in studio D6 were selected to reflect the research work.

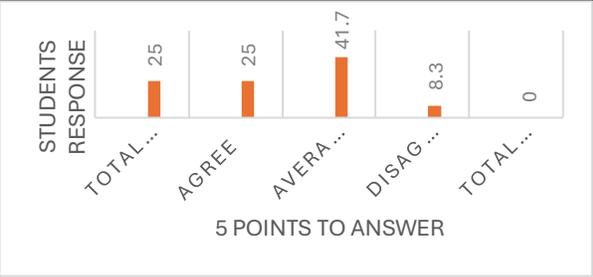
3. Results

3.1 The results from the survey

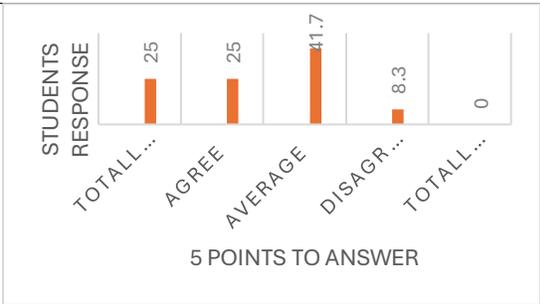




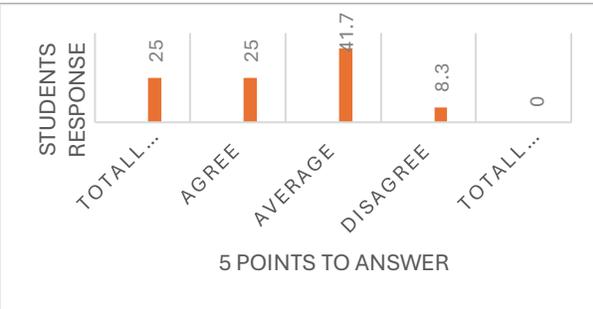
Q.5 Do you apply the Artificial Intelligence (AI) in Rendering and background



Q.6 Do you apply artificial intelligence in sustainability solutions?



Q.7 Do you apply Artificial intelligence in developing the building form and structure?



Q.8 Do you apply Artificial Intelligence in applying new materials?

Q.9 Tell us about your experience in using Artificial Intelligence in D6 or other projects

Useful experience

Very useful, helps to come up with new unique ideas thinking outside of the box

It helps me to develop more work in a short time

In my experience, using Artificial Intelligence (AI) in projects, including D6, has significantly enhanced efficiency and outcomes. In the D6 project, AI was leveraged for various tasks such as data analysis, predictive modeling, and process automation. For instance, we utilized machine learning algorithms to analyze large datasets, extracting valuable insights that informed our decision-making processes. Predictive models were developed to forecast trends and identify potential risks, allowing us to proactively address issues before they became problematic. Additionally, AI-driven automation streamlined repetitive tasks, freeing up team members to focus on more strategic activities. This not only improved productivity but also ensured higher accuracy and consistency in our outputs.

Ease of developing the design idea through Ai programs

- chat gpt
- Midjourney, PromeAi
- Chat gpt

ChatGPT – promAI– mmnni
 CHATGPT AND PROMAI
 Mnml.com
 Mnml ai - prome ai - caht gpt – poe

Figure 2.3: The survey results. (Analyzed by Author)

3.2 The Survey Results

Table 2.2. The survey result (Designed by author)

	Questions	Totally Agree	Agree	Average	Disagree	Totally Disagree	Average
Q.1	Do you apply artificial intelligence to design concepts?	41.7	50	8.3	0	0	100%
Q.2	Do you apply Artificial Intelligence (AI) in the Development research phase?	41	25	25	8.3	0	99.3%
Q.3	Do you apply Artificial Intelligence in studying the case studies?	25	33.3	8.3	25	8.3	66.6%
Q.4	Do you apply Artificial Intelligence in studying statistics?	16.7	25	33.3	8.3	16.7	75%
Q.5	Do you apply Artificial Intelligence (AI) in Rendering and background?	50	33.3	8.3	8.3	0	91.6%
Q.6	Do you apply artificial intelligence in sustainability solutions?	25	25	41.7	8.3	0	91.7%
Q.7	Do you apply Artificial intelligence in developing the building form and structure?	33.3	8.3	33.3	25	0	74.9%
Q8	Do you apply Artificial Intelligence in using new materials?	33.3	33.3	25	8.3	0	91.8%
Q.9	Tell us about your experience in using Artificial Intelligence in D6 or other projects						

Q.10 Tell us about the AI
program

3.2. Case Studies

Case study one

STAGE 1: CASE STUDY BY CHATGPT

National Cultural Centre for Arts and Knowledge Exchange

Introduction

The National Cultural Centre for Arts and Knowledge Exchange (NCCAKE) is a contemporary architectural marvel designed to foster creativity, learning, and cultural engagement. Located in a major metropolitan area, it seamlessly blends traditional and modern design elements to create an inspiring and functional space.

Architectural Design

Concept and Vision

NCCAKE was envisioned as a hub for artistic and intellectual pursuits, promoting idea exchange across diverse fields. Designed by a renowned architectural firm, the project reflects the region's cultural heritage while embracing modern aesthetics.

Structural Layout

NCCAKE includes:

1. Main Exhibition Hall: Flexible galleries for various exhibits.
2. Performing Arts Theatre: A 1,200-seat venue for performances.
3. Knowledge Exchange Wing: Libraries, lecture halls, and seminar rooms.
4. Outdoor Amphitheater: Space for open-air events.
5. Residencies and Studios: Accommodation and workspaces for artists and researchers.

Design Elements

Key design elements include:

- Facade: Geometric patterns inspired by traditional art, using glass, steel, and local stone.
- Atrium: Central skylit space enhancing openness.
- Circulation: Intuitive pathways and bridges connecting sections.
- Materials: Sustainable and locally sourced materials.

Sustainability Features

NCCAKE incorporates several green features:

1. Energy Efficiency: Advanced HVAC, solar panels, and high-performance glazing.
2. Water Management: Rainwater harvesting and greywater recycling.
3. Green Spaces: Roof gardens and landscaped courtyards.
4. Daylighting: Maximizing natural light.
5. Waste Reduction: Recycling programs and prefabricated components.

Cultural Significance NCCAKE is a cultural hub, showcasing local and international art, and hosting exhibitions, performances, workshops, and conferences. It engages the community through educational programs and collaborative projects.

Community Engagement

The center offers outreach initiatives and public spaces, fostering community inclusivity and engagement.

Impact and Reception

Since its opening, NCCAKE has been praised for its architectural excellence and cultural contributions, becoming a landmark destination that boosts tourism and the local economy.

Awards and Recognition

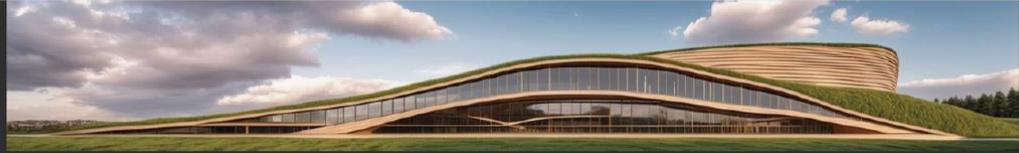
NCCAKE has received awards for:

- Green Building: Sustainability features.
- Cultural Heritage: Promoting and preserving heritage.
- Architecture Excellence: Innovative design.

Conclusion

The National Cultural Centre for Arts and Knowledge Exchange is a model of integrating art, architecture, and sustainability. It enhances the cultural landscape and sets a high standard for future cultural institutions worldwide.

STAGE 2: PRIMARY DESIGN AI RENDERING



STAGE 3: FINAL DESIGN AI RENDERING



Figure 2.4: Case Study one, earth morphology. (Designed by the students)

Case study two

<h3>Artificial Intelligence (Study Phase)</h3> <p>using :chatGPT</p> <p>Project Introduction</p> <p>The Cultural Arts Center in Al-Arid, Riyadh, spans 50,000 square meters and promotes culture and arts through a design inspired by traditional Najdi motifs. The project features two theaters, five exhibition halls, a cinema, restaurants, cafes, and a children's play area, making it a comprehensive cultural destination.</p> <p>Design Philosophy</p> <p>The design abstracts traditional Najdi door motifs, particularly concentric circles resembling the sun, blending heritage with modernity.</p> <p>Structural System</p> <p>The building uses a truss system for large, column-free spans, ideal for halls and theaters.</p> <p>Design Elements</p> <ul style="list-style-type: none">- Facades: Made of local stone, treated glass, and treated wood.- Green Roofs: Enhance environmental sustainability. <p>Sustainability</p> <ul style="list-style-type: none">- Environmental: Local materials and green roofs reduce emissions.- Economic: Diverse services support the local economy and create jobs.- Social: The center fosters cultural exchange and community bonds. <p>Conclusion</p> <p>This center combines Najdi heritage with modern design, serving as a cultural landmark in Riyadh and a model for sustainable development.</p>	<p>Research by using Chat GPT helps in searching about the case studies in the Culture center and helps in concept development</p>
<h3>Snapshots of Artificial Intelligence (Design Development)</h3> <p>using :mnm1.ai</p> 	<p>The concept development of the project is Art and Culture Center, concept development by using the Refit program</p>
<h3>Snapshots of Artificial Intelligence (Render)</h3> <p>using :ai-architect</p> 	<p>Using AI in Rendering Shots</p>

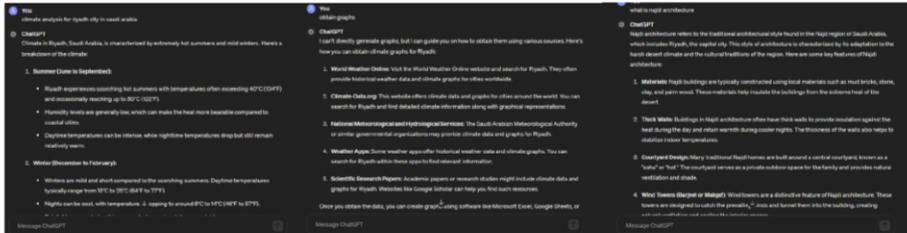
Figure 2.5: In Case Study 2, the center sphere represents the heritage (Designed by the student 2)

Case Study 3

As AI evolves, we reached to a point where we must use it in our day-to-day life, and as students became more and more familiar with it, we started wondering how it can be used in architecture and here we discuss how to use it in most of the phases in architectural designs, whether in the design itself or just in the rendering phase.

DATA GATHERING PHASE CHATGPT

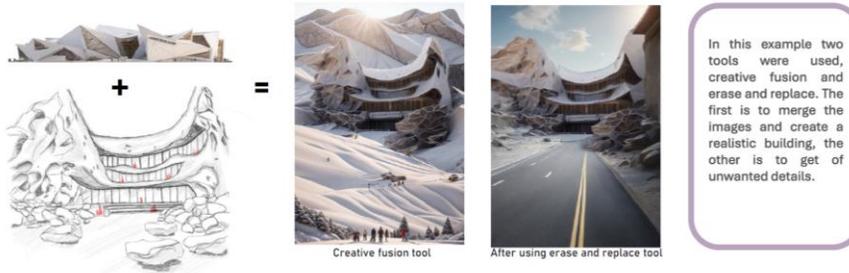
A common example of AI would be ChatGPT, in architecture it can be used partly in the site analysis phase as it helps with gathering some of the data with minimum effort. As shown below you can ask about the site information, and it also can be helpful in the concept phase. Although it might not be able to generate certain graphs however it would recommend some sites that could provide it.



Applying the Chat GPT in searching about the case studies in Art and Culture center

CONCEPT PHASE PROMEI

After the case studies phase most students will find a project where they feel it is close to what they wish to design and when deciding a concept students will start drawing an initial sketches to the mass as way to express their ideas, however the remaining question is how to merge the concept with the inspiration project, here comes the benefit of using AI. As an example, one can use (Promei) website and a tool called (creative fusion), where two images must be uploaded and there is a measure of style intensity, where in this example the case study's project images are the style.



Applying The AI in concept and form development

PRIMARY DESIGN PHASE PROMEI

When deciding the form AI can be helpful to generate other variations of it, which can be helpful in testing new ideas to decide the final form, as shown below it provided various options to choose the style that you would like to go with, these were obtained by image variation tool with no text provided.



ELEVATION DESIGN PHASE PROMEI

After settling with a certain form designing the elevation can be challenging and time consuming, there fore one can use AI to obtain some variations in elevations, it can be in the materials only or patterns or the overall design and these were also these were obtained by image variation tool with no text provided.



INTERIOR PERSPECTIVES PHASE PROMEI

Sometimes interior perspectives are required, yet there might not be enough time to work on them, and here comes the use of AI where you can take an image of the perspective you want to design, include the layout (walls, tables, windows, doors, etc..) and use AI to design the rest.



The project by using the Refit program.

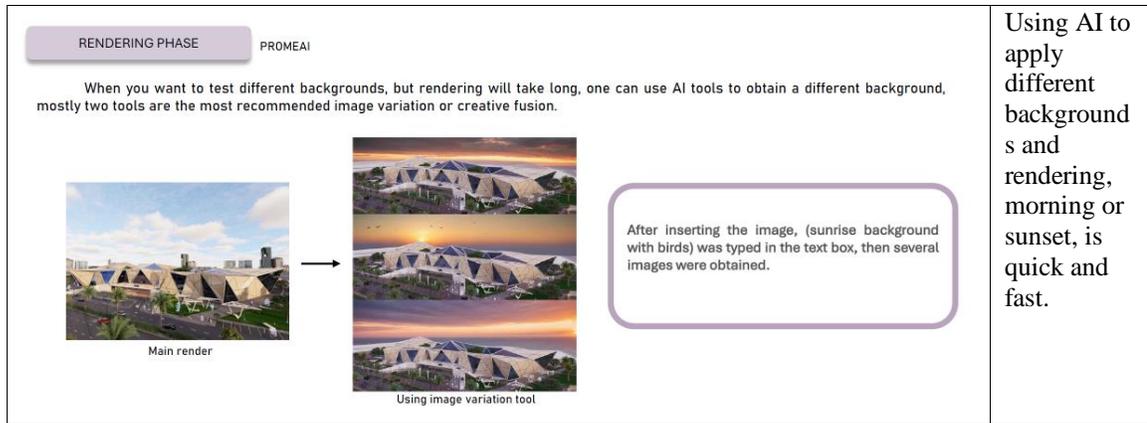


Figure 2.6: Case Study 3, represents Najd style with the Sulmani style. (Designed by the student 3)

4. Discussion

4.1 discuss the survey results

The survey was distributed in May 2024, the total respondents were 20 female students, and 20/20 answered the survey questions. The results showed students applied (AI) in developing their design process in concept as shown in Figure 2. Here the research agreed with (Peuter, 2023) (AI) was a useful tool used to develop design processes in the first question 100% of the students answered that they applied AI in concept development and those students had no idea how to use AI programs, they were involved in groups, helping them to apply AI, and helping them to improve their skills.

In the second question, third, and fourth questions more than half of the students agreed that (AI) helped them to develop the research about site analysis applied by 99.9%, data analysis, and statistics used by 75% of the studies analysis applied by 66.6%, AI gave them more visualization of the project site. Here the research met with (Almadhoun, 2024)

who highlighted the importance of creating research capability and capacity through innovation and knowledge involving the students in research and data collection, using new technologies and computer programs.

In the fifth question, 91% of the students used AI in rendering, it gives quick background images, skyline, and sunset about the project, here the research met with (Ploennigs, 2023) AI is used to create interior and exterior 3D images, with the latter combining the strengths of the different platforms.

In addition, in question six, 91% of the students agreed that they applied AI to sustainability solutions. The AI gave them solutions such as adding green roofs, terraces, reflected glass in elevations, and green terraces as shown in case studies of plants and trees in the outdoor environment

Also, in the seven questions, 75% of the students applied AI to develop building forms and structures, here the research agreed with (Ploennigs, 2023) in combining the strengths of the different platforms

In question eight, 92% of the students applied AI to find new building materials in the elevations.

Question 9 was an open question, and the students were asked about their experience with applying AI in the design D6 they said it was a useful experience, to come up with new unique ideas thinking outside of the box

One student said It helps me to develop more work in a short time

Another student said in my experience, using Artificial Intelligence (AI) in projects, including D6, has significantly enhanced efficiency and outcomes. One student said: The D6 project leveraged AI for various tasks such as data analysis, predictive modeling, and process automation. In addition, one student said for instance, we utilized machine learning algorithms to analyze large datasets, extracting valuable insights that informed our decision-making processes. Predictive models were developed to forecast trends and identify potential risks, allowing us to

proactively address issues before they become problematic. Additionally, AI-driven automation streamlined repetitive tasks, freeing up team members to focus on more strategic activities. This not only improved productivity but also ensured higher accuracy and consistency in our outputs and ease of developing the design idea through AI programs.

Question ten was open, and the students were asked about their used program. And they answered that they used Chat box, Chat GPT, Midjourney, Prome, and Mnml.com.

Finally, the use of AI still needs training to be applied in all design studios, now in this semester it was officially applied in design D6, and we need to extend the experience to all design studios, improve design skills, and increase the student learning outcomes ILOs

4.2 Discuss the case studies

The project is National Culture Center and Knowledge Exchange considered a multi-disciplinary public space, considered a hub of intellectual exchange, exploration, and enrichment, serving as a destination for those seeking to understand a different culture, play a significant role and landmark in the city, locally in Saudi Arabia such culture center as King Fahad Culture Center, in Riyadh, and Jameel Square in Jeddah, while internally. example Jaber Al Ahmad Culture Center. This Art and Culture center includes a Large space theater with 3500 m², a small area theater with 2500 m², a cinema with 2000 m², multi-proposed halls used as art halls and seminar rooms, workshops halls, and artificial intelligence hall, a library, and restaurant and administration and, Historical Museum.

The first case study

The first case study concept, designed as a sculptural form, emerged from the linear intersection, of pedestrian paths, within the cultural district, and sprouted a network of preaches. gradually, developed, into a growing organism, spread as the earth's geological layers, addressed climatic change, with curved layers.

AI was applied to develop the building form, shown in Figure 7, AI generated 12 different shots that helped to create the building form, the main AI program used was “Prome” .9 generated shots by AI in the following Figure 6.

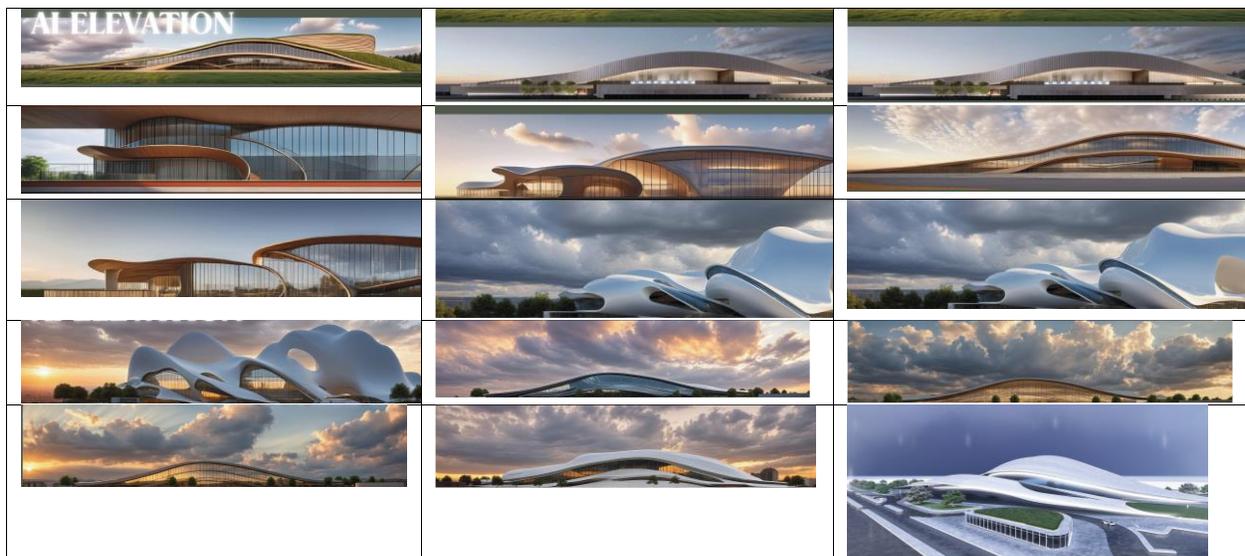


Figure 2.7. The AI shots were generated in case study one by using the Prome AI program. (Designed by the student 1).

The second case study

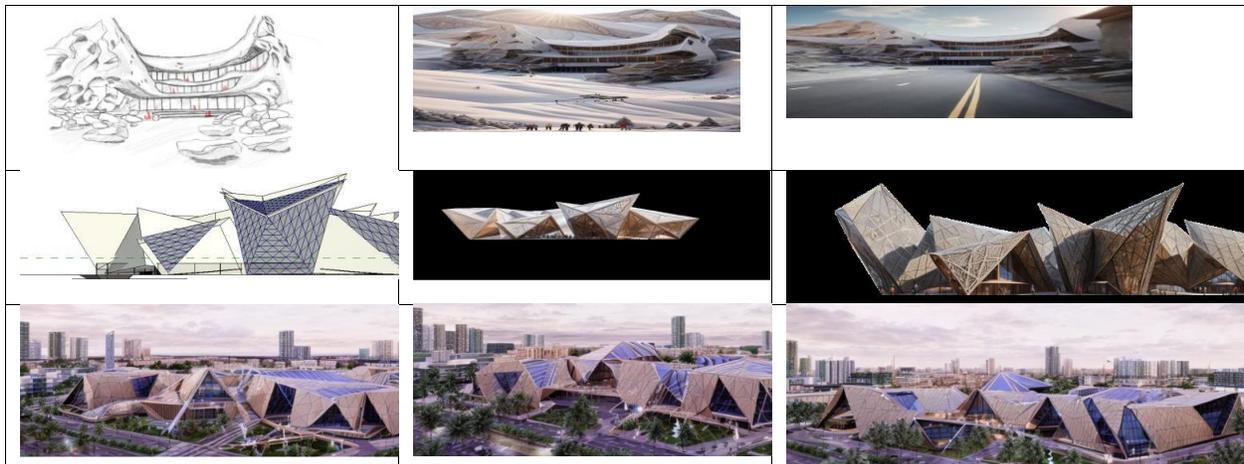
The design concept is abstract from Najd style and door motifs, Particularly concentric circles, resembling the sun, blending heritage with modernity., applied local building materials such as Riyadh stone, and sustainability was used in the reflected glass and green roof and green landscape. The building form was developed using sketches and, AI giving different geometrical forms. As shown in the following figure. Three shots of concept development and three shots in rendering a total of six shots by AI using Midjourney and Chat GPT AI programs.6 shots were generated in the following Figure 8.



Figure 2.8. The AI shots were generated in case study two by using the Midjourney AI program. (Designed by student 2)

The third case study

The concept extracted from the Najd style, designed two courtyards and all the functions and spaces surrounding the two courtyards, then reflected the Sulmani style in a new way and modern design by applying the triangles windows with reflected glass and sky lighting. The AI used in the research phase in Chatbox helped in some information about site analysis, and data analysis. Also in the design development phase, the student started by drawing sketches about the concept, then inserted the sketches in AI, and Prome AI was applied to develop the design concept. Building form and rendering. 9 shots were generated in the following Figure 8.



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Figure 2.9. The AI shots were generated in case study three by using the Prome AI program. (Designed by student 3).

Case study four

The concept of the culture center is Orbit, which contains the conference hall and cinema, lecture rooms and exhibitions

The student applied AI in building form, render, and sustainability, total number of shots were 8, she applied Prome AI program.

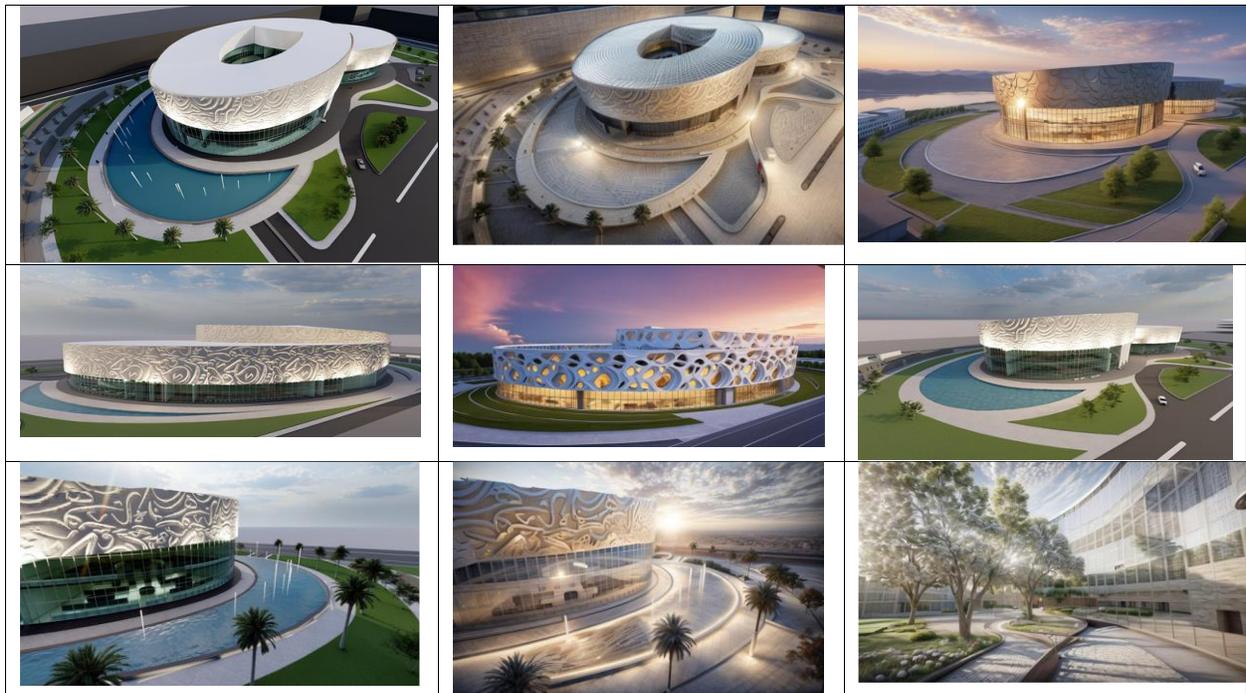


Figure 2.10. The AI shots were generated in case study three by using the Prome AI program. (Designed by student 4).

Case study 5

The concept of the culture center is containment, the three cylinders were the conference hall, cinema and lecture hall, , on the arm the VIP well coming hall and workshops room, in the intermediate space the main foyer of the center. The student applied the AI to develop the concept, render, and sustainability, the total number of shots was 8 shots, and she applied the Prome AI program.





Figure 2.11. The AI shots were generated in case study three by using the Prome AI program. (Designed by student 5).

Challenges facing Applying AI tools in architecture

- Not all the students know about AI programs
- To solve this problem the teacher divided the students into small groups to learn the programs in pairs
- The need to repeat the input with different keywords to have better results
- More shots should be provided from 4 to 12 to have different solutions in elevations, form, backgrounds
- limitations associated with AI adoption in architecture education.
- ethical considerations
- cost factors to downloading the AI programs
- the need for continuous learning and adaptation and training and workshops in AI programs

Explanation of AI tools

- The students used different AI tools to design and write the exercise in Table 1 the names of these programs, advantages, and disadvantages of each program
- Advantages include the fast, innovative AI tool, which gives more solutions to develop the concept and form. Render shots and sustainability
- Disadvantages include the need for training, it works for 24 hours if it's free
- The process starts by downloading the program and then uploading the sketches or photos, writing the keywords, writing the number of shots, choosing the theme, then start
- In A few seconds the AI will give you the result
- You could repeat the process, with more keywords to have better results

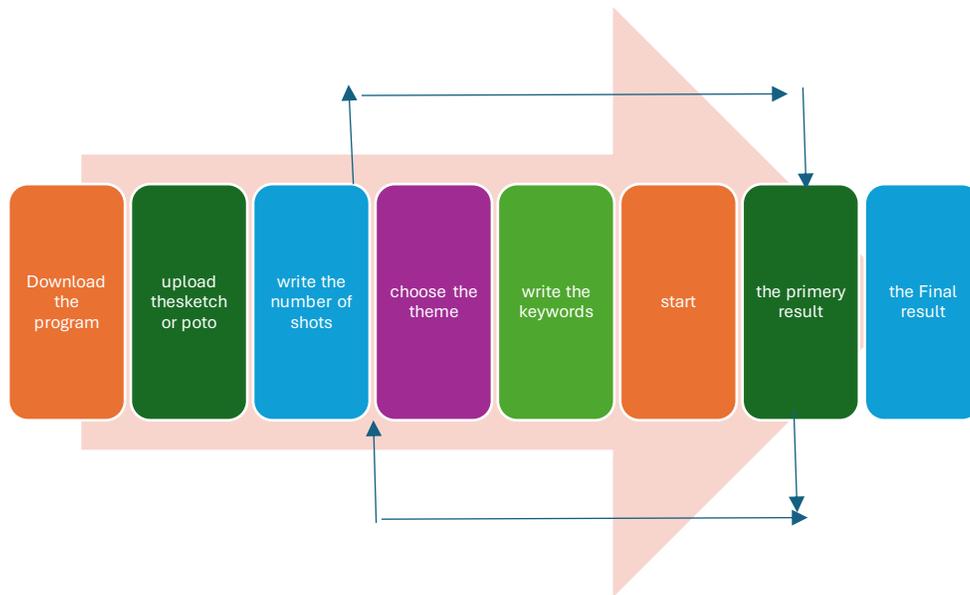


Figure 2.12: The Process of AI tools.

Compare the results between the two following research by AL

Table 2.3: Comparing the two types of research applied AI (Designed by the Author).

	First research 2024-1 (Khogali, H., 2024)	Second research 2024-2 This research
Research	72	99
concept	75	100
Building form	72	74
Rendering	48	91.6
Coloring	50	Not applied
Sustainability	70	91.7
Material	72	91.8
Structure	72	91.6

By comparing the results of this research with the results of (Khogali, H., 2024) shown in Table 2, I recognize that the achievement percentage of doing research is increased to 99 %, in concept increased to 100%ing, building form increased to 74%, rendering increased to 91%, coloring is not applied in this project, sustainability increased to 91.7%, material, and structure increased to 91.6%, generally the student's performance and applying AT is increasing the ILOs and developing their project up to 91.6%.

5. Conclusion

The novelty of this research lies in applying Artificial Intelligence throughout the entire architectural design process. AI was utilized to develop the primary research, building form, and rendering on Design Studio 6. The research methodology applies AI programs in different stages of the design project. Additionally, a survey was distributed to record the students' responses to AI.

The outcomes show that the students applied AI in primary research 99 %, in the development of building form 74%, and in rendering 91%, of the students apply AI in developing design processes to achieve the ILOs.

This research is a response to SADAIA the Saudi National Authority in AI and smart systems in different sectors, one of these sectors is education.

The AI assists students in primary research in excellent ways, in case studies, and site analysis.

The research recommends using AI to develop building forms. More than fifty percent of the students use AI to develop building forms after they draw sketches in the primary design.

The research recommends using AI in rendering, providing different backgrounds in 3D, and giving quick images about the design.

Comparing the results of this research with those (Khogali, H., 2024) in Table 2, we found that applying AI in developing design processes increases the course's CLOs.

This research highlighted the importance of students' training in applying AI to different programs, to develop design processes in Architecture colleges at all levels.

The research encourages Knowledge transfer, through workshops, webinars, and competitions internally and externally with other universities.

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Obtained.

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The Publication Ethics Committee of the Canadian Center of Science and Education.

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Data sharing statement

No additional data are available.

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CHAPTER THREE

Saudi Applying AI in Interior Design, Case Study Gaming Arena, With Focus on, Lighting, Materials, and Structure

Saudi Applying AI in Interior Design, Case Study Gaming Arena, With Focus on, Lighting, Materials, and Structure

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Abstract

In November 2024, the Saudi Commission started applying Artificial intelligence (AI) in many disciplines such as Architecture. This research aims to study the effect of using AI in Interior Design programs, especially design studios. The case study is the project of D7, Gaming Arena.

The methodology of the research is applied for AI programs in three main design steps: Elevation design, Structure, lighting, and materials, and distributing a survey to Design 7 students to register their responses using AI in Interior design selected case studies from student work were chosen to reflect the research works.

The survey results show that the students achieved applying AI in primary interior lighting by 90%, in interior materials, and in interior structure by 90%.

The research concludes that AI should be applied in the design process, including Elevation design, Structure, lighting, and materials, under the teacher's supervision, and taught as a course in architecture engineering colleges.

Keywords: Artificial intelligence in Interior design programs, application of AI in Elevation design, Structure, lighting, and materials.

1. Introduction and Literature Review

Applying AI in Interior Design Programs and other programs is becoming crucial, this research is Gaming Arena applied for D7, the research project contains two main parts, the Architecture and interior design and the building systems solutions including Structure, Lighting, HVAC, Safety and Plumbing, the program was applied through different steps the concept, site analysis, Architecture drawings, and the systems, the teacher focuses on many skills such as the group work, the site visit, the storyline, and Applying the AI at last in developing the main elevation, and apply materials in elevation, apply lighting in Gaming Arena, and Structure. In this research three case studies were taken from students' works, and analyzed.

Limited literature was found in the field of Artificial Intelligence (AI) in Architecture from 2022-2024 Here were classified into research five focus areas

1.5 AI in Research and Education

(Khogali, 2024) discussed a research paper on the first application of AI in Design Studio 6 in the last semester Focusing on the design process in developing design concepts, building form, sustainability, and rendering the research outcomes showed less percentage in color and rendering application and development. (Hafiz, 2024) highlighted the importance of applying this powerful tool in interior design, the study focuses on the history of architecture and interior design reimagination, and AI in the current phase can not replace Human thinking.

1.2 AI in Interior Design

The book *Artificial Intelligence in Architecture and Interior Design* focuses on construction and building management to improve building efficiency and extract innovative ideas (Abuagla, 2023). In addition, Mehmet discussed the importance of including AI as an effective tool in interior design education (Kahraman, 2024). (Alia, 2024) Discussed the book chapter on applying sustainable images using AI in interior spaces.

(Patil, 2024) This paper presents a comparative study of leading generative models—StyleGAN, AI models that elevate the design process and create more tailored interior solutions, and a survey to examine the model. (Arfeli, 2025) This book chapter explains how to use, shape, and develop AI applications, using the research outcomes' comprehensive AI competence matrix to be applied to students of Stuttgart University of Applied Sciences in Germany.

1.3 AI in Lighting

(Şekerci, 2024) Discussed and investigated the use of AI in the concept development stage, which is one of the essential phases for an interior designer to create a unique space, developed the concept by using an AI program in groups, then a survey was analyzed. The research outcomes showed that 65% had a positive impact, 25% had a negative effect, and 10% had invalid answers.

1.4 AI in Materials

(Wu, 2023) The paper discussed the importance of applying AI and VR in interior design, as it shortens time and enhances student communication. The outcomes of the paper were Based on a series of evaluative tests, which showed that the interactive design system for interior decoration presented in this paper is feasible and worthy of further promotion and application.

1.5 AI in Structure

(Shreya, 2024) highlighted that applying AI in the world is significantly impacting the field of interior design, giving good imagination of 3D and design furniture the outcomes of the paper are better the design pedagogy by equipping them with the skills necessary to master AI tools

Hypothesis

- 10) To train the students in Artificial intelligence.
- 11) To be able to use AI in the Lighting system in the interior space of Arena Stadium
- 12) To be able to use AI in elevation design and apply material
- 13) To be able to use AI in the structure system in the interior space of Arena Stadium

2. Method

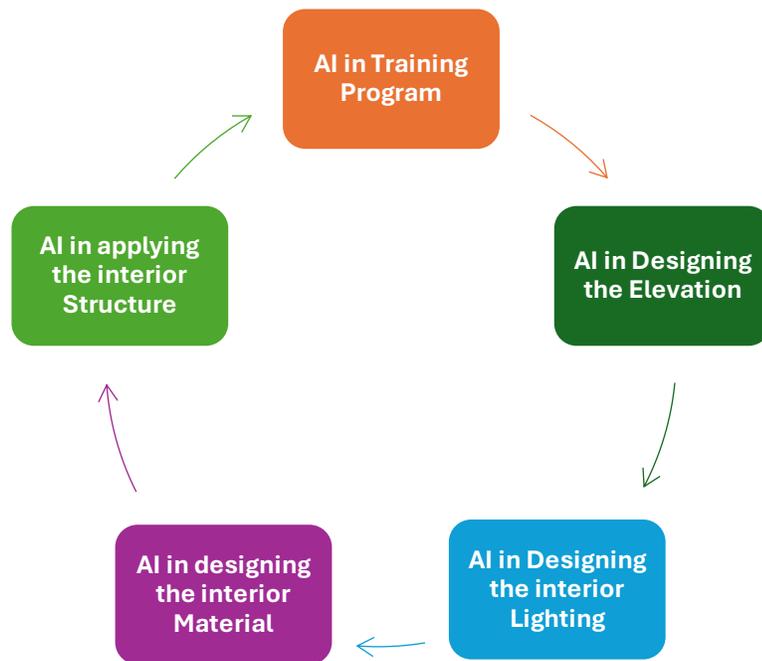


Figure 3.1. Shows the research process plan

The methodology of the research is passed through four steps.

Many AI tools were used from 1991 to 2010 and new tools were generated from 2011 to 2020 (Hamza, 2021).

Applying the AI program in the design of the elevation and applying materials, AI in lighting, and AI in structure, in Architecture Design Studio 7.

Table 3.1. Show the AI program applied by the students

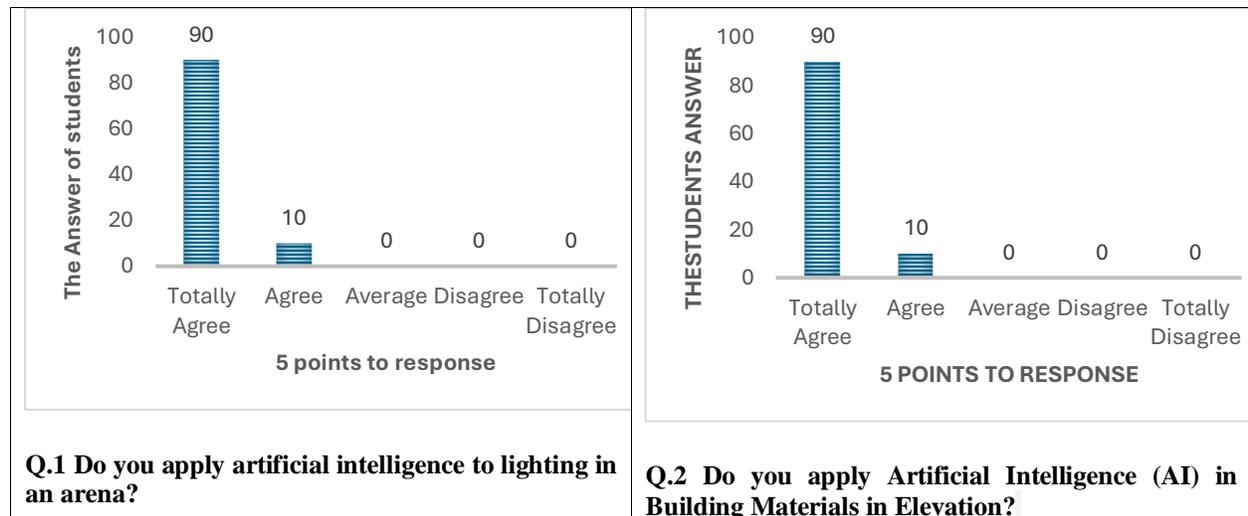
Case study No.	AI program	Advantages	Disadvantages
1	http://promeai.com/ website is a rendering concept.	Different development concepts.	AI changes its form.
2	Midjourney	Develop the form	Need training
3	Photo AI	Develop the form Need training	Develop the form Need training
4	Deepa	Develop the form Need training	Develop the form Need training
5	Chat GPT	Help to develop writing quality Help to provide the students with the case study Help in statistics Help in Analysis	Need to be reviewed By Human

2) Distribute a survey to the students in Architecture Design Studio 7 to register their responses towards using AI in their design project 7. The survey was designed by Google Forms and distributed to all the students by email, the total number of students was 11 female students. All the students answered the survey, the response was 100%.

3) Three case studies from students' work in studio D7 were selected to reflect the research work.

3. Results

3.1 The results from the survey



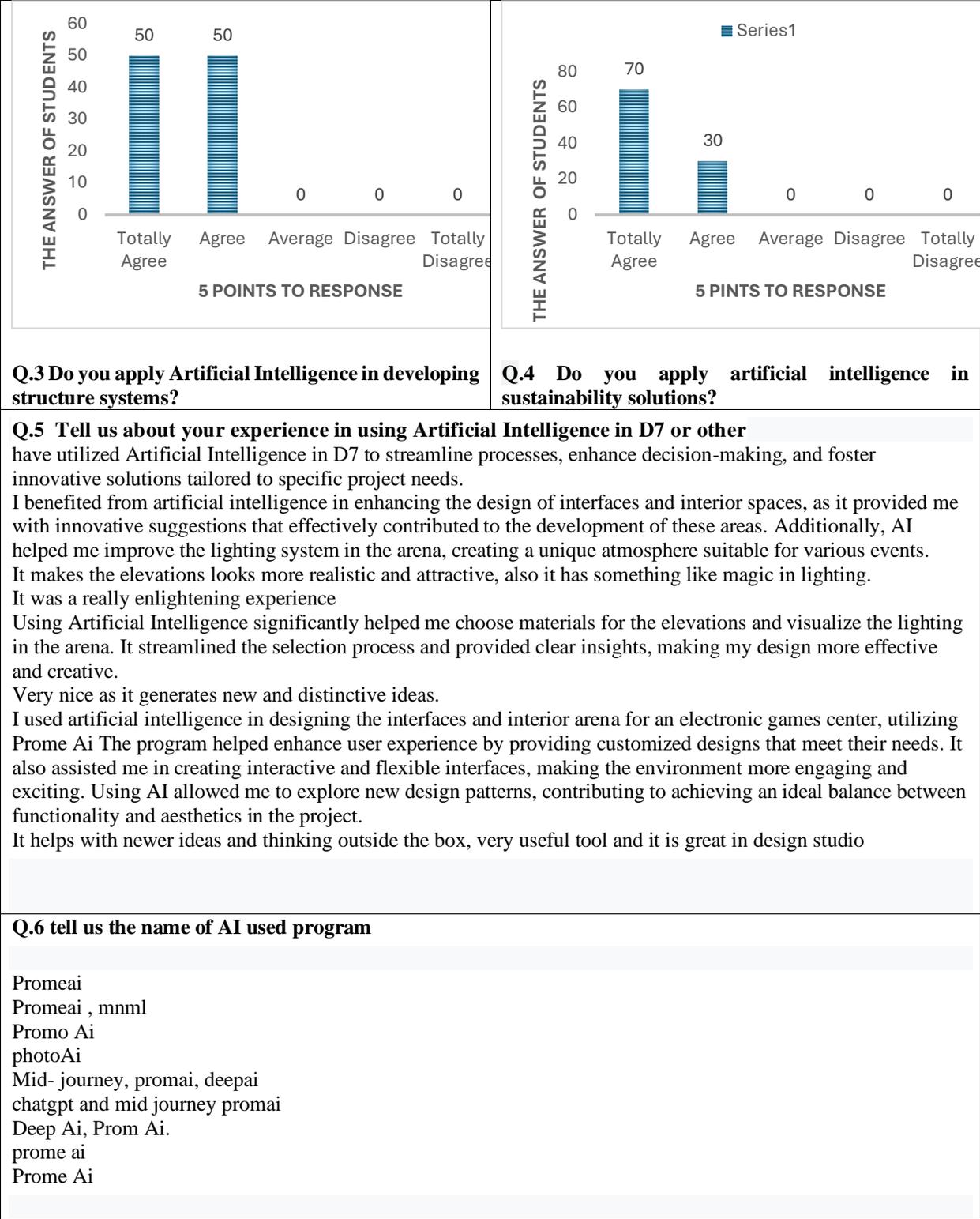


Figure 3.2: The survey results

3.2 The Survey Results

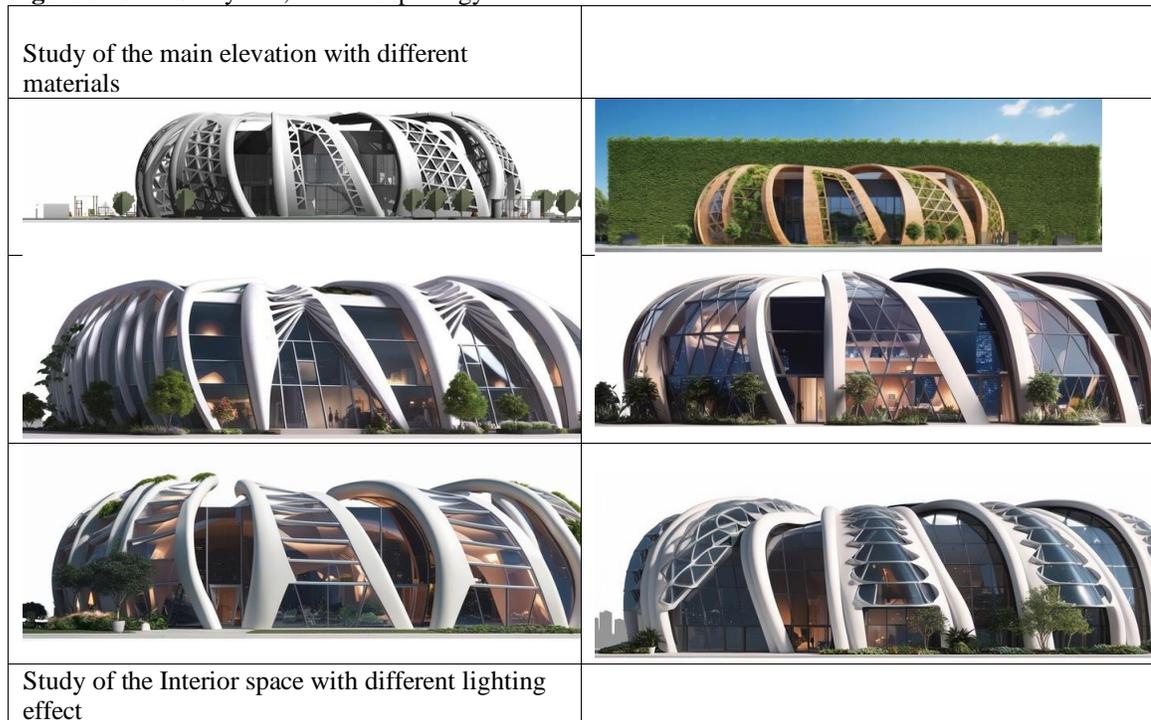
Table 3.2. The survey result

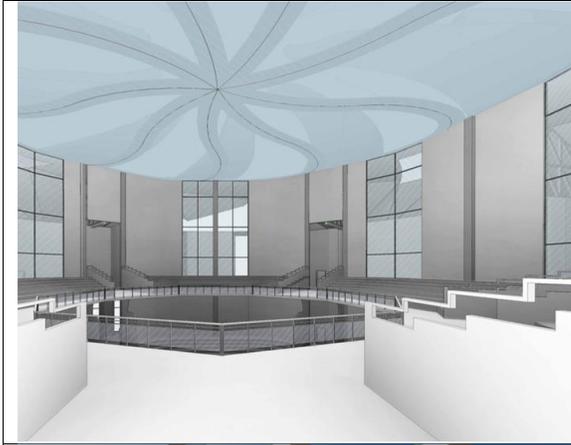
	Questions	Totally Agree	Agree	Average	Disagree	Totally Disagree	Average
Q.1	Do you apply artificial intelligence to lighting in an arena?	90	10	0	0	0	90 %
Q.2	Do you apply artificial Intelligence (AI) to building materials in elevation?	90	10	0	0	0	90 %
Q.3	Do you apply artificial intelligence to developing structure systems?	50	50	0	0	0	90 %
Q.4	Do you apply artificial intelligence in sustainability solutions?	70	30	0	0	0	94 %

3.2. Case Studies

Case study one

Figure 3: Case Study one, earth morphology.



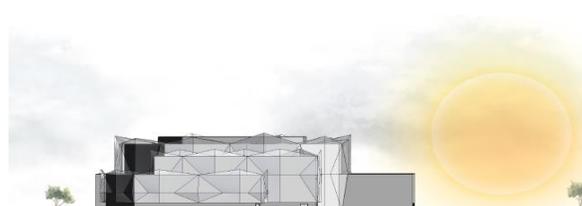


Study of Interior Structure



Figure 3.3: Case study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area

Case study two

Study of the main elevation with different materials	
	
	
	
	
	
	
Study of lighting	

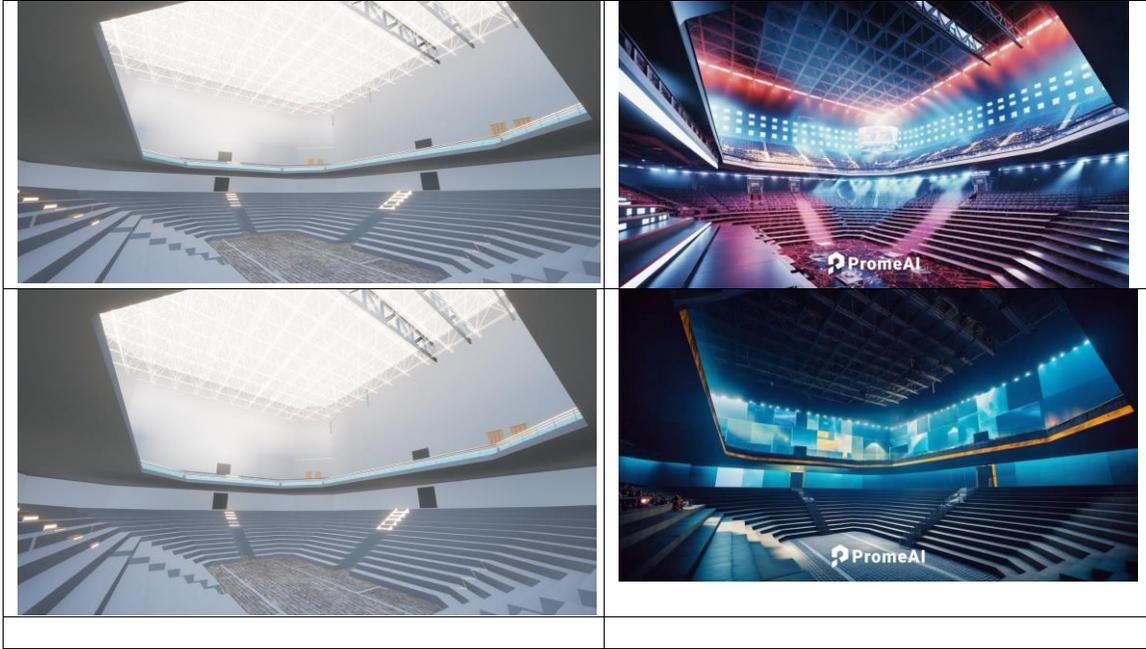
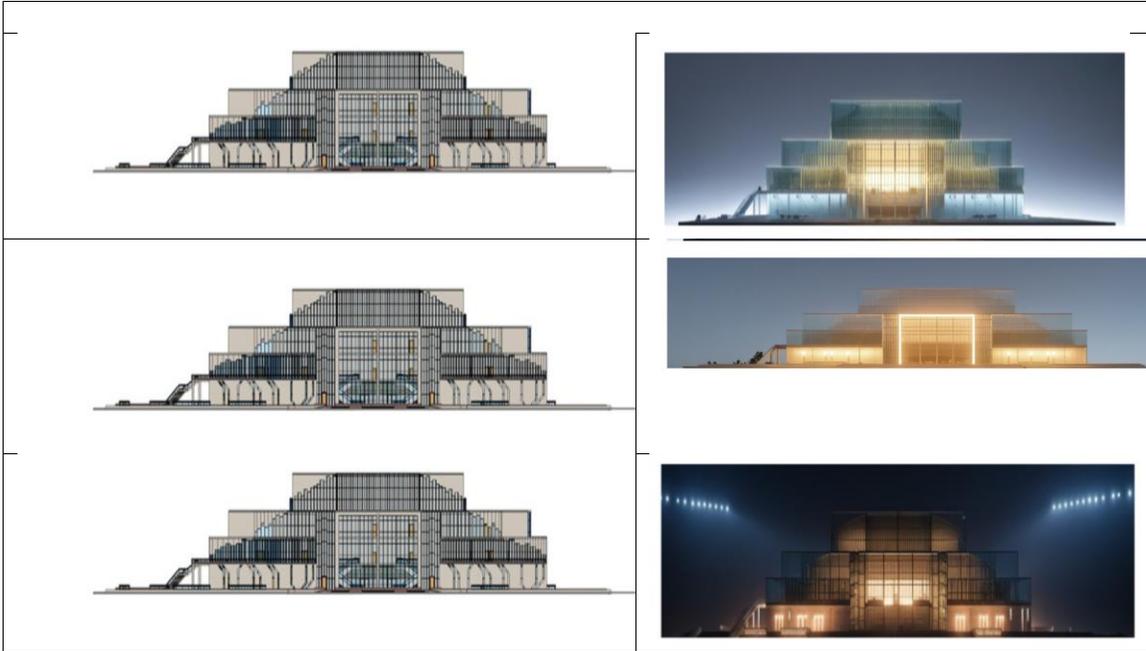
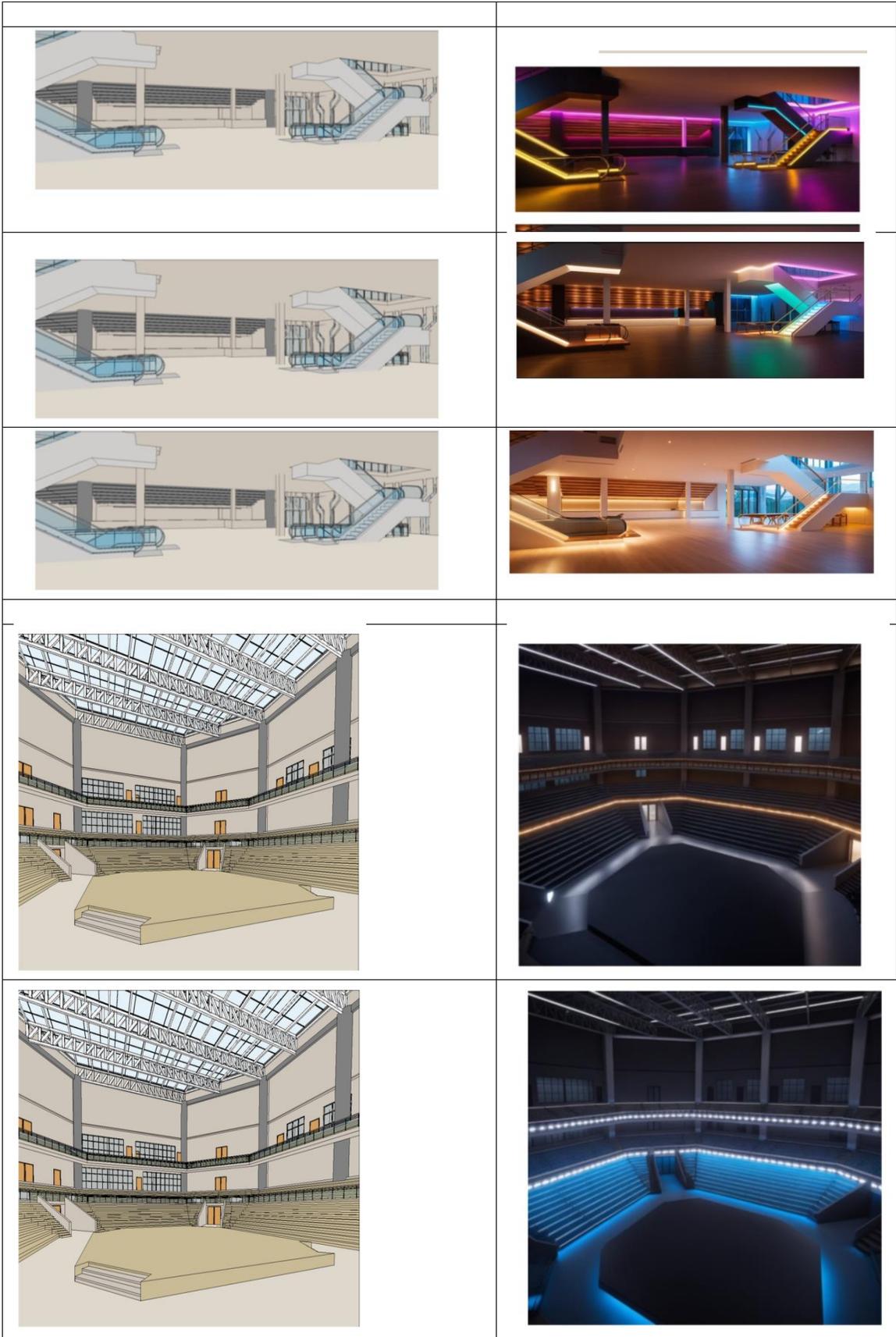


Figure 3.4: In Case Study Figure 3: Case Study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area





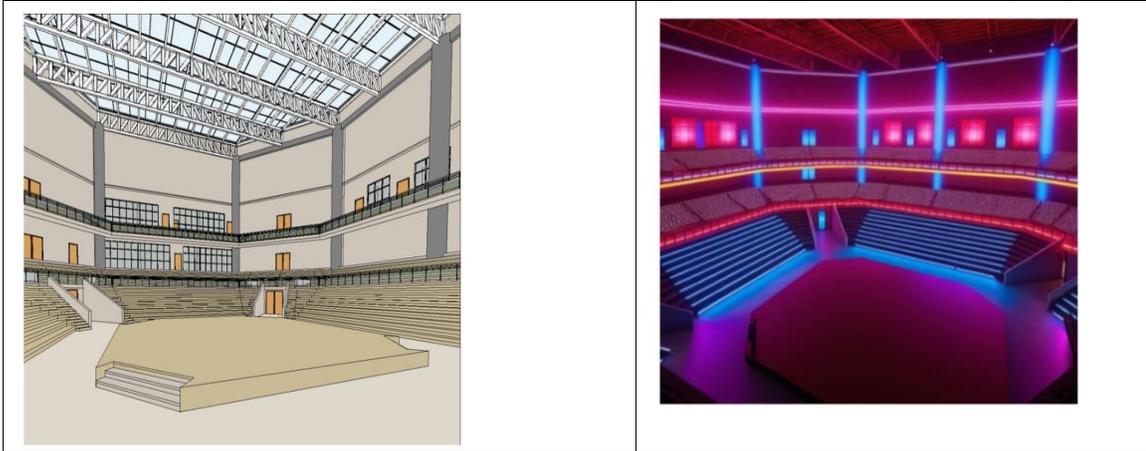


Figure 3.5: Case Study 3, Figure 3: Case study one, Applying AI in developing the main elevation with materials, lighting, and structure of interior space and Gaming Area

4. Discussion

4.1 discuss the survey results

The survey was distributed from Nov. 2024 to Dec 2024, the total respondents were 11 female students, and 11/11 answered the survey questions. In the first question 'Do you apply artificial intelligence to lighting in an arena?' The results showed most of the students applied (AI) in interior lighting as shown in Figure 2 and Table 2. Here the research agreed with (Khogali, 2024) that (AI) is a useful tool used to develop design processes., in the first question all the students answered that they applied AI in interior lighting and those students had no idea how to use AI programs, they were involved in groups, helping them to apply AI, and helping them to improve their skills.

In the second question 'Do you apply Artificial Intelligence (AI) in Building Materials in Elevation?' all the students applied (AI) in developing their material selections in interior space and in designing the main elevations.

In addition, the third question is, "Do you apply Artificial Intelligence in developing structure systems?" Half of the students answered totally agree, and half of the students answered agree, the research results all the students applied AI in developing structure systems in interior space and in designing the structure of the Arena.

In addition, in question four 'Do you apply artificial intelligence in sustainability solutions?' All the students agreed that they applied AI to sustainability solutions. The AI gave them solutions such as adding green roofs, terraces, reflected glass in elevations, and green terraces as shown in case studies of plants and trees in the outdoor environment.

Question five was an open question, and the students were asked about their experience with applying AI in the design D7. Here are some of their answers:

Q.5 Tell us about your experience in using Artificial Intelligence in D7 or other

-One student said utilized Artificial Intelligence in D7 to streamline processes, enhance decision-making, and foster innovative solutions tailored to specific project needs.

-Another student said I benefited from artificial intelligence in enhancing the design of interfaces and interior spaces, as it provided me with innovative suggestions that effectively contributed to the development of these areas. Additionally, AI helped me improve the lighting system in the arena, creating a unique atmosphere suitable for various events.

It makes the elevations look more realistic and attractive, also it has something like magic in lighting. Other students said AI helps me in improving the weakness points in my project.

It was an enlightening experience. Another student said using Artificial Intelligence significantly helped them choose materials for the elevations and visualize the lighting in the arena. It streamlined the selection process and provided clear insights, making my design more effective and creative, and very nice as it generated new and distinctive ideas.

Also, one student said: I used artificial intelligence in designing the interfaces and interior arena for an electronic games center, utilizing Prome Ai the program helped enhance the user experience by providing customized designs that meet their needs. It also assisted me in creating interactive and flexible interfaces, making the environment more engaging and exciting. Using AI allowed me to explore new design patterns, contributing to achieving an ideal balance between functionality and aesthetics in the project. It helps with newer ideas and thinking outside the box, very useful tool and it is great in the design studio.

Question six was open, and the students were asked about their used program. And they answered that they used Chat box, Chat GPT, Midjourney, Prome, and Mnml.com.

Finally, the using AI still needs training to be applied in all design studios, and we need to extend the experience to all design studios, improve design skills, and increase the student learning outcomes ILOs

4.2 Discuss the case studies

The project is National Culture Center and Knowledge Exchange considered a multi-disciplinary public space, considered a hub of intellectual exchange, exploration, and enrichment, serving as a destination for those seeking to understand a different culture, play a significant role and landmark in the city, locally in Saudi Arabia such culture center as King Fahad Culture Center, in Riyadh, and Jameel Square in Jeddah, while internally. example Jaber Al Ahmad Culture Center. This Art and Culture center includes a Largespace theater with 3500 m2, a small area theater with 2500 m2, a cinema with 2000 m2, multi-proposed halls used as art halls and seminar rooms, workshops halls and artificial intelligence hall, a library, and restaurant and administration and, Historical Museum.

The first case study concept, inspired by NASA images galaxies visualization Arena transforms visual space into a cosmic experience. This design celebrates the digital intangible nature of e-sports.

AI was applied to apply materials in designing the elevation, apply lighting in the interior design of the Area, and develop the structure system in the interior space of the Arena as shown in Figure 3, number of AI shots 5 to 7.

The second case study

The design concept The exterior design of an electronic games center can be inspired by Minecraft by incorporating cubic shapes that reflect the game's aesthetic, With facades resembling blocks like stone and wood. A vibrant color palette can create a fun atmosphere, while decorative elements such as trees and small structures enhance interactivity. Dynamic Led lighting can add liveliness, reflecting the game's energy. Additionally, outdoor areas for interactive games, like building zones or challenges, can be promoted. Social interaction among visitors. This Design Allows the center to embody the spirit of Minecraft,

AI was applied to apply materials in designing the elevation, apply lighting in the interior design of the Area, and develop the structure system in the interior space of the Arena as shown in Figure 4, number of AI shots 4 to 8 using Midjourney and Chat GPT.

The third case study

The concept extracted from the Najd style, designed two courtyards and all the functions and spaces surrounding the two courtyards, then reflected the Sulmani style in a new way and modern design by applying the triangles windows with reflected glass and sky lighting. The AI used in the research phase in Chatbox helped in some information about site analysis, and data analysis. Also in the design development phase, the student started by drawing sketches about the concept, then inserted the sketches in AI, and Prome AI was applied to develop the design concept. Building form and rendering. 9 shots were generated in the following Figure 8.

The fourth case study

The concept is from Bazzel cubes, the main cube at the center is the Arena stadium, then the VIP area, the consul and e-gaming area, and the food court, the students concentrating on color presentation in the main elevation, shown in Figur4, total number of AI shots were 8.

The Fifth case study

The concept is from diamond, the diamond at the center of the Arena stadium, then the VIP area, the consul and e-gaming area, and the food court, the students concentrating on structure presentation in the Arena hall, shown in Figur5, total number of AI shots were 8.

Table 3.3 Compare the results between the three following research by AI

	(Khogali, H. 2024)	(Khogali, H, 2025)	This Research
process	72.54	x	x
Coloring	50	x	x
rendering	48	x	x
sustainability	70	x	90
Primary research	x	99	x
Form	72	74	x
Rendering	x	91.3	x
Interior lighting	x	x	90
Sustainability	x	x	90
Interior and exterior Material	x	x	90
Interior Structure	x	x	90

From the comparative table, we notice the student's performance was improved by applying AI in developing design process, sustainability, and material lighting and structure and doing the primary research.

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