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Beyond Blueprint

Advancements in Architectural Education and Innovations

Cinius Yayınları

Hourakhsh Ahmed Nia
Architectural Education and Innovations
Yayınları

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Introduction

In the fascinating world of architecture, where creativity meets functionality, the role of education and innovation cannot be overstated. Architects shape the built environment, bringing dreams to life through their designs. However, the field of architecture is not immune to the winds of change. The ever-evolving landscape of technology, the emergence of artificial intelligence, virtual reality, and new methodologies have revolutionized the way architects think, design, and construct. In this era of progress, it has become imperative to foster a new generation of architects who are not only academically adept but also well-versed in the tools and trends shaping the present and the future.

"Beyond Blueprints: Advancements in Architectural Education and Innovations" delves into the realm of architectural education, exploring the advancements, technologies, methodologies, and approaches that are reshaping the field. This book serves as a comprehensive guide, designed to equip educators, students, and practitioners with the knowledge and insight necessary to navigate the ever-changing landscape of architecture.

Architecture, as an art form and a profession, has always been a reflection of the society in which it exists. Over the centuries, architectural styles and techniques have evolved in response to cultural, social, and technological shifts. Today, we find ourselves in an era where technology is omnipresent, permeating every aspect of our lives. Architecture is no exception. The integration of advanced technologies, such as artificial intelligence and virtual reality, has opened up new horizons for architects, allowing them to explore design possibilities and push the boundaries of creativity.

In this book, we explore the significance of these advancements in architectural education. We delve into how technology is transforming the way architects learn, design, and communicate their ideas. We examine the impact of artificial intelligence on the design process, from generative design algorithms that optimize space utilization to machine learning algorithms that analyze user preferences. We uncover the potential of virtual reality as a tool for immersive design experiences and architectural visualization. We also shed light on the methodologies and approaches that educators are adopting to prepare students for this brave new world. The major objective of this book is to raise a generation of architects who are not only proficient in traditional

architectural principles but are also aware of the present and future trends in the field.

We aim to bridge the gap between academia and industry, ensuring that the architects of tomorrow are equipped with the skills and knowledge necessary to thrive in a rapidly evolving profession. By embracing advancements in technology, students can harness the power of AI, VR, and other innovative tools to enhance the design process, improve sustainability, and create spaces that are responsive to the needs of the users and the environment.

The path to architectural excellence lies not only in mastering the technical aspects of the trade but also in understanding the broader context in which architecture operates. As the world grapples with pressing challenges such as climate change, urbanization, and social inequality, architects have a pivotal role to play in shaping a sustainable and equitable future. By embracing advancements in architectural education and innovations, we empower students to become agents of change, capable of addressing these challenges head-on.

Through the pages of this book, readers will embark on a journey of discovery, exploring the cutting-edge advancements, methodologies, and approaches that are shaping the field of architecture. We have gathered insights from leading educators, practitioners, and researchers who are at the forefront of architectural innovation. Their expertise and experiences will inspire readers to embrace the transformative power of technology and to reimagine the possibilities of architectural design.

With the advent of virtual reality, architects can now step into their designs, experiencing spaces before they are even built. We delve into the realm of virtual reality, exploring its potential as a powerful tool for architectural visualization, enabling clients and stakeholders to fully immerse themselves in the design process. We also examine how virtual reality can be integrated into educational settings, providing students with immersive learning experiences that foster creativity and collaboration.

Moreover, this book goes beyond technological advancements and delves into the evolving methodologies and approaches in architectural education. We explore the importance of interdisciplinary collaboration, encouraging architects to work alongside experts in fields such as engineering, psychology, and sustainability to create holistic and impactful designs. We also shed light on the significance of design

thinking, emphasizing the importance of empathy, user-centered design, and iterative problem-solving in architectural education.

As the world becomes increasingly interconnected, architects must also develop a global mindset. We discuss the importance of cultural awareness and the integration of diverse perspectives in architectural education, recognizing that architecture has the power to shape communities and promote social cohesion.

"Beyond Blueprints: Advancements in Architectural Education and Innovations" serves as a guidebook for educators, students, and professionals who are passionate about embracing the future of architecture. It provides a roadmap for incorporating advancements in technology, methodologies, and approaches into the curriculum, ensuring that students are well-equipped to face the challenges and opportunities of the 21st century.

Through the pages of this book, readers will gain a deep understanding of the significance of these advancements in architectural education. They will discover the transformative power of technology and innovation, and how these tools can enhance the design process, improve sustainability, and foster creativity. They will be inspired by real-world examples and case studies, showcasing the remarkable projects and achievements that have emerged from the intersection of architecture and technological advancements.

Ultimately, "Beyond Blueprints: Advancements in Architectural Education and Innovations" aims to ignite a passion for lifelong learning and exploration in the field of architecture. It encourages architects, educators, and students to embrace a mindset of continuous growth and innovation, constantly seeking new ways to push the boundaries of design and create spaces that truly enrich the lives of those who inhabit them.

As we embark on this journey, let us embrace the opportunities that advancements in architectural education and innovations present. Together, let us shape a future where architecture serves as a catalyst for positive change, where creativity and technology intertwine to create a built environment that is visionary, sustainable, and human-centric. May this book serve as a source of inspiration, knowledge, and empowerment as we navigate the exciting frontier of architectural education in the 21st century.

Husam R. Husain

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Urban Transformation Through Technology: Impacts on Perception, Branding, and Cultural Heritage Preservation

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CHAPTER I

In the contemporary urban landscape, technology has emerged as a powerful force reshaping every facet of city life. From smart city technologies and the Internet of Things (IoT) to artificial intelligence (AI) and big data analytics, technology is revolutionizing urban planning, service delivery, energy management, and security. Cities are evolving into interconnected systems where efficiency and automation are paramount, promising a future characterized by smarter, more sustainable, and livable urban environments. Simultaneously, technology and digital media are profoundly influencing the perception and understanding of cities. Social media platforms and digital mapping technologies are instrumental in shaping cities' brand identities and narratives. However, these platforms can also distort our perception of urban realities, blurring the lines between reality and manipulated representations. The preservation and presentation of urban heritage are integral to this transformation, as technology enhances accessibility to historical and cultural sites. This study explores the dynamic interplay between technology and urban development, with a particular focus on the transformative potential of IoT, AI, and big data. These technologies are driving innovation across various urban domains, from traffic management to public safety and urban planning. They are key enablers of efficient resource allocation, sustainability, and enhanced quality of life. Moreover, this abstract delves into the evolving perception of cities, where the virtual realm increasingly influences the real. Social media and digital platforms allow cities to construct idealized images that may diverge from reality, impacting expectations and understandings of urban environments.

Technology's rapid advancement is forging new connections between cities and their inhabitants, transforming cities into interconnected entities where every element plays a role in a complex system. Cultural heritage, as a cornerstone of urban identity, assumes a critical role in this digital era. Technology offers unprecedented opportunities to promote and protect heritage sites while reshaping how cities present themselves to the world. Urban art forms and interventions, combined with social media strategies, are turning previously overlooked places into iconic hotspots, attracting visitors, and generating a virtual presence that fosters tourism and cultural appreciation. Hashtags have emerged as a potent tool in this digital promotion of cities and places, allowing local institutions to gauge public opinion and measure the success of their promotional initiatives. These initiatives can engage the public, showcase cultural assets, and track the effectiveness of marketing strategies. In conclusion, technology is driving a profound transformation in our cities, impacting both physical and virtual realms. As urban life becomes more efficient and sustainable, our perception of cities is increasingly shaped by technology. The fusion of the virtual and the real presents exciting possibilities and challenges for the cities of the future. Balancing progress with heritage conservation and effectively utilizing technology for urban development will be paramount in shaping the cities we inhabit and experience.

Introduction

Urban Transformation Through Technology: Impacts on Perception, Branding, and Cultural Heritage Preservation.

Technology and digitalization have become key components of urban life and urban developments. Technology is influencing and transforming almost every aspect of city life, from city planning to service delivery, from energy use to security (Bibri & Krogstie, 2017). Technology has become the determinant of modern city life and future urban developments. Developing technology significantly affects and shapes the functioning, design and perception of cities. Technological tools such as smart city technologies, Internet of Things (IoT), Artificial Intelligence (AI), and big data analytics are helping cities become more efficient, sustainable, and livable (Hashem et al., 2016). Thanks to these technologies, it is thus possible to provide better services to the people living in the city.

On the other hand, technology and digital media have also significantly influenced the perception and understanding of cities. While social media platforms and digital mapping technologies are helping cities brand, they are also transforming the way cities tell their identities and stories (Thompson & Ku, 2019). The preservation and display of urban heritage also plays an important role in this process. Technology is increasing the ability to bring historical and cultural sites to a wide audience and effectively protect them (Lu et al., 2019).

In this study is address the impact of technology on cities and how urban heritage plays a role in this new era. Grasping the intricate relationship between technology and urban development is vital for shaping forthcoming strategies in urban planning and management. Having established the pivotal role of technology in modern urban life and development in the introduction, we now delve into the transformative power of technology in shaping cities.

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2. Technology Transforming Cities

In the ever-evolving world we live in, new technologies are revolutionizing cities, transforming them into interconnected systems where automation and efficiency prevail. Technology is the driving force behind smarter, more efficient, and more liveable cities of the future. It has become an indispensable factor in the functioning and design of urban environments. The emergence of smart cities, fuelled by advancements such as the Internet of Things (IoT), artificial intelligence (AI), and big data, exemplifies the profound impact of technology on urban landscapes (Angelidou et al., 2018).

The IoT has the potential to revolutionize city life in numerous ways ***(as shown in Figure 1).***

Figure 1. *Applications of IoT in smart cities*
(Belli et al., 2020)

In today's urban landscape, cities are grappling with a myriad of challenges, including shifting economic paradigms that place a premium on cultural values, demographic shifts marked by rural-to-urban migration, and pressing environmental concerns like climate change and pollution. Particularly in cities aspiring to be cultural hubs, the creative elements underpinning various aspects of municipal life, such as innovation, knowledge exchange, cultural interaction, and artistic production, have gained significant attention. This burgeoning interest in cultural heritage and its nexus with local economic development has been noted. Additionally, various forms of creative activities have been found to influence tourist satisfaction and motivation.

Urban mass tourism within a city is typically driven by a range of attractions and services tailored to cater to the preferences and interests of the average city visitor. This tourism concept can be construed as a location-based activity entailing the knowledge-based inclinations of the visitors. Urban mass tourism is characterized by various forms of direct and indirect interaction between the municipality and the city's denizens, including tourists. It also encompasses the consumption, production, and provision of tourism-related services across different municipal areas.

Consequently, the substantial volume of information generated by tourists as they navigate the city, combined with the significance of cultural activities and heritage, opens up opportunities for the implementation of location-based and knowledge-driven innovation strategies. IoT technologies assume a pivotal role in these contexts by facilitating enhanced interaction among data consumers, data producers, and municipal leadership. These fosters enduring collaborative processes and encourages participatory governance. Furthermore, tourists are increasingly transforming into creators of multimedia content, which they produce and share via social networks. This phenomenon can be harnessed by an IoT-based smart city architecture.

In the development of smart cities with a tourism focus, it's imperative to address and resolve conflicts and tensions that may arise. These conflicts may be sparked by the cumulative use of urban resources by both residents and tourists, the scarcity of public spaces, and the potential overuse of infrastructures and facilities.
Ultimately, the United Nations World Tourism Organization (UNWTO) emphasizes the growing importance of flexible urban tourism products and services in response to evolving tourism dynamics. Tourism's vitality is poised to drive new changes in urban landscapes, personal interactions, job creation, and the sustenance of urban infrastructures and public services. IoT-oriented solutions have the potential to significantly enhance tourism and culture, offering innovative possibilities such as mobile apps equipped with technologies like Augmented Reality (AR), Near Field Communication (NFC), Inertial Navigation System (INS), and Global Navigation Satellite System (GNSS) to enrich tourists' experiences during their visits, both within exhibitions and throughout the city (Belli et al., 2020).

Furthermore, as we delve deeper into the role of technology in urban areas, let's shift our focus to Artificial intelligence (AI) is another technology making significant contributions across various urban areas:

- Traffic Management: AI-powered systems provide real-time traffic information, allowing for more effective use of roadways (Cohen & Kietzmann, 2014).
- Municipal Services: AI optimizes public services, such as garbage collection and maintenance planning, enabling local governments to improve efficiency and resource allocation (Angelidou et al., 2017).
- Public Safety: AI technologies like facial and object recognition enhance crime prevention and public safety by identifying criminals and facilitating swift response to incidents (Hvass et al., 2020).
- Urban Planning: AI aids city planners in improving infrastructure and meeting public needs by analyzing data to predict population changes, transportation requirements, and environmental impacts (Batty, 2018).

Big data, IoT, and AI are intertwined technologies that, when combined, yield powerful results across various domains. Big data encompasses vast and complex datasets derived from diverse sources, aggregated quickly, and continuously updated. IoT devices serve as valuable sources of large-scale data, while AI and machine learning algorithms analyze this data, identifying patterns, making predictions, and, in some cases, driving decision-making processes. For instance, data collected by IoT devices can be processed and analyzed using big data technologies, with AI algorithms subsequently leveraging this information for reducing traffic congestion, optimizing energy consumption, or monitoring air quality.

Having discussed the impact of technology on urban landscapes, let's now focus on the practical aspects of its implementation shifting the focus from the theoretical aspect, the subsequent section delves into the active transformation of urban landscapes by technology.

3. The Influence of Technology on Urban Spaces: Smart Cities and the Evolving Significance of Cultural Heritage

In the contemporary world, cities are undergoing rapid transformations in how they are perceived, and at the heart of this revolution lies technology. Technology is fundamentally reshaping the functioning, design, and even the very essence of cities. Cities are no longer merely collections of concrete and steel structures; they are increasingly recognized as intricate ecosystems with digital and virtual dimensions. Additionally, technology is playing a crucial role in branding cities and presenting them as marketable products (Kavaratzis & Ashworth, 2006).

The impact of technology extends beyond the operational aspects of cities; it has a profound influence on how cities are perceived and evaluated. Social media and other digital platforms have become powerful tools in establishing the brand identity of cities, often shaping an idealized image that may diverge from reality (Morrison & Krugman, 2001). The arrangement of photos and videos circulated through social networks, driven by different intentions, can distort the perception of urban realities and give rise to false impressions. These distorted perceptions shape expectations in diverse ways and significantly impact our understanding of the urban environment. Moreover, the rapid advancement of technology is revolutionizing the interconnectivity among cities, transforming them into interconnected entities where every element, including the inhabitants, becomes integral to a complex and dynamic system. However, technology also presents an opportunity to reach a broader audience and preserve cultural heritage more effectively (Vecco, 2010).

In the present era, technology continues to reshape the perception of cities, simultaneously allowing them to be branded and perceived as products (Batty, 2013). Understanding the intricate interplay between technology and urban development is crucial in shaping future strategies for urban planning and management. To gain insights into the future of cities, we must consider both technological innovations and their impact on urban heritage and cultural identity. Urban heritage plays a vital role in the branding process, as historic buildings and cultural sites reinforce a city's image and attract tourists (Richards, 1996).

Extending our analysis from the realm of cultural heritage, the subsequent section delves into the intricate technological landscape of cities. Before exploring the transformative role of social media platforms and hashtags, it's essential to comprehend the broader spectrum of technological interactions within urban environments. This comprehensive examination will not only provide context but also ensure a seamless transition from the discussion of cultural heritage to the exploration of how technology, specifically through social media and hashtags, is actively reshaping the projection of city identities and influencing urban perception.

4. Hashtags and Urban Icons: Shaping City Identities in the Digital Era

The article "Urban Transformation Through Technology: Impacts on Perception, Branding, and Cultural Heritage" emphasizes the significant impact of technology, particularly Big Data, IoT, and AI, on urban development and perception. The authors elaborate on how technology is reshaping cities into interconnected systems, focusing on efficiency, sustainability, and improved quality of life. Social media, digital mapping technologies, and hashtags are highlighted as crucial tools in shaping cities' brand identities and narratives, ultimately influencing public perception of urban realities.

In this context, the authors choose to focus on social media and hashtags due to their transformative potential in urban branding and promotion. Social media platforms like Instagram have become instrumental in marketing and promoting cities, with users often using location-based hashtags to share their experiences. Hashtags, in particular, are discussed as effective tools to organize and promote content related to a city, allowing for targeted visibility and engagement. They also enable local institutions to gauge public opinion, measure the success of promotional initiatives, and adapt strategies accordingly.

Furthermore, the article delves into the emerging trend of using urban art forms, interventions, and video mapping as new iconic hotspots in cities. These new hotspots generate significant attention on social networks, further promoting the city's image and attracting visitors. The authors stress the importance of leveraging these digital strategies to enhance tourism, cultural appreciation, and economic development. When we think about a city, we always remember about iconic places, heritage architecture, or even about art icons from that city. It is because of that we can recognize and have an idea about a specific city. Otherwise, we only have an unfocused idea, very generic. Now, let's explore how the use of hashtags and social media is transforming the way cities present themselves and how they're perceived.

Hashtags are commonly used online to promote a city, a place, and in general to bring attention about something that people want to show, look up, or learn more about. Hashtags act as a powerful tool to build awareness about a topic and shape public opinion online. They are a valuable tool for local governments and sales and promotional teams to share details about a city or a place and target potential visitors and customers. Hashtags help to organize content related to a city or a place by allowing people to search and click on a particular hashtag to analyze the conversations people are having about it. For example, tagging a post with a hashtag such as #californiabeaches, or #hollywoodsign instantly brings attention to a particular city or place which locals, tourists, and just about anyone with access to the Internet can look up information about. This practice enables locals, tourists, and virtually anyone with internet access to find information about these destinations. In this digital age, cities are increasingly leveraging social networks, particularly Instagram, as a strategic tool for marketing and promotion. Every time a city resident or a visitor goes to a specific location and takes a photo or a selfie, a common trend is to use hashtags that not only promote their Instagram profile but also capture the attention of others, signaling that they've been to that place.

We have done online research, as an example, about the number hashtags that some European cities has during the year 2019 and we found a direct relation between the number of visitors and the number of times that the city name hashtag was used in the internet.
Outlined below are the primary cities featured in the "Top 10 Instagram Cities" as documented in an online publication by Cosmopolitan (Malbon, A, 2021). This compilation has a distinctly European flavor, revealing the cities that have garnered substantial recognition on Instagram through hashtag counts:

1. London: 119.9 million hashtags
2. Paris: 100.8 million hashtags
3. Barcelona: 47.4 million hashtags
4. Rome: 44.8 million hashtags
5. Berlin: 36.1 million hashtags
6. Madrid: 31.2 million hashtags
7. Amsterdam: 26.7 million hashtags
8. Lisbon: 17.7 million hashtags
9. Hamburg: 15.3 million hashtags
10. Valencia: 14.1 million hashtags

In a comprehensive analysis featured in the esteemed "Jornal de Negocios," a reputable publication focusing on business and economic matters, a careful examination of the top city destinations for the year 2019 was conducted. This study leveraged data sourced from the European Union (EU) statistical office (Statista, 2021), providing valuable insights into the estimated number of visitors to the prominent TOP 10 cities. The findings shed light on the robust tourism landscapes of these cities, portraying their magnetism to global travellers:

London: Standing as a global nucleus of commerce and culture, London boasted an impressive estimated visitation of 85.1 million individuals. This staggering figure solidifies the city's position as a leading international tourist hub, drawing visitors with its rich history, iconic landmarks, and diverse cultural experiences.

Paris: Renowned as the epitome of romanticism and artistry, Paris captivated approximately 52.45 million visitors in 2019. Its timeless allure, epitomized by the Eiffel Tower, Louvre Museum, and charming streets, continues to enthral travellers from around the world.

Barcelona: A city where modernist architecture meets a lively Mediterranean spirit, Barcelona welcomed an estimated 19.85 million visitors. The city's architectural wonders, beautiful beaches, and vibrant culinary scene beckoned tourists seeking a dynamic blend of culture and leisure.

Rome: A living museum of ancient history and a seat of European civilization, Rome played host to around 29.07 million visitors. The Colosseum, Roman Forum, and Vatican City are just a few of the countless attractions that drew travellers to immerse themselves in the city's rich heritage.

Berlin: Reverberating with a palpable energy of creativity and history, Berlin enticed an estimated 34.12 million visitors. The city's unique blend of modernity, historical significance, and a thriving arts scene provided an irresistible magnet for global tourists.

Madrid: The heart of Spain, Madrid, captivated approximately 20.68 million visitors with its vivacious lifestyle, world-class art museums, and a culinary culture that delighted the senses. The city's unique blend of traditional Spanish charm and contemporary elegance left a lasting impression on travellers.

Amsterdam: Adorned with picturesque canals, historic architecture, and a rich cultural heritage, Amsterdam attracted an estimated 18.38 million visitors. This figure underscored the city's enduring appeal, offering a charming and eclectic experience for those exploring its winding streets and iconic landmarks.

Lisbon: Emerging as a rising star on the tourism map, Lisbon enticed an estimated 10.5 million visitors in 2019. The city's blend of old-world charm, stunning coastal views, and a burgeoning culinary scene made it a must-visit destination for those seeking a unique European adventure.

Hamburg: Nestled on the Elbe River, Hamburg, with its maritime heritage and modern urban attractions, welcomed an estimated 15.43 million visitors. The city's maritime history, lively waterfront, and diverse cultural offerings proved appealing to a broad spectrum of travellers.

Valencia: Balancing history, futuristic architecture, and a sun-soaked Mediterranean coastline, Valencia captivated around 4.5 million visitors.
The city's dynamic mix of old and new, exemplified by the futuristic City of Arts and Sciences and the historic Old Town, enticed visitors seeking diverse experiences.

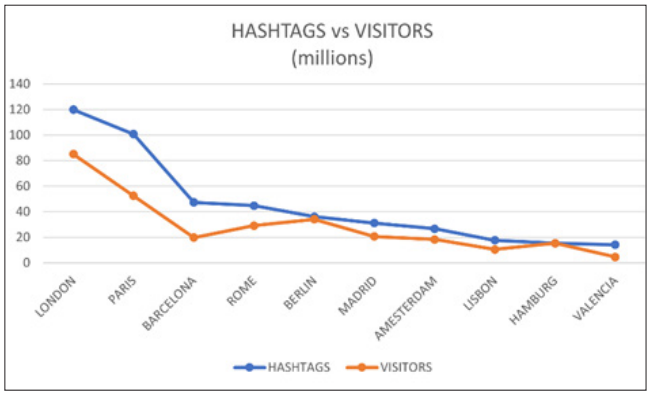

Figure 2. *Hashtags vs visitors* (millions)

Cities are increasingly using social networks, Instagram for example, as a strategy for marketing and promotion. Every time a city local or a visitor goes to a specific place and takes a picture or a selfie, the most common trend is to choose hashtags that somehow help that person to promote his or her Instagram profile and at the same time draw the attention of other people, showing that they have been there. Marketing strategists know that the use of these hashtags will influence and attract people to visit the city, sooner or later the advantages will become obvious (Deffner. A., Liouris. C., 2005).
In this way, nowadays, more and more cities are open to what is known as urban art, large-scale paintings of walls or interventions that are either artistic, but that will become, somehow, the new iconic places of reference of the city. These places are thus the new icons of the city and for this reason are increasingly photographed and posted on social networks. Some of these places have as many or more visualizations than those referring to traditional historical.

The use of internet and new digital technologies are becoming an essential tool for the promotion of a place. It is notorious that more and more tourists decide to visit a particular city because they have seen images of that city and some specific spots in the social networks. So, we believe that the use of hashtags and social networks are obviously an advantage to be considered when seeking to promote a place.

Furthermore, many local tourism boards today use specially crafted hashtags related to their cities to promote tourism and inform people about certain aspects, events, or attractions of their city. Not only do hashtags aid in promotion, but they can also help local institutions to gauge public opinion and survey preferences of potential and current visitors. Citizens are enticed to tweet using certain hashtags to express their experience with a city or a place or to share their opinion on what could have been done better. This helps parties involved to better understand how their communication efforts are resonating with the public. Additionally, hashtags can help tourism boards to measure the success of their promotional initiatives and adjust their strategies. They reflect the experiences of the tourist at specific destinations (Pan, MacLaurin and Crotts 2007).

We found on the website campaignmonitor.com in the article "The Best Hashtags for Events to Use on Social Media", some of the best hashtags, according to them research, to promote city. According to this article we could understand that the use of the city name linked with some specific words, will increase the number of visualizations, and likes. Tho's hashtags are, for example: #CityNameLove, #CityNameVibes, #LiveLoveCityName, #VisitCityName, #CityNameLife, #CityNameExperience, #OnlyInCityName.

Of course, creativity always comes up, since marketing strategies, associated with the digital world, are essential and with very fast results.

This is a very actual subject and there are, already some research about how some cities is using the social network and Instagram to attract more visitors. For example, posting interactive content, such as polls, quizzes, surveys, and contests, is a great way to grab the attention of potential visitors and showcase the city's assets. This is the case of Miami city that used Instagram to launch an interactive travel quiz targeting potential travelers, which doubled their engagement rate .Cities, also, should use visuals to showcase their unique culture, attractions, and local businesses. (Pocock, N., Zahra, A., McIntosh, A., 2009).

For example, the city of Detroit celebrated their city's culture by creating a city-wide mural tour using the Instagram geotag feature. Places and monuments have become products that sell a specific image (Resane, K.T., 2018).
Some other strategies can be used to promote the city, include creating an Instagram brand, sharing exclusive content, using location tags, taking advantage of emerging trends, and more. The city itself is now becoming a Brand.

The number of visitors in a city directly correlates with its online presence, as depicted by hashtag counts (Figure 2.). With the widespread use of technology and social media, visitors contribute to a city's digital footprint, illustrating the symbiotic relationship between real-world experiences and their virtual amplification through social platforms.

In summary, the authors' focus on social media and hashtags is justified by the profound influence of these digital tools in shaping how cities present themselves, interact with the public, and promote urban culture and heritage. Social media, hashtags, and urban art forms are seen as integral components of contemporary urban branding and marketing strategies, highlighting the dynamic interplay between technology, perception, and urban development. Hashtags are an effective tool to promote a city or a place and better assess the opinion of the public on a certain topic. Hashtags provided on social media platforms allow locals, tourists, and anyone with a device to access information about the city or the place, and to connect and discuss topics related to it. Furthermore, local institutions such as tourism boards can use hashtags to leverage understanding about visitors' preferences and opinions as well as measure the success of their promotional initiatives.

The city has been changing and the perception we have about it has also been undergoing considerable changes over the last decades. The use of technology and the Internet have transformed cities into veritable machines. Everything is interconnected and has its own functions, which basically aim to organize spaces, traffic, and the quality of life of its inhabitants. However, this excess of technology also raises questions about ethics and privacy.
Regardless of these issues, which are beyond the scope of this article, the way we live in the city is currently much more mechanized and guided by networks and systems that use the Internet as a fundamental element for everything to work perfectly.

But cities also know that they must use digital technology and images to promote themselves and interact with people (Pinto, L , Gwiazdzinski, E., 2022) . These images can be static and merely informative, or they can have a more playful character, as is the case with video mapping. Now, cities no longer promote themselves only through their traditional icons or their historical legacy, they use marketing strategies, associated with urban art forms, that quickly become hotspots or points of interest. These hotspots attract visitors who end up taking pictures and sharing them on social networks. In this way, there is a kind of parasitism, between the city as a brand, which is quickly associated with the forms and artistic interventions, which are its true hotspots. But there are also hotspots, created through images in movement, we are referring to video mapping, for example. In this case, the city becomes a natural screen, where the images are projected onto the buildings, thus for the first time creating a link between the Real and the Virtual, where one doesn't exist without the other, as they depend on each other for the projections to make sense.

This technological advance will thus interact with the city, or more specifically with an area of the city, creating a new reality and transforming that place into a new attraction. In this way, thousands of photos will be taken and posted on social networks, and once again, the city as a brand, as a place associated with culture, leisure, and business, ends up benefiting from these events. Technological advances have opened new windows of creativity, since technology, which was initially invented for differentiated situations in everyday life, ends up being used to create new ways of interacting with people.

5. Conclusion

In the contemporary urban landscape, technology has emerged as a powerful force reshaping every facet of city life. From smart city technologies and the Internet of Things (IoT) to artificial intelligence (AI) and big data analytics, technology is revolutionizing urban planning, service delivery, energy management, and security. Cities are evolving into interconnected systems where efficiency and automation are paramount, promising a future characterized by smarter, more sustainable, and liveable urban environments. Simultaneously, technology and digital media are profoundly influencing the perception and understanding of cities. Social media platforms, digital mapping technologies, and the strategic use of hashtags play pivotal roles in shaping cities' brand identities and narratives.

Moving forward, it is essential to consider various aspects:

- Ethical Implications: One critical avenue for future research is to delve into the ethical implications of technology's increasing integration into urban life. Researchers should explore issues related to privacy, data security, and the potential for technology-driven disparities within cities.
- Long-Term Effects: Another significant area of study should focus on the long-term effects of technology-driven urban transformations on community cohesion, cultural heritage preservation, and social equity. Future research can investigate whether these changes enhance or disrupt the fabric of urban societies.
- Predictive Analytics: Future research can also explore the potential of predictive analytics in urban planning, utilizing AI and big data to forecast trends in population growth, resource usage, and environmental impact.

In terms of contributions to the field:

- Urban Planning Guidelines: The insights provided by this study can significantly contribute to the development of guidelines for city planners. These guidelines would enable planners to harness the full potential of technological advancements in their work.
- Cultural Heritage Preservation: The research highlights the vital role of technology in cultural heritage preservation. It emphasizes the importance of integrating technology into heritage protection strategies.

To address the research questions and arguments:

- Technology's Impact: This study comprehensively explores and explains the transformative impact of technology on cities, encompassing physical infrastructure and virtual perception.
- City Branding: The study underscores how technology, particularly through social media and hashtags, influences city branding and the presentation of cities to the global audience.
- Balancing Realities: Acknowledging the challenges of balancing idealized virtual representations of cities with their tangible realities, the research emphasizes the necessity of adopting a nuanced approach to city promotion.

In conclusion, technology is a driving force shaping the cities of the future, offering unparalleled opportunities and challenges. As we move forward, it is imperative to navigate this landscape with a keen awareness of the ethical considerations, long-term consequences, and the potential positive contributions to urban planning and cultural heritage preservation. This study serves as a foundational pillar for further exploration in these directions, ultimately guiding the evolution of cities into more efficient, sustainable, and culturally rich environments.

Hashtags, in particular, have gained immense importance within the social media sphere. They serve as a categorical tool, allowing for the aggregation of related content and enabling researchers to identify patterns and trends. Analysing hashtag usage provides insights into public opinion, social movements, and emerging topics, making it a goldmine for researchers interested in understanding societal dynamics.

Moreover, hashtags offer a unique opportunity to explore the impact of AI algorithms on content visibility and propagation. AI plays a crucial role in suggesting and curating content to users, which can influence public discourse and opinions. Studying the usage and influence of hashtags in this context helps shed light on the interplay between technology and societal narratives.
We highlight with this article that technology, particularly through social media and hashtags, profoundly influences urban perception and branding. These tools are vital in shaping city identities and promoting cultural heritage, pivotal for navigating future urban landscapes.

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Grafting Construction Thinking: An Action-Based Approach to Construction Course Redevelopment

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CHAPTER II

Construction courses are essential to architectural education since they equip students with the knowledge to realize their design ideas. However, learning and appropriating construction knowledge in design thinking are challenging for many architecture students, as the authors have witnessed this hardship in their teaching practice in Turkey. Consequently, this study aimed to develop the hypothesis that an 'experiential facilitation approach,' which employs and crosses back and forth among multiple senses, modes, and scales of engagement with knowledge, including full-scale building, has the potential to increase the reception of construction knowledge. To evaluate their hypothesis, the authors have designed action research that tracks, measures, and reflects on the effects of these multiple methods, scales, media, and tools through first-hand observation, short surveys, semi-structured in-depth interview questions, and reflection on course outputs. The outcomes show how students come to terms with construction knowledge as an embodied experience. The research outcome contributes to the teaching of construction courses in architecture schools in general.

Introduction

Grafting Construction Thinking: An Action-Based Approach to Construction Course Redevelopment

Technology-based courses are essential to architectural education as they equip students with practical knowledge to actualize design ideas. They not only prepare students to move into practice as more equipped with technical knowledge but also increase their creative genius and expand their insight into the poetics of building (Rinke, 2019). 'Technology' comes from the Greek word techne, which denotes knowledge achieved through making or production (Heidegger, 1977). It refers to both arts and crafts. Technology is applied knowledge, and due to its engagement with natural laws, i.e., imitation of physis, its creative role may become forgotten.

As our contemporary period highlights the socio-political role of architecture and emphasizes the role of architects as agents of social change, there is diminished visibility of the inherent significance of technology-based knowledge that allows generating building and the poetic character and tectonic language of architecture. Whereas in some architecture schools, technology-based courses are closely related to design studios and inform design thinking more efficiently, they remain more adjacent or secondary in other architectural curricula. While appropriating structure and construction knowledge in design thinking can be a challenge in many cases (Voyatzaki, 2002; Schwartz, 2015), recent studies point out a lack of interest in construction courses and disconnection between design studios and construction courses in architecture programs (Masri, 2017; Rauf & Shareef, 2019). Carpenter (1987, p. xi) noted the criticism that pointed to "students' inability to deal with pragmatic things." Today, there is still a growing amount of complaints about the lack of knowledge of recent graduates to detail buildings for realization (Wood, 2006).

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The authors of this chapter teach construction courses at the Department of Architecture at Yeditepe University, where the changes in its architecture curriculum in 2019 reflected a reduction of the weight of technology-based courses in the curriculum. Before Aktuna joined the department, construction courses used to follow a teaching model after the Beaux-Arts, which depended on a drafting-centered practice approach common in architectural schools in Turkey. Despite the crucial dependence of building on construction drawings (Ridgway, 2009), drafting as a learning tool has shortcomings. Various scholars investigated the newer methods of teaching construction courses to improve construction courses in architectural education in Turkey. They have proposed the incorporation of three-dimensional physical models to establish a more concrete bridge between drawings and reality (Diri & Mayuk, 2019; Bodur et al., 2020; Kavraz, 2021); Gür & Yüncü (2010) proposed engagement with real-scale works to solidify the connection between theoretical and practical knowledge; and Agırbas (2020) experimented with the use of digital technologies in construction courses.

As the authors have taught construction courses at Yeditepe University (Karahan since 2008 and Aktuna since 2021), they have observed that the connection between a building and its representation in working drawings is hard for many architecture students and poses a fundamental barrier to accessing and applying construction knowledge in design thinking. Due to the challenge for most students to grasp construction knowledge as practiced in construction drawings, which further posed a barrier to engaging with construction knowledge and incorporating tectonic language into design work, the authors planned to redevelop the construction courses. Having witnessed the students' struggle, the authors developed the following hypothesis: an 'experiential facilitation approach,' which employs and crosses back and forth among multiple senses, modes, and scales of engagement with construction knowledge, has the potential to facilitate construction thinking and representation. To evaluate their hypothesis, the authors devised action research to engage students with construction knowledge through multiple instruction methods, tools, and scales and to observe how students respond. The study compares the course outputs with those of previous semesters for course redevelopment while retrieving the experiential themes of construction learning.

This chapter consists of seven parts. After this 'Introduction,' the second part reviews the approaches to teaching construction courses in Turkey and compares them with the context of the action-based study; the third part introduces the theoretical background of the research; the fourth part presents the research methodology; the fifth and sixth parts consider the results and discuss the main contributions of this study, which leads to the 'Conclusion.'

2. The Teaching of Construction in Architectural Schools in Turkey and the Case of Yeditepe University

This part reviews the literature on the teaching of construction in architectural schools in Turkey and the methods used to instruct construction knowledge. Through a review of the universities' websites, it compares the construction courses' place and scope in the architectural schools' curriculum of three prominent state schools (Middle East Technical University, Istanbul Technical University, and Mimar Sinan Güzel Sanatlar University) with Yeditepe University. It further examines the potential contribution of the applied course hours.

The Department of Architecture of METU has three mandatory construction courses and five construction-related courses. The 'ARCH 259: Building Construction Technologies' course takes place in the third semester with two theory and two practice hours. It covers the examination of the structural components that make up the construction system of a building in wood, steel, reinforced concrete, and composite building systems. The practice involves architectural drawings, field trips, and seminars. 'ARCH 351: Building Detail Modelling' is in the fifth semester with two theory hours and four practice hours. The course covers orthogonal architectural representation for architectural projects, theory, techniques, methodologies, tools for architectural detailing, and the advantages and disadvantages of different approaches to architectural representation. The application hours entail drawings and models. The 'ARCH 453: Construction Design Practice,' a fourth-year course, entails three theory hours and two practice hours. It covers systems, system details, and performance considerations of a building and entails writing specifications in addition to producing construction drawings and models.

The Department of Architecture of ITU has three mandatory construction courses and ten construction-related courses, including elective courses. 'MIM 203: Building and Construction in Architecture' takes place in the third semester with three theory hours and one practice hour. It introduces the concepts of architectural and construction technology, systems approach, building elements, building and construction methods, user-environment-building system interaction, wall and partition systems, window and door systems, flooring systems, vertical circulation systems, and roof systems. Application hours entail full-scale models, analysis, and synthesis. 'MIM 204: Architectural Building Element Design' takes place in the fourth semester with three theory and two practice hours.

It introduces the analysis, design, and integration of building elements according to defined criteria and boundaries, wall and partition systems, window and door systems, flooring systems, vertical circulation systems, roof systems, outer shell, and the mutual interaction of design and structural elements. Application hours include two-dimensional technical drawings and three-dimensional digital models. The 'MIM 484: Construction Project' course takes place in the seventh semester with two theory hours and six practice hours. It includes material selection in the context of a comprehensive building design, construction techniques, environmental control systems selection, and design, arrangement of the carrier system, design stages according to the current building legislation, integration, and coordination of building subsystems with other building components, explanation of each design stage, project design following national and international project regulation principles. Application hours contain drafting.

The Department of Architecture of MSGSU has four mandatory construction courses and twelve construction-related courses, including elective courses. 'MIM 108: Construction 1' is in the second semester, with two theory hours and three practice hours. 'Construction 1' covered the general rules of masonry and reinforced concrete frame construction, building elements, the earthquake-resistant structure design, foundations, flooring, walls, and roofs. 'MIM 207: Construction 2' occurs in the third semester with two theory hours and four practice hours. 'Construction 2' covers wood and steel skeleton construction, reinforced concrete, wood, and steel staircase organizations and roofs. Application hours entail two-dimensional technical drawings and physical models (Diri & Mayuk, 2019). The 'MIM 205: Architectural Application Project 1' course takes place in the third semester with three theory hours and two practice hours. The 'MIM 206: Architectural Application Project 2' course has three theory hours and three practice hours in the fourth semester. The course description states that the student learns the architectural design process from the preparatory and preliminary research studies to the environmental and site plan studies, the idea project, the preliminary project, and the final project, in the detail-whole relationship, through analytical thinking, synthesis, evaluation, problem-solving, developing technical and graphic expression skills, and the course brings design awareness to the students. In 'Architectural Application Project 1,' the students design a structure. In 'Architectural Application Project 2,' the students prepare the application project of the designed structure. Application hours entail two-dimensional technical drawings and three-dimensional models.

In architecture schools in Turkey, construction education mainly consists of two parts. The instructor gives theoretical knowledge; in the second part, students apply this knowledge, mainly by drawing. Methods such as seminars, laboratory studies, and examination of samples are also used during class hours (Yücel, 2018). The traditional approach starts with the instructor's presentation and demonstration of theoretical knowledge in the lectures and the students watching and listening to the lecture. At this stage, the student takes a passive role, and the instructor takes an active role. Although construction courses mainly depend on applying construction knowledge through technical drawings, they also include modeling. In this regard, the literature contains studies conducted at the Architecture Department of MSGSU (Diri & Mayuk, 2019), OMU (Bodur et al., 2020), GTU (Mayuk & Cosgun, 2020), and KTU (Kavraz, 2021).

The Architecture Department of YU has two mandatory construction courses and six construction-related courses, including elective courses. The 'Construction' course currently takes place in the second semester, with two theory hours and two practice hours, and includes the general rules of the reinforced concrete frame structure and an introduction to building elements from the foundation to the roof. The 'Construction Project' is in the sixth semester with two theory hours and three practice hours. Besides the rules for preparing the application project, the course contains the construction of timber and steel frame structures, wooden and steel stairs, and roofing. In both courses, the practice entailed drafting before the intervention through action research.

Table 1. The weight and methods of construction courses in several leading universities compared to Yeditepe University (Developed by the Authors).

	Construction Courses	***Weekly Hours (T+P)***	***Application Methods***
METU	Building Construction Technologies Building Detail Modelling Construction Design Practice	2+2 2+4 3+2	Drawings Drawings and digital models Drawings and models
ITU	Building and Construction in Architecture Architectural Building Element Design Construction Project	3+1 3+2 2+6	Full-scale models Drawings and digital models Drawings
MSGSU	Construction 1 Construction 2 Architectural Application Project 1 Architectural Application Project 2	2+3 2+4 3+2 3+3	Drawings and physical models Drawings and physical models Drawings and models Drawings and models
Yeditepe University	Construction Construction Project	2+2 2+3	Drawings Drawings

Compared with some of the leading architecture programs above, the construction courses have less weight in the architecture curriculum of YU, and the 'Construction' course takes place sooner in the program. The fewer hours dedicated to construction courses in the curriculum lead to the intensification of content while students need help connecting theoretical and practical knowledge when the application depends on the representational realm of technical drawing, especially for first-year students. When technical drawing is both a learning and still a learned tool, it introduces a paradox. It raises the need for other means of access to construction knowledge. Consequently, the authors turned to the idea of an 'experiential facilitation approach' by merging ontology and representation of building—as explained below.

3. Splitting and Merging of Design/Construction in Architectural Education/Practice

The dominance of technical drawing in architectural education follows the split between design and construction and ontology and representation. Today, in both education and professional practice, architectural work is designed and fully developed in a representative environment. The application follows after the design. This split puts a great distance between the designer and the construct. In design studios, the phrase application follows the language of modeling software, in which the designer applies structure and materials to the surfaces of their already formed projects. Models based on combining many surfaces lack depth, sensuality, or structural logic.

Carpenter (1987, p. x) highlighted this distance between design and construction and the architect and construction site that starts in architectural education and continues in professional practice: "In school we are taught that the architect must observe construction. The architect works in another place, usually at a distance from the building activity, and sends messages—plans, drawings, and specifications—to the site." In history, Leon Battista Alberti was the first person in architecture to separate the intellectual task of design from the craftsmanship of construction. In this view, which has been developing for centuries, with the distinction of mind and hand—besides discourse—surface, ornamentation, and image became the architect's task (Moravánszky, 2018). The separation of design and construction processes, the hindrance of the difference between entities and their representations, and the spread of a surface-oriented thinking process are important topics of contemporary criticism. While Frampton argues for attention to the difference between ontological and representational, he also underlines that architecture is an abstract discourse based on surface, volume, and plan after an existing building (Frampton, 1995).

The ontology of the work requires a deep understanding of the material and structural system that never leaves its symbolic or phenomenal meaning (ibid).

With the development of tectonics, a stance that aims to reunite design and construction thinking has developed in architectural education again. The distance between design (in a representational realm) and construction (as application or realization) in architectural pedagogy has been overcome in the 'design/build' approach in recent decades. Design-build is an umbrella term with applications ranging from industry to education. It is a project delivery method in the industry. Unlike the traditional three-part structure consisting of employers, architects, and contractors, in the design-build method, the team works under a single contract as a single stakeholder to provide design and construction services to the project owner (Canizaro, 2012). Design-build is an alternative pedagogical approach to architectural education, which happens in a theoretical, desk-based, and tool-driven design process with drawings, models, and digital models common to design schools (ibid). In the design/build approach, design and construction, actual and representation, and theory and practice merge.

While design/build in architectural education developed in Britain and USA for community service (Canizaro, 2012; Hailey, 2016), its scope is beyond community service. Design/build pedagogy goes beyond comprehension and allows for innovation by engaging with materials, methods, and the tectonic language of buildings. Weber suggests the potential of building to bridge form, materials, and methods. Weber (2018, p. 2) notes, "Design build can be a pedagogical tool that teaches students to slow down and value the materials and methods of building as the carriers of architectural meaning." Design/build pedagogy merges ontology and representation in work—work as a site, process, practice, and construct. Currently, the design/build approach in architectural education serves various ends.

Early on, Carpenter (1987) introduced the idea of building as a learning tool in construction studios to grasp the connection between thinking and making, which remains valid in this era. Carpenter's view further suggests an 'experiential learning' approach, which engages all senses, especially touch and hapticity, to register knowledge. Experiential learning emphasizes "learning from experience or learning by doing" (Lewis & Williams, 1994, p. 5).

In the act of building as a learning-by-doing tool, knowledge is not only acquired by the eye and mind but also by the hand and the whole body. The knowledge is thus embodied. It merges not only ontology and representation but also mind and body. Along these lines, international debates on teaching construction in architectural education also underline a paradigmatic shift in construction teaching "from a learning-by-studying and learning-by-being-taught to a learning-by-doing process or rather to a learning-by-playing one" (Voyatzaki, 2002, p. 15).

Based on the literature review, the authors derived from the dynamics between ontology and representation in design/build pedagogy and designed an experiential facilitation approach to enable students to access construction knowledge splitting and merging ontology and representation. The study further contributes to the literature by revealing how construction learning occurs when merging ontology and representation.

4. Research Methodology

The authors have designed this study as action research due to its intention for active curriculum development through the ongoing revision of construction courses. Action research is widely used in education to develop pedagogical practices and revise methods and approaches systematically. It positions researchers as 'reflective practitioners' (Schön, 1983). Ontologically, action research deals with dynamic and human-modified reality situations (Coghlan & Brydon-Miller, 2014). Epistemologically, action researchers see knowledge as something they generate and a living process. Knowledge derives from people's own life, performances, and learning experiences. In action research, information is never static or complete; it is in continuous development as new understandings emerge (Mcniff & Whitehead, 2002). Action research operates as a "spiral of cycles of planning, acting, observing and reflecting" (Carr & Kemmis, 1986, pp. 125–126; Kember, 2000, p. 19). This method, which entails developing a horizon while acting, is similar to the assumptions of hermeneutic philosophy about the circularity and broadening of the horizon. Therefore, the analysis framework of this research is based on the cyclical relations of the hermeneutic circle (Gadamer, 1988).

This research was conducted in 'Construction' taught by Aktuna and 'Construction Project' taught by Karahan. Both courses took place parallelly in Fall 2022 when each course had only one section. The instructors exposed students to 'experiential learning,' which immerses learners in an experience that leads them to reflect on the experience "to develop new skills, new attitudes, or new ways of thinking" (Lewis & Williams, 1994, p. 15). Along the lines of action research, this research led to revisions. It allowed reflection on the outcomes for further actions and revisions. In this study, planning denotes the preparation for new action, i.e., course modification. Acting refers to the conducting of the course each semester. Observation happens during classes and enables data gathering. Reflection occurs through a comparison of course outputs and thematic data analysis, and it prepares for the next planning cycle.

The first action cycle started when Aktuna, an outsider with a different background, joined the department in Spring 2021 and joined the 'Arch 110: Construction' course. At that time, the teaching methods of construction courses had followed lecturing and drafting. In Fall 2021, Aktuna had a pilot study in the course, which entailed introducing teamwork, model-making, and hands-on engagement with materials and methods covered in the course after the inspiring pedagogical work by Huang (2020) to allow student encounters with materials, principles, and systems. Aktuna presented the course outcomes to colleagues at the end of the semester. Consequently, model-making was introduced more systematically to the course in Spring 2022, positively impacting student works, performances, and interests.

In Fall 2022, Aktuna and Karahan revised both construction courses holistically, which entailed the revision of the course content order, theoretical lessons, application methods, and evaluation approach. In these courses, the authors introduced multiple modes of instruction and representation. This introduction sought a balance between lecturing, drafting, model-making, and building toward the repeated splitting and merging of ontology and representation of the building. It further sought to foster potential benefits of individual, group, and collective work and enable a learning process that depends on the instructor, peers, and the self. The authors compared course outcomes for Fall 2022 to previous semesters. The data were collected separately in both courses.

This study employed thematic data analysis to define the essential themes of experience in accessing construction knowledge. Maguire & Delahunt (2017, p. 3353) describe the aim of thematic analysis as "to identify themes, i.e. patterns in the data that are important or interesting, and use these themes to address the research or say something about an issue." Braun & Clarke (2006, p. 87) suggest six phases in conducting thematic analysis: "familiarizing yourself with your data," "generating initial codes," "searching for themes," "reviewing themes," "defining and naming themes," and "producing the report." During thematic analysis, the authors read the data closely to create as many categories as possible and write a label that best describes each category (Norton, 2019). After the authors followed six steps of thematic analysis separately for both data sets from the two courses, the authors created a unified narrative of findings. The themes guide planning and acting as the next steps in course revision.

4.1. Engagement with the 'Construction' Course

The 'Construction' course was revised in Fall 2022. The course content remained the same: reinforced concrete structural frame systems, foundations, slabs and stairs, timber roofs, walls, wall openings, plans and partial sections of the foundation, slab, and roof, architectural floor plans, and entire sections and elevations. However, it was revised to include various application methods more systematically. Besides drafting, the application methods included modeling/model-making ***(Figure 1)*** and building workshops ***(Figure 2)***. Rather than the individual working methods of the preceding semesters, students worked individually on drafting, in pairs for model-making, and collectively for building activities. The course also depended on industry seminars with applications and demonstrations. The brick manufacturer Kilsan gave a lecture followed by a wall-building application ***(Figure 3).*** The glass manufacturer Roto Frank held a seminar supported with window prototypes.

Figure 1. *Model by Defne Akalın & Serra Erdag* (Photograph by Bahar Aktuna).

Figure 2. *Building workshops*
(Photographs by Bahar Aktuna & Umut Bektas).

The course included 18 enrolled students who followed the course. Three students were retaking the course—two of them for the third time. In the course, Aktuna observed the learning environment and created one midterm and one end-of-the-term surveys to compare student responses to different engagement methods with knowledge. The midterm survey asked to rate different methods' efficiency in fostering access to construction knowledge. The final survey asked similar questions in more detail to allow more nuanced responses. The surveys asked students to rate each instruction method between 1 (not efficient) and 10 (fully efficient). This survey, not designed for quantitative analysis, helped to establish initial observations and generate interview content for qualitative analysis.

A semi-structured interview took place at the end of the semester after the final exam but before the grades were announced. Aktuna conducted interviews with six volunteering students with a range of passing grades. She held the discussions with each student separately and asked: "What have you learned from this course? Which topics did you learn best? Which methods of this course were liberating or challenging? What knowledge will stay with you the longest? What were some fun moments? What was most challenging about the course?" The interviews were recorded with a tape recorder and transcribed. Both interviews and observations on student work and performances shed light on the success of multiple methods that depend on splitting and merging ontology and representation.

4.2. Engagement with the 'Construction Project' Course

The 'Construction Project' course was conducted with 19 registered and regularly attending students. The course content remained the same: site plans, floor plans, sections, elevations, and stair system detail, timber frame and steel frame structures, slab, stair, roof, and facade cladding systems in line with the principles of preparing a construction application project. The students applied the topics covered in the theoretical courses to their previous construction projects, designed as a reinforced concrete carcass system. They positioned their current project on sloping land, added a basement, designed a part of their project as a timber frame, changed some of the existing reinforced concrete slabs to steel-bearing and timber-bearing slabs, and designed a single-flight timber or steel staircase. Theoretical lectures were supported by digital presentations, videos, and drawing on the board. Technical drawings, three-dimensional modelling, model-making ***(Figure 3)***, and building workshop methods were used in the course applications. The workshops produced a timber slab and roof ***(Figure 4)*** in actual scale and materials. During all studies, the instructor paid attention to the active use of student-instructor dialogue.

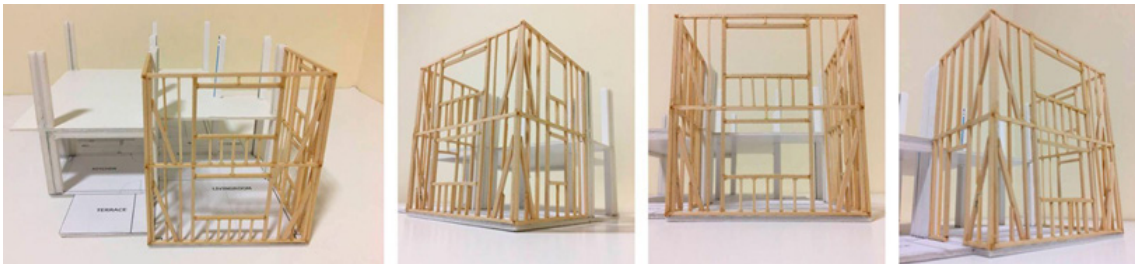

Figure 6. *Model by Pavel Fefelov*
(Photographs by Pavel Fefelov).

Figure 4. *Building workshops*
(Photographs by Rıdvan Özel & Yonca Alın).

Throughout the 'Construction Project' course, Karahan made observations and created three surveys. Karahan conducted the first survey with the participation of nineteen students after the timber slab building workshop. In the first survey, the students were asked how many times they took this course, and if more than once, the reasons for their failure. Another question asked whether the workshop helped them understand the subject. The last question asked to explain the basic principles of timber slabs with sketches to evaluate the workshop's learning outcomes. Karahan conducted the second survey after the wood frame roof workshop, and six students participated. The survey asked to assess the teaching methods of the course between 1 (not efficient) and 10 (fully efficient) and to explain the basic principles of the timber frame roof with sketches. The instructor further observed the students throughout the semester. The third survey was conducted before the final exam. Karahan surveyed the students' experiences of the instruction methods through semi-structured questions and collected written answers from fifteen students. Questions were asked about the subjects the students had the most difficulty with, the reasons for this, and the evaluation of the contribution of the instruction methods to their learning.

5. Results

In 'Construction,' there was a radical improvement in student work, especially the representation of construction knowledge in technical drawings. The success rate of the course was also higher than in the previous semesters. Thus, the authors interpret that introducing multiple methods increased access to construction knowledge and construction thinking. The midterm survey results (Table 2), which provide supporting data for thematic analysis, highlight student preference for building, teamwork, modeling (as a more accessible realm of representation), individual critiques on drawings, enlarged view of representation, collaboration, and collective discussions. The final survey results (Table 3) highlight student preference for studying existing construction drawings (precedents), individual critiques, building workshops, visiting firm seminars, drawing, model-making or building after theoretical lectures, peer learning, and learning from our everyday environment. The interview content will be presented as a narrative format in the 'Discussion' and show how the students have experienced the access to construction knowledge.

Table 2. First survey, 9 November 2022 (Developed by Bahar Aktuna).

	1	2	3	4	5	6	7	8	9	10	11	12	13	total
..... Lecturing through course slides	10	5	8	8	2	4	10	10	10	-	6	2	6	81
..... Note-taking	9	5	0	8	7	7	9	10	10	-	5	4	3	77
..... Self-study through lecture slides	8	6	10	8	10	3	10	10	10	10	5	3	6	99
..... Weekly readings of course sources	5	0	0	9	2	0	10	10	10	10	7	3	7	73
..... Model-making	10	8	7	10	9	10	10	10	10	10	8	5	8	115
..... Individual drafting on your desk as in class exercise	10	5	4	8	8	9	10	10	10	5	6	5	6	96
..... Collective drafting on the whiteboard	10	7	10	8	10	8	9	10	10	8	7	10	4	111
..... Individual drafting on your desk as homework	10	7	0	8	7	8	10	10	10	10	7	10	7	104
..... Building workshops	10	10	10	10	4	10	10	10	10	8	10	10	8	120
..... Individual critiques	10	9	2	10	6	10	10	10	10	10	10	10	10	117
..... Collective pin-ups and discussions	10	8	10	10	8	10	9	10	10	10	8	10	-	113
..... Group discussions on projections of student works	10	10	10	10	7	9	10	10	10	8	10	10	9	123
..... Teamwork	10	10	10	8	8	8	9	10	10	10	9	10	10	122
..... Individual work	10	7	0	10	9	8	9	10	-	10	7	5	8	93
..... In-person critiques	10	7	0	9	7	10	10	10	-	10	10	10	10	103
..... Online critiques	10	7	0	10	10	5	10	10	-	1	4	0	8	75

Table 3. Second Survey, 7 December 2022 (Developed by Bahar Aktuna).

	1	2	3	4	5	6	7	8	9	10	11	12	total
THEORETICAL LECTURING-BASED METHODS													
Weekly lecturing through lecture slides	10	8	9	10	3	10	10	8	10	9	6	7	100
Taking notes in the class	8	8	10	10	4	9	10	6	8	2	5	2	82
Self-study through lecture slides	8	1	10	10	1	8	10	7	10	6	5	8	84
Weekly readings of course sources	9	-	10	10	0	10	10	9	5	6	5	8	82
Studying a drawing made by the instructor together	10	10	10	10	8	10	10	10	10	8	10	10	116
Lecturing before drawing, modeling or building	10	10	10	10	5	10	10	8	10	9	10	10	112
Lecturing during drawing, modeling or building	10	1	10	10	6	10	10	7	10	7	10	7	98
Lecturing after drawing, modeling or building	10	1	10	10	4	6	10	5	5	3	10	5	79
DRAFTING-BASED METHODS													
Individual drafting as in-class exercise	8	10	7	10	8	9	10	10	8	8	10	10	108
Individual drafting as homework	10	3	9	10	6	9	10	10	8	5	10	7	97
Collective drafting on the whiteboard	10	10	10	10	7	10	10	10	8	8	10	8	111
Individual table critiques	10	8	10	10	9	10	10	10	10	9	10	10	116
Individual online critiques	10	1	10	10	3	10	10	10	10	0	10	8	92
Collective pin-ups and discussions	10	3	9	10	5	9	10	8	10	6	5	6	91
Group discussions on screen projections of student works	10	1	9	10	4	9	10	8	10	6	6	6	89
Drafting after modeling	10	1	10	10	7	6	10	7	8	6	10	8	93
Drafting after building	10	1	10	10	7	9	10	7	5	6	10	10	95
Drafting after viewing your peers' drawings	10	10	9	10	7	10	10	9	8	7	10	9	109
CRAFTING-BASED METHODS													
Model-making as homework	9	3	10	10	7	10	10	9	5	5	10	8	96
Model-making in class	8	10	7	10	6	8	10	8	2	7	5	8	89
Model-making before drawing	9	1	9	10	7	5	8	7	5	6	10	5	82
Model-making during drawing	8	3	7	10	5	8	10	8	10	3	5	10	87
Model-making after drawing	9	10	10	10	5	9	10	9	5	8	5	8	98
BUILDING-BASED METHODS													
Hands-on building workshops	10	10	10	10	10	10	10	10	8	8	10	9	115
Visiting firm seminars	10	10	10	10	10	10	10	10	8	4	10	8	110
Studying our built environment	10	10	10	10	10	10	10	8	8	6	10	7	109
Building after drawing	10	10	10	10	8	10	10	10	10	0	10	9	107

In 'Construction Project,' most of the 19-student class consisted of students who had already taken this course once or twice (three students for the first time, five students for the second time, and eleven students for the third time, according to the first survey). Taking the course several times and failing made the students disinterested. Working with multiple methods increased the students' motivation and enabled them to follow the course more closely. The second mid-term survey, conducted with six students, shows that model-making, building workshops and individual critiques of their work helped students to access construction knowledge (Table 4). The thematic analysis of the survey data is presented in the 'Discussion' section.

Table 4. Second survey, 12 December 2022 (Developed by Esra Karahan).

	1	2	3	4	5	6	total
Lecturing through course slides	*7*	*10*	*8*	*5*	*10*	*6*	*46*
Video screening	*8*	*10*	*9*	*6*	*9*	*6*	*48*
Model making	*10*	*8*	*10*	*10*	*10*	*9*	*57*
Individual drafting on your desk as in class exercise	*10*	*7*	*8*	*7*	*10*	*6*	*48*
Individual drafting on your desk as homework	*7*	*4*	*5*	*6*	*9*	*6*	*37*
Individual three-dimensional works	*10*	*6*	*8*	*8*	*7*	*8*	*47*
Building workshops	*10*	*10*	*10*	*10*	*8*	*10*	*58*
Individual critiques	*8*	*8*	*10*	*7*	*10*	*10*	*53*

6. Discussion

The content of the interviews and surveys majorly communicates what students comprehended, what they learned well, and what was helpful and fun. It also contains what was challenging, but a positive learning experience outweighs the challenges. Presented below, the retrieved interrelated themes reveal how the students grasped different aspects of construction thinking that fold into the logic of construction.

"It was Like Cooking!": Revelation of Immediacy and Ordinariness

In construction courses, the students are called to imagine the representation of things. The representation makes things far away, hindering their immediate and everyday being. The construction activities happen somewhere far away from the students, and these activities are inaccessible in their minds. However, when building hands-on, they engage with tools, materials, sizes, measurements, and details, overcoming the impenetrable distance to the construction world. Along these lines, the students repeatedly referred to the liberating effect of casting concrete and framing a roof when those become everyday activities like cooking: "Pouring concrete liberated me, and I will never forget that day. [...] We all got our cement there; we mixed it all together. Oh, let's put some water. It was like cooking [...]. It didn't feel far, frankly, dealing with concrete." Similarly, in applied seminars, the students grasped the immediate connection between an object and its representation:

> *I found the Roto Frank seminar very informative. Seeing the information on the slide they gave us in front of a window and showing it to us with that window cut in half was also beneficial for me. Because I could really see the intermediate elements of the window. And I was very impressed that they gave examples from the windows in our classroom. If necessary, they gave examples from daily life.*

Sometimes, the students engaged with the sections of real-size building elements; they learned to see plans and sections in objects. Thus, orthographic drawings further became demystified. One student noted how she came to understand the representation, on plans, of stairs that run several stories:

> *The stairs were more accessible because we discussed the need to cut the stairs at eye level in one of our lessons. When we went out of the classroom and cut from this level on the school's stairs, it became easier for me to make sense of the stairs. The stairs seemed more accessible because things were directly in front of my eyes.*

One of the exercises entailed stretching ropes as the axes to find the intersection points to place columns. Although it had been harder to get students to draw axes as an important symbol on the drawings in previous years, students learned from making axes tangible this time. Along these lines, one student noted: "When we showed the axes with the rope, it was very effective." In the current revision of the course, the axes were laid on the models at the beginning of the semester while designing the structural frames. They were also laid on the floor during the roof-building workshop to mark the places of the studs. Thus, the immediate connection to the symbols through showing their essence to construction is ongoingly practiced.

Opposite to the demystification of representation and access to things, as noted above, several students stated the inaccessibility of foundations as the 'hidden' elements of buildings: "I had trouble with the foundation plan because it's a piece we don't see much. Frankly, I had difficulty not seeing it around me." Another student said, "It was the foundation I had the most difficulty with; grasping the foundation plan had been hard." In response to this struggle with the representation of foundations, the instructors incorporated foundation modelling into the current semester, enabling students to lay out foundation plans simply while making the model without realizing that they were already drawing them.

"Ah, That Gap Between the Purlin and the Wall!": Illumination of the Unnoticed Details

Besides allowing encounters with mystic tools, materials, and elements, building workshops allowed students to look closer at the objects of representation. Building the roof frame allowed them to pay attention to joints and details students never noticed and felt were important to represent. On the other hand, the construction drawings depend on these small joints and details in their constructive logic. Along these lines, one student elaborated on how she had a revelation on the connections of roof components she observed in the 1:1 building workshop.

> *When I placed the purlins, I did not pay any attention to the small details, like I had to leave a gap between the purlin and the wall when I drew them last term. [...] I understood it much more easily when we had the 1/1 application. [...] Actually, I couldn't think much in my mind about how the rafters would be placed or how much I could leave the gaps. I am much more comfortable now. [...] While placing the rafters in my head, I did not fully grasp that the rafters should meet each other like this. I didn't realize that the right and left sides (rafters) had to meet each other when they ended at the ridge. I used to stagger them. But I realized that they had to meet each other.*

“Yes, It is All the Same Thing!”: Revelation of the Cross-referential World of Construction Drawings

Although inherent to the logic of construction projects, cross-referentiality is hard for most students to grasp and apply. The switching among multiple media enabled students to comprehend this basic concept of construction thinking. One student describes how that logic was revealed to her when she was transferring the roof from one medium to another after the first failed attempt to model it correctly:

> *In fact, we realized that we could draw the plan, take a section from the plan, and make the model more easily from the section. While I was doing all these at that time, I actually understood drawing the roof plan. Then, adjusting the slope when I cut the section, shifting the ridge, and all these details became much easier.. That’s why making models was also very good. Afterward, we corrected the model and received critique. 1:1 practice, making models with my teammate, drawing in class, and getting criticism, all of them were very useful. I can’t single out any of them; they were all beneficial.*

Internalizing Knowledge

Construction courses, in addition to giving basic building information, also focus on identifying the problems of the building and the methods of producing solutions in line with the determinations. Students are expected to deliver solutions in line with the issues using the primary education they have received. At this point, knowledge’s internalization is significant to find answers to changing structural problems. The internalization of knowledge also describes the ability to access new information by using what is known in the face of differing situations beyond understanding and grasping knowledge. In this respect, internalizing knowledge is essential for construction courses.

Opposite to the demystification of representation and access to things, as noted above, several students stated the inaccessibility of foundations as the 'hidden' elements of buildings: "I had trouble with the foundation plan because it's a piece we don't see much. Frankly, I had difficulty not seeing it around me." Another student said, "It was the foundation I had the most difficulty with; grasping the foundation plan had been hard." In response to this struggle with the representation of foundations, the instructors incorporated foundation modelling into the current semester, enabling students to lay out foundation plans simply while making the model without realizing that they were already drawing them.

After the timber slab and roof workshops, the students were asked about the contribution of the application to their learning. The following answers were received: "Practicing is catchy," "Seeing and touching the material, dealing with it, and coming to a conclusion has been very effective," "Trying methods, trial, error, and retrying made it easier for me to understand," "With these applications, our drawings gain dimension and become more instructive," "I think that making the applications in 3D provides ease of learning and makes the information permanent," and "Doing the roof and slab construction step-by-step was more efficient and memorable than watching it on a slide." The students stated that they found the workshop practices positive regarding memorability, that is, the internalization of knowledge.

In the building workshops, they encountered the actual dimensions and materials of the structural elements they had represented with orthographic drawings, and they understood the potential and problems of the material. These experiences gave students a radical improvement in their understanding and internalization of construction knowledge. They could translate this knowledge into the representational medium of sketches ***(Figure 5).***

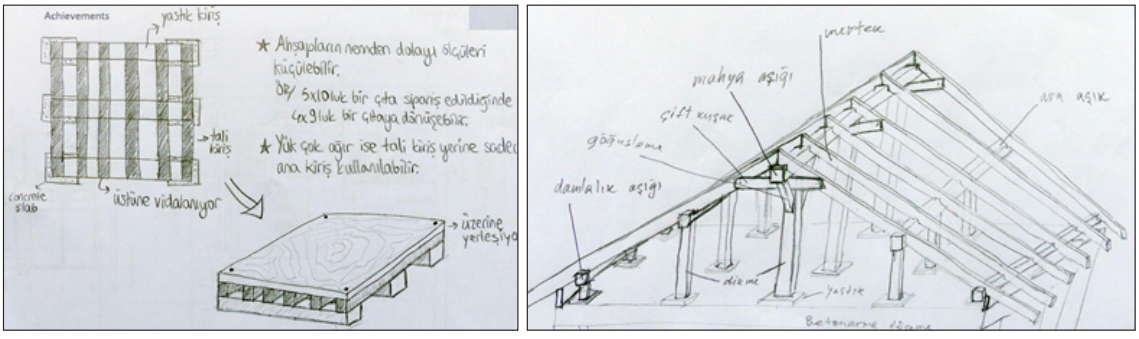

Figure 5. *Student sketches*
(Images by Esra Karahan).

Learning-by-enjoying

Students are passive learners in theoretical lessons, while the instructor is active. In long theoretical lectures, students become alienated from the subject. The students are still passive during critiques. However, the roles change in practices where the student actively participates. The instructor takes a passive position as an observer and supporter when necessary, and the student takes an active position as a producer. There is also some play in the student's work using materials and working in a team. In teamwork, all peers participate in the play. The word 'play' contains a childlike joy in it. When the students were requested to interpret the study after applying the timber slab, they initially and immediately said that: "It was a delightful application," "It was a different experience, and it was enjoyable," "Being fun encouraged learning more," and "I wish we could learn every subject by practicing like this; we both learned and had a lot of fun." Building culture fosters teamwork and active communication. Although being a serious activity with the need for job safety, the building workshops allowed connection, jokes, and fun moments during the long building process.

The findings illuminate the experiential process of students as anecdotal moments of confrontation with the reality of the building. Gaining and regaining a perspective into construction knowledge is challenging but possible through engaging with various scales (including 1:1) and media. Through multiple methods presented here, the students gained the skills to move between ontology and representation by constantly regaining a perspective of the entity under study and processing and narrating the reality surrounding representation through their moods, senses, feelings, and embodiment.

The interpretation of the findings contributes to designing the teaching of construction courses to enable students to access construction knowledge more efficiently. The findings underline the importance of parallel engagement with reality directly and while learning to represent it through other tools, and they indicate the importance of providing an educational landscape to students to engage with construction knowledge hands-on, collaboratively, and diversely. Retrieving essential themes as an ongoing process allows us to reflect on the issues surrounding students' learning process and re-plan the instruction of construction courses accordingly.

7. Conclusions

This action research has confirmed the success of experiential learning and found that applying knowledge through maintaining the diversity of representation results in enhanced learning of construction courses. It has further retrieved experiential anecdotes of learning. This study was limited to two construction courses at Yeditepe University but has wider implications for teaching of construction courses in general.

Since the action in this research started, there has been ongoing progress in grafting construction thinking in the architecture program. The course instructors have accumulated much experience, and the successful works of students have also built up to create the infrastructure and artifacts of new building culture. This study indicates the importance of providing the required environment for the multiple-methods approach, such as material and building laboratories and building workshops in educational institutions to support the realm of construction courses.

Due to the importance of experiential learning in supporting knowledge acquisition, it is vital to include elective courses, such as design/build, in the curriculum, where experiential learning is at the forefront and can support construction courses.

As these experiences and accumulations contribute to the newer generation of construction students, the authors will follow the impact on students' design studio work in future research. Following the reflections of construction courses on design studios and students' professional practices is essential. The inclusion of new techniques and methods will follow as the authors continue to act, observe, reflect, and plan toward founding a more robust building culture.

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Conflict of Interests

The authors declare no conflict of interest.

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Critical Analysis of Design Studio Adopting a Narrative Methodology as a Means to Fragmenting Knowledge within Architectural Pedagogy

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CHAPTER III

The purpose of this paper is to critically analyse a pedagogical approach adopted in graduation design studios at Cairo University. The design studio under investigation in this article adopts a story-telling method, which aims to provide a unique design experience for graduating students other than the functional or digital approaches for dealing with design projects. The methodology used in the article is a qualitative analysis of the approach mentioned and critique of the methods of teaching and learning with application on the outcomes of the studio during the last three cycles. The approach introduced in the before mentioned studio relies on narrative storytelling, as a means of fragmenting knowledge leading to identifiable, pluralistic and inclusive architecture. This methodology of teaching depends on "outside-in" design to create unique public buildings materializing a narrative expressed by each student and developed through layers of investigation and research in order to translate this narrative into an architectural form. This narrative is implemented additionally on the spatial experience of the interior composition. The three cycles are analysed based on documenting and comparing the narratives of the students which describe their cinematic vision of their projects and their formulation of this vision into an architectural outcome. Thus, provides a means for additional innovation in architectural pedagogy and an assessed tool to develop and combine creative and critical thinking in architectural design. This approach is deeply analysed and assessed through three consecutive years concludes with a comprehensive learning tool for architects and educators.

Introduction

The Narrative Approach in Design Studios as a Pedagogical Methodology

The purpose of this paper is to showcase and critically analyse a pedagogical approach adopted in graduation design studios for more than 10 years at Cairo University. The methodology used is to qualitatively analyse the approach and criticize the pedagogical methodology of this studio. The pedagogical approach introduced in the before mentioned studio relies on narrative storytelling, as a means of fragmenting architectural knowledge which leads to identifiable, pluralistic and inclusive architecture. This methodology of teaching depends on "outside-in" design to create unique public buildings which take into account a narrative that is expressed by each student and developed through layers of investigation and research in order to translate this narrative into an architectural form. This narrative is implemented additionally on the spatial experience of the interior composition. The qualitative analysis is conducted on the outcomes of the last three consecutive cycles (2020-2022), to validate the success and weakness points of this teaching methodology. The originality of this research lies in providing an overview of the themes for each cycle reflected on the outcomes of a total of sixty students in the three cycles. The adopted framework of analysis is based on a series of steps, first the conceptual approach expressed by the student as a narrative statement expressing their consciousness of the project post the research phase, followed by diagrammatic abstracted illustrations reflecting their understanding of the written narrative, followed by abstract scaled down physical models iterations justifying the translation of the narrative into 3D form, then testing of the programmatic requirements in parallel to applying the narrative statement on the spatial experience. The significance of this study is the wide spectrum of architectural solutions both on the level of idea and implementation which resulted from this methodology of dealing with design problems. The hypothesis which was considered while designing this learning approach is that regardless of the previous design capabilities of students, this systematic and gradual transformation from narrative to form to spatial experience will aid them to reach a considerable unique outcome. This will be verified through a cross-reading between the outcomes of the three studied cycles.

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Keywords: Storytelling, Architectural Pedagogy, Graduation Architectural Design Studios, Pluralism in Architecture, New Approaches in Pedagogy, Fragmenting Architectural Knowledge.

2. The Design Studio Approaches and Considerations

The design studio tools, methods, strategies and enhancements are always under question and research, since the studio reflects the core of architectural pedagogy. The design studio creates a simulation for real practices in architectural realm, thus, it blends different knowledge acquired by students from other disciplines during their journey of architecture academia. Precisely in the current era, it is not expected to merely dictate architectural students with codes, regulations and functional requirements associated with buildings, but rather to provide them with a complex design problem, which challenges them to think in a critical manner to correlate the knowledge they can easily access. The role of the tutor, coach, or professor is to design the problem and the methodology of solving this problem, through the integration of the state of the arts knowledge in the design studio. And in the shadows of the current paradigm, it is important to regard problem solving in design studio with regards of the SDGs developed by the United Nations and promoted in architecture by the Union of International Architects, in order to provide a floor for architectural students to raise awareness regarding the current global challenges.

The debates previously raised by scholars will be briefly highlighted in this introduction based on two main lines of thought. First is related to the philosophy of learning and teaching in the design studio from a broader perspective, and then specifically how storytelling is contributing to pedagogy as a more specific methodology incorporated in design.

Design studios are the core of architectural pedagogy (Kurt, 2009) and have been regarded by scholars as a medium for re-thinking since the 1970s (Salama, 2007). The tools and motives behind the studio are seen as to encourage skills development and practice critical thinking, in order to respond the future work environment soon to be undertaken by today's students, (Salama 2007). As Saghafi (2021) debates, there must be more stress on linking knowledge acquisition and application in the design studio. While hands on learning is regarded as the most important asset in the design studio, it ought to be quoted, "tell me and I forget, teach me and I may remember, involve me and I learn", (Xun and Knoblock, 1990). Thus, the studio ought to provide a more "collaborative, multi-sensory, learner-centered, constructivist, experiential problem-based teaching environment", (Kurt, 2009).

Based on Charalambous and Christou (2016), supposition that the research on design studio doesn't change the fact that teaching is still very traditional in terms of merely searching for forms, and that the real challenge lies in the need to search for new arenas of explorations targeting setting a redefinition of architectural education. Additionally, they regard the need to deeply inter-relate different types of knowledge and complex system thinking in the architectural studio based on the needs of our current era. For instance, specialized human studies (Coleman, 2010), the study of material, digital data, systems science, radically change the outcomes of design studios. This relates to the constructivist teaching strategies which Kurt (2009, 2011) introduce as a solution to enable students to gain a better learning experience through "learning communities, "problem-based," "discovery," and "hands-on" problem solving. In accordance with the ideological approach of transforming the design studio from upper hand tutor dictating into hands-on learning by doing process, Lukman et al. (2012) urge the aim of architectural pedagogy to introduce the students to "learning to learn". Critical thinking and creative thinking need to be introduced hand by hand, since the later enhances finding solutions via new formations and alterations, while the former allows for the evaluation of different new alternatives to reach solutions which are more comprehensive and optimized, (Lukman et al. 2012).

The critical approach was further advocated by Ciravo lu (2014) who highlights the need to question and to prove reasoning while allowing creative approaches in design pedagogy, (Bridges, 2006), (Crowther, 2013). Thus, in this process of blending creative and critical thinking, self-critique is an important instrument which allows the student to synthesize the values and draw backs and to reach the most reason rooted solution (Ciravo lu, 2014), (Coleman, 2010), stemming from answering the questions including declarative knowledge "what", procedural knowledge "how" and contextual knowledge "why, when and where", (Bridges, 2006).
In addition to the previous quests which need to be addressed in the studio, Crowther (2013) exposes how the studio can act as a "signature of design". Through the learning process, each studio has a signature reflecting the approaches of thinking to which the students are directed. This acts as a process of introducing branded lines of thought likewise the real life experiences of design practice.

The calls for re-addressing the design studio axes of empowerment return back to Schön's four learning constructs back in 1988, where he highlights the need to understand the difference between results and methods of inquiry, learning about phenomena vs the behaviour of phenomena, the role of prototypes, and finally kinds of skills, (Schön, 1988). Stemming from this those four constructs cannot be regarded in isolation, but rather blended in the comprehensive learning approach. While Salama and O'Reilly (1999) reflects on the transformation from the artistic paradigm to the socio-behavioural paradigm in pedagogy.

2.1. Storytelling and Narrative Strategies, Methodology and Tools in Architectural Design Studios

With regards to the new teaching methodologies which can promote better for the enhancement of skills acquired by architecture students, storytelling has been researched via scholars. Story telling is not only advocated as a practice which enables tutors to deliver the required knowledge in a more experience transfer based way, but also, when exchange of roles takes place between students and tutors, this methodology helps to place students in a real life mimicking experience. The aim here is to explore the strategies related to storytelling in design studio in order to develop a framework for analysis to be applied on the studio under investigation.

Heylighen et al. (2007), discussed an experience for an experimental course at California-Berkley, based on building stories. The research highlighted the discussion forming dialogue about the nature of knowledge in architecture, and the means of transforming knowledge into scenarios of architecture through storytelling. While Morton and O'Brien (2005) criticized the teaching pedagogies of design studios which only depend on visual illustrations without focus on oral presentation techniques. The impact of rhetoric structures and public speaking is considered one of the important methods of real life practices in the architectural practice, (Morton and O'Brien 2005). Additionally Nazidizaji et al. (2015) explained how narration and story- telling is one of the powerful pedagogical tools in academia, which helps in the clarification of different inter-related knowledge. This was also asserted by Fabula et al. (2017) regarding the introduction of narrative story telling in architecture design studios.

Narration allows for the inclusion of pluralism in arts and science, which crosses the boundaries of time and space. This nature of narrative story telling is very relevant to the architectural pedagogy and its inter-connected disciplines, (Thompson, 2019). The possibility of declaring a setting, characters or players, climax, genre, conflicts, experiences and incidents help students to visualize their aspirations while solving an architectural problem into a scenario which they work to materialize.

According to Khodeir (2015), Mehmet et al. (2020) this narrative story telling as a methodology in design studios encourages student's curiosity, because it creates individual identities relaying life stories. This also creates stories beyond representation to actual architecture. Augmenting the reality of how people will react in spaces, how the story is manifested in context, and how emotions are transformative in the experience evokes imaginative thinking while solving complex architectural problems, Hisarligil (2012). Stories cognitively work on multiple planes where listeners move in the simulated worlds envisioned, achieving multilevel learning experiences ranging from superficial to comprehensive understanding, Mehmet et al. (2020). This creates a world where students deliver their preferences, values, culture, purposes in a setting which can be easily altered and developed on through critical thinking.

As quoted by Fabula et al. (2017), "Architecture is embedded storytelling," since like stories and novels, architecture visualizes a world yet to come through the imagination of the architect. The creation of fiction is what marks architecture distinct apart from merely the action of building and material construction (Bernabei et al, 2011), (Havik and Sioli, 2021). Thus, "architects are storytellers not only when they make their own designs but also when they talk about their ideas with clients, builders, and other architects", Fabula et al. (2017). And this process is one which is worth training on from the early teaching process in design studios, (Thompson, 2019).

The five stages for the pedagogical methodology of storytelling are; story finding, storytelling, expanding, processing, and reconstruction, (Mehmet et al. 2020). Tzec et al. (2013), further expand on the pedagogical methodology to include: characters, setting actions, time pins, objects, emotions, intentions and values. While KhakZand et al. (2015), explain that the metaphor-based process consists of three main stages: idea, concept, and form. Accordingly Pasin (2017), argues that pedagogical methodologies transform multi-disciplinary knowledge on architecture and can be gained by means of intellectual, communication and social skills. Parsons (2009) explains that creating a narrative environment in architecture, could be defined as either a situated narrative, or a site-specific narrative. It should be designed from the start till the end, should be formulated to obtain a clear specific closure, a certain genre in terms of its meaning target.

2.2. Narrative Storytelling to Link Critical and Creative Thinking in Design Studios

The following figure, ***(Fig. 1)*** represents the methodological correlation of concepts related to adopting problem solving and self-critique from one side, and narrative story telling in design studios, which would be applied and merged as the methodological criteria in analysing the design studio under investigation.

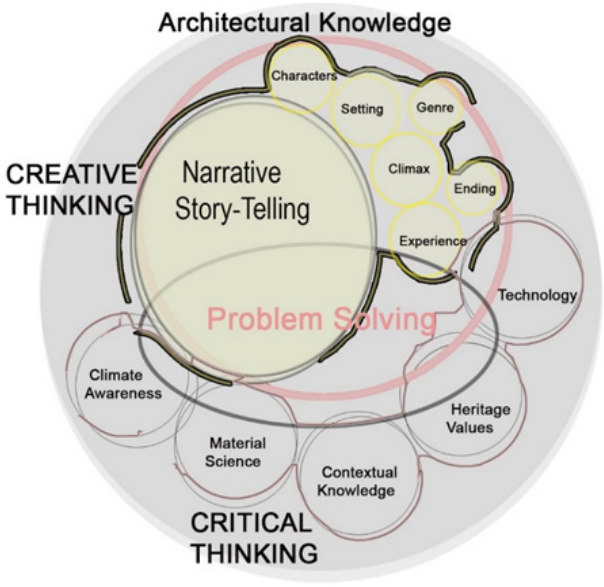


Figure 1. *Inter-relation of Storytelling Narrative Approach in Creative thinking to Create a Combination of Creative and Critical Thinking*
(Developed by Authors, 2023).

3. Materials and Methods: Graduation Design Studio at Cairo University- Three Cycles Review

The materials for analysis of the methodological pedagogy approach of narrative story telling in design studios are the outcomes of a three cycles design studio implemented in the Graduation Design Studio at Cairo University during the period of 2020-2022. The Graduation Design Studio studied here is one of many other offered to students in their final year. The students select the studio based on their preferences and their will to undertake a special approach. Thus, the students are already aware before joining this particular studio with the narrative story telling approach in design they shall experience. It is worth mentioning that the program where this studio is offered is internationally accredited by the Union of International Architects (UIA), and the 16 points related to the high quality education charter are taken into account during the problem definition of the project, and additionally introduced to the students in outline at the beginning of the year. Those aspects in the charter are also an important grading rubric in the final project internal and external jury evaluation.

3.1. Methodology

The methodology of analysis depends on qualitative critical approach, which highlights the degree of success or weakness in implementing the narrative in inter-disciplinary mode to reach an architectural outcome fulfilling the narrative story telling technique. This will be assessed based on the process of narrative development throughout the project since the formulation of the narrative up till the final phase of the project. Furthermore, the combination of creative thinking and critical thinking in problem solving to reach an architectural outcome will be critically assessed in the results. This shall guide the results of the paper in relation to the quality of higher education to provide methodologies to help future architects to think in a more comprehensive approach. Accordingly, this affects the quality of the built environment in the near future.

During the three cycles, the students are first introduced to the selected theme of the cycle, the variations of land-plots they are provided and the narrative design approach break-down. They are advised to undergo an individual storyboard development guided by research on the sites and the theoretical themes in order to develop their own tailoring of the design forces by means of narrative expression. The proposed outcomes of the narratives are discussed by each student, critiqued by the instructors and their peers to develop a complete cinematic scenario of who, where, how and why responses abiding to the general theme and fitting the chosen site.

This phase is the key point of considering a personalized project, since the individuality of the proposals and their uniqueness is highly manifested. Following this, comes the layer to form expression to fit and deal with the site, theme and translate the narrative into a materialistic form best expressing the narrative. This phase obtains a degree of subjectivity in whether or not the narrative is best expressed. However, this is solved through peer discussion and highlighting several keywords to narrow down endless potentials of form. Although in this approach pluralistic expressions are approved to give floor for imaginative explorations. The final phase is related to functionality implementation. This is the phase where the approved physical model is used to implement the programmatic needs, codes, spatial experiences, façade treatments and landscape elements. This phase is the most technical and tricky part since it challenges the students architectural capabilities in transforming their dreams into reality. And accordingly, this becomes a point of assessment of architectural problem solving as will be seen in the upcoming analysis.

3.2. Case Studies Overview

The three cycles under study in this paper adopted the themes of "Media Architecture: 2019-2020", "Reactionary Architecture of Reason: 2020-2021" and finally "Re-defining Typologies: 2021-2022". The common attribute in all three cycles were the selection of contextual sites options for the students to select from. In the first cycle, the site options were a land facing the Nile Front in Rod El-Farag and the location of the old Opera House demolished by fire at Downtown Cairo. While the sites selected for the second cycle were a location next to Ain Al-Seera Lake in Al-Fustat, a land plot overlooking the Ancient Walls of Cairo and a location overlooking the new Grand Egyptian Museum and the Pyramids. For the third cycle, a land plot next to the Madrasa of Sultan Hassan was selected, along with River Nile waterfront land plot and finally a location overlooking the walls of Salah El-Din's citadel in Cairo. Selected sites for the three cycles are shown in the figures below ***(Fig.2-8).***

Figure 2. *Cycle 1, Site 1, "Rod El-Farag Overlooking the Nile",* (Authors, 2020).

Figure 3. *Cycle 1, Site 2, "Downtown- Opera Square",* (Authors, 2020).

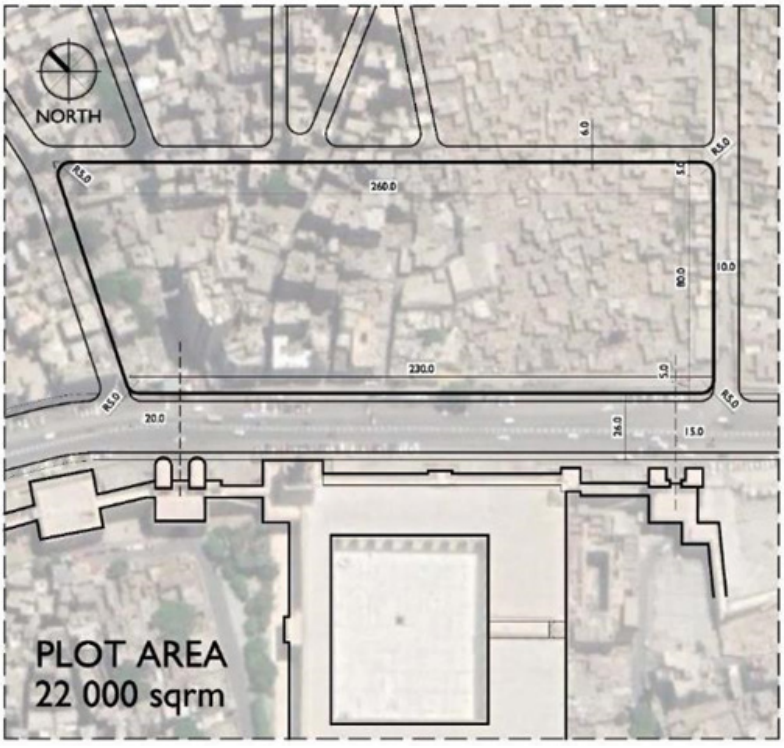


Figure 4. *Cycle 2, Site 1, Old Cairo- Overlooking Al-Hakim Mosque,* *(Authors, 2021)*

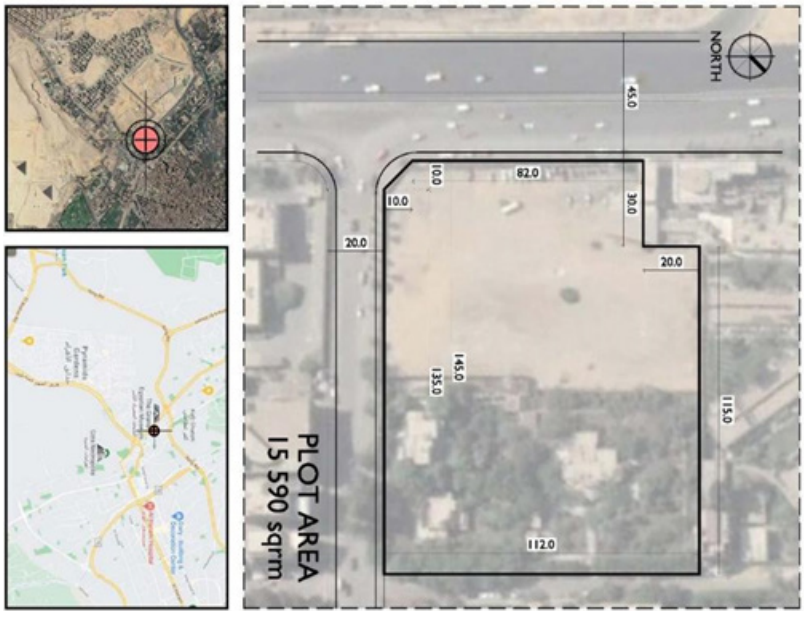


Figure 5. *Cycle 2, Site 2, Haram Street Overlooking the Great Pyramids,* *(Authors, 2021)*

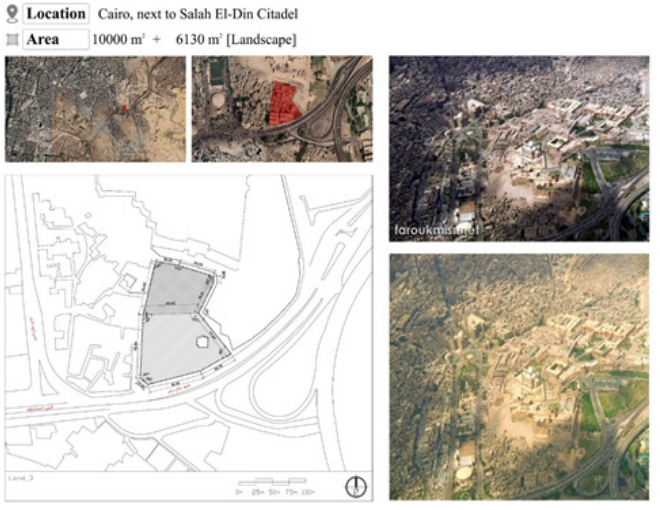


Figure 6. *Cycle 3, Site 1, Salah Salem Adjacent to the Citadel Walls, (Authors, 2022)*

Figure 7. *Cycle 3, Site 2, Mourad Street-Giza, (Authors, 2022)*

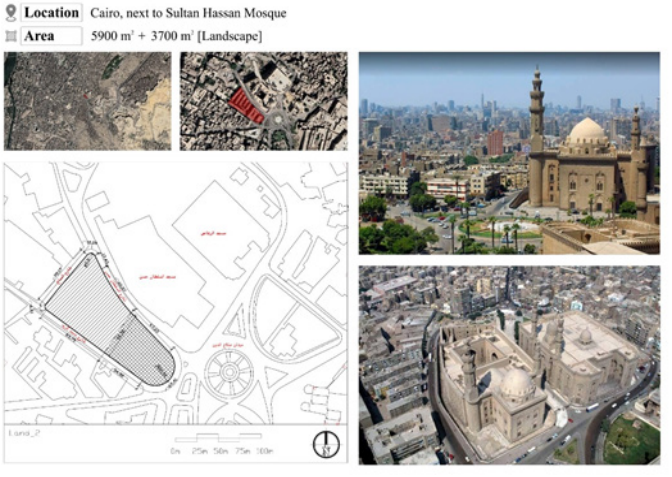


Figure 8. *Cycle 3, Site 3, Remela Square Adjacent to Sultan Hassan Mosque, (Authors, 2022)*

The initial phase of each cycle was to introduce the dilemma of the theme to the students, based on theoretical approaches adequate to each year's theme. The students are then given some time to investigate three main aspects, the location they would choose from the options provided, contextual challenges of the site and the theoretical approach they would adopt for the program and the components of the project. This phase is one of the most challenging, since the student creates a scenario for the players, the different spaces where those players would interact, how the spaces in mind would interact, compliment or contrast with the context and why.

This research phase concludes with a report which narratively acts as the book the students develop to help assess how their imaginative thinking would respond to the theme, the context and their own narrative scenario. A contextual physical model is in parallel built by each group of students selecting the same location, which helps the students to build and place their narrative imaginative thoughts in 3-dimensional form and experiment how their addition would affect and get affected by the surrounding.

3.3. Narrative Approach in Engaging Creative Thinking in the Design Studio

The following phase of developing their narrative research into architectural form relies on summarizing the outcomes of the research into a single concept statement. This statement is presented by each student and long discussions in regards to how this statement is expressive enough to be translated into architecture are undertaken in the studio. The concept statement aim is to reflect a spatial experience which fulfils the aspirations of the student's narrative scenario and reflect a form which would leave a narrative footprint in context. The keywords or conceptual words are briefed from the concept statements and several iterations of form are attempted by the student to reach an experiential expression which reflects their narrative scenarios. During the iterations, the assessment of whether the scaled down 3-dimensioanl expression is mature enough or not to proceed in architectural problem solving is created based on the contextual model adequacy, some architectural tips provided by the tutors on basic functional requirements and the extent to which the concluded form best describes the keywords. In the last point assessment, peer critique during the studio is encouraged to make sure a variety of opinions are corresponding.

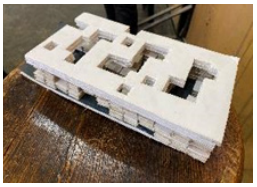
The following tables ***(Table 1-3)*** showcase the methodology adopted in linking narrative story telling throughout the three cycles under study to build a consistent pedagogical approach which helps students translate their ideas and conceptions through creative thinking into a problem solving tool.

3.3.1. First Cycle Analysis: Media Architecture

The challenge in this cycle was to reflect the pluralistic approaches introduced via the sites and also from the theme of "Media Architecture". The first site of the old Opera House plot in Cairo which was demolished as a consequence of fire, and later the land plot was used to build an enormous parking building, had several layers of pluralistic approaches to consider. The sample of 10 students shown below in ***(Table 1)***, reflect how the imaginative, pluralistic story telling narrative beheld several layers of different responses. With the presence of the informal marketplace at one end of the plot and the statue of Ismail Pacha at other end, the students created differing approaches to foresee the future between the elegant past and the chaotic presence. The second land plot overlooked the Nile and also a newly constructed cables bridge which drifted attention to the old importance of Rod El-Farag in Cairo's economic and trade activities. The narratives of the students encompassed the will to create a global statement while encouraging locals to keep their traditional economic capitals. Between those two tensions, the narratives also included layers of foreseeing the future through the lens of the present assets.

Table 1. Initial Experiential Models Emerging from Narrative Scenarios Vs. Typologies and Final Outcomes in 1st Cycle, Authors, 2023

Initial Keywords	**Primary Play-dough Model**	**Typology/ Program**	**Final Architecture Outcome**
Case 01: -Fluid -Harmony -Reach out		Contemporary Music Centre	
Case 02: -Random Intersections -Re-organizing -Gradual -Link		***"Onward"*** Business Centre	
Case 03: -In between Spaces -Piercing -Artery		***"The Spear"*** Contemporary Art Centre	
Case 04: -Breaking Barriers -Re-direct -Merge		***"The Compass",*** Business Incubator	
Case 05: -Chaos to order -Fractal - Temporary vs. permanent		Local Market and Exhibition Centre	

Initial Keywords	**Primary Play-dough Model**	**Typology/ Program**	**Final Architecture Outcome**
Case 06: -Platform -Intersects -Breaking Barriers -Rise-up		***"Jodran/ Walls"*** Complex Community Centre	
Case 07: -Versatile - Dynamic -Bridging -Exchange		***"Hashtag"*** From pixel to whole, Media Stat-up centre.	
Case 08: -Struggle -Rise -Overpass barriers -Networking		Start-Up and Marketing Centre	
Case 09: -Polarities -Penetrate -Stream -Bonded-Dimensions		***"Exhibiting the World of Opposites"***	
Case 10: -Rise -Dominant -Memory -Re-introduce		***"Business Park"*** and Ideas Harbour	

The following table (2) provides a qualitative assessment of the process of storytelling narrative formulation for the ten previously presented cases in cycle one. The five stages are evaluated according to the layers of narrative development with the students in the initial phase of conceptualization. Additionally, based on the development of the narrative into a 3-dimensional experiential model elaborating the story. And lastly, according to the reconstruction of the narrative into an architectural product and interior spatial experience. The weights reflect a scale out of 4; where 4 is the best achievement of the phase and 1 is the minimal achievement of the phase. The qualitative value is used as an indicator for success to further elaborate on this analysis in the results and discussion.

Table 2. Relative Weights for the Narrative Story telling Phase in Conceptualizing the Narrative into an Architectural Outcome, Authors, 2023

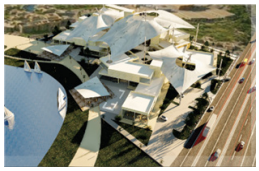
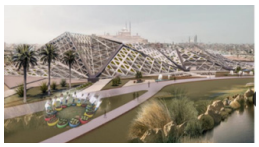
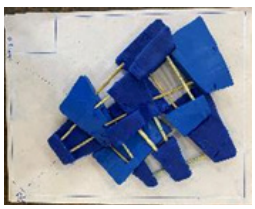
	Story Finding (4)	Storytelling (4)	Expanding (4)	Processing (4)	Reconstruction (4)
Case 01	4	4	3	3	3
Case 02	4	4	4	4	4
Case 03	4	3	2	2	3
Case 04	3	3	4	3	4
Case 05	4	4	3	2	3
Case 06	4	4	3	2	2
Case 07	3	3	4	4	4
Case 08	4	4	3	3	2
Case 09	4	4	2	2	2
Case 10	2	2	2	2	2

3.3.2. Second Cycle Analysis: Reactionary Architecture of Reason

In the second cycle, for which the work sample of ten students selected are shown in ***(Table 3)*** below, the challenge was to peruse a narrative scenario reflecting the theme "Reactionary Architecture of Reason", and to respond proactively to the valuable contexts of the natural lake, the Fatimid Walls and the Great Pyramid of Giza . The theme implied beholding a responsive responsibility of reaction to current needs, challenges, especially related to SDGs. Accordingly, the cycle as will be displayed held various reactions, whether to re-defining our role towards history, towards the environment or towards the current socio-cultural challenges. Under the umbrella of pluralistic conditions of the current post-modern communities, the students were encouraged to address tangible as well as intangible heritage aspects, to create narrative scenarios which react towards the well-being of the communities their projects are located.

As shown in ***(Table 3)***, the range of creative solutions for contextual and programmatic reactions ranged to cover ecological, social, communal, economic and spiritual spectrums. This informed the richness of stories presented in this cycle as a way to express a reactionary scenario for the architectural addition in the rich contexts. This is clear in the ideas, narratives and the storytelling break down in ***(Table 4)***.

Table 3. Initial Experiential Models Emerging from Narrative Scenarios Vs. Typologies and Final Outcomes in 2nd Cycle, Authors, 2023

Initial Keywords	**Primary Play-dough Model**	**Typology/ Program**	**Final Architecture Outcome**
Case 01: -From part to whole -Roots -Tank		The Up-riser Cultural Heritage Centre	
Case 02: -Responsive -Resilient -Elastic -Message driven		Ecological Centre	
Case 03: -Interlocking -Linking -Reaching out		***Ethar"*** Community Bank and NGOs	
Case 04: -Journey -Raises -Bridge -Storytelling		Folklore Cultural Centre	
Case 05: -Reunite -Connect -Overlap -Bonded divisions		***"Amenta"*** Museum of Myths	

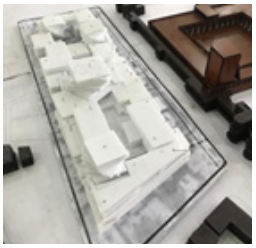
Initial Keywords	Primary Play-dough Model	Typology/ Program	Final Architecture Outcome
Case 06: -Multi-layered -Incubator -Metamorphosis -Expose		***"Madar"*** Traditional Crafts Centre	
Case 07: -Echoes -Unveil -Intangible Facets -Gap		Ancestors Folklore Centre	
Case 08: -Layering -Interaction -Diversity -Connection		***"Osoul"*** Edutainment Interactive Hub	
Case 09: -Journey -Multi-faceted -Connecting -Revealing		The Ostraca Land of Arts	
Case 10: -Various -Pixels -Link -Glocal		***"Pixel"*** Craft Centre	

Table 4. Relative Weights for the Narrative Story telling Phase in Conceptualizing the Narrative into an Architectural Outcome in the 2nd Cycle, Authors, 2023

	Story Finding (4)	Storytelling (4)	Expanding (4)	Processing (4)	Reconstruction (4)
Case 01	3	3	3	2	3
Case 02	4	3	3	2	2
Case 03	4	4	4	4	4
Case 04	4	4	3	2	2
Case 05	4	4	4	4	4
Case 06	4	3	2	2	3
Case 07	4	4	4	3	2
Case 08	4	4	3	3	2
Case 09	4	4	4	4	4
Case 10	3	3	2	2	3

3.3.3. Third Cycle Analysis: Re-defining Typologies

The third and last cycle studied in this paper embraced the theme of "Redefining Typologies". This call was a reflection of how current typologies can respond to the aftermath of pandemics and unstable conditions in communities. The three selected sites were the land plot adjacent to Madrasa of Sultan Hassan in the heart of historic Cairo, a plot adjacent to the Citadel Walls and plot in Giza overlooking the Nile and Giza Zoo from the other side. The students were encouraged to re-think how to add typologies which complement to the existing typologies of the context which would fit with the current users (players) and the context challenges. Additionally, the new typology derived from the context should consider the energizing of the current state of the community and come up with programmatic impacts to help the community experience well-being and to be self-sustained projects with positive environmental, social and economic implications.

The outcomes of the cycle manifested in the scaled down contextual models are shown in the table below ***(Table 5)***. The aim in this cycle is to present the outcome in relation to the contextual challenge and to highlight the newly derived typology as a result of the narrative analysis expressed by each student. Additionally, the keywords used by the students to express narratively their aspirations in their new typologies are listed to showcase their levels of personal reaction post the research outcomes and how this reaction was capitalized upon in the narrative to reach a comprehensive architectural project. As in the previous cases, the breakdown of the narrative scenario development for each case is shown in ***(Table 6).***

Table 5. Final Outcomes of 3rd Cycle Represented as Contextual Models and the Typology of Each Case with the Relevant Narrative Keywords, Authors, 2023.

 **Case 01:** Research Centre | Re-direct, Layering, Connection	 **Case 02:** Creative Art Boost Centre | Divergence, Interaction, Convergence	 **Case 03:** Sociological Research Centre | Roots, Re-orient, Connect	 **Case 04:** Skill Development Centre for Women | Uplift, Empower, Direct
 **Case 05:** Educational Hub | Multiple Axes, Reunite, Elevate, Open up	 **Case 06:** Community Walls | Urban Research Centre, Separators Vs. Connectors	 **Case 07:** Visual Documentation Centre | Twist, Stack, Reorient	 **Case 08:** Incupedia | Hybrid, Interaction, Bridging
 **Case 09:** Wearable Architecture | Interweaving, Raise, Connection	 **Case 10:** Urban Street | Connectivity, Openness, Dynamics	 **Case 11:** Re-thinking Workspace | Embedding, Motion	 **Case 12:** Creative Participatory Hub | Various, Dynamics, Layering
 **Case 13:** Training School for Arts and Architecture | Raising Awareness, Bridging the gap, layering	 **Case 14:** Collaborative Hub | Juxtaposition, Emergence	 **Case 15:** Iwan - Ideas Market | Breaking, Connecting, Layers	 **Case 16:** Cultural Heritage Preservation Centre | Uncover, Roots, Raise
 **Case 17:** Community Art and Technology Centre | Multiplicity, Chaos, Blend, Organized	 **Case 18:** Experimental Crafts Centre | Integrate, Reveal, Reach out	 **Case 19:** Recalling Festivals | Emergence Redirect, Unite	 **Case 20:** Productive Community Home | Reveal, Compact Containment, Linking

Table 6. Relative Weights for the Narrative Story telling Phase in Conceptualizing the Narrative into an Architectural Outcome in the 3rd Cycle, Authors, 2023

	Story Finding (4)	Storytelling (4)	Expanding (4)	Processing (4)	Reconstruction (4)
Case 01	3	3	2	2	3
Case 02	4	4	3	4	4
Case 03	4	4	3	3	3
Case 04	4	4	4	3	4
Case 05	4	4	4	4	4
Case 06	4	4	4	4	4
Case 07	4	4	4	4	4
Case 08	4	4	3	3	4
Case 09	4	4	3	3	4
Case 10	3	3	3	3	3
Case 11	3	2	2	2	2
Case 12	3	3	4	4	4
Case 13	2	2	3	3	3
Case 14	4	4	4	4	4
Case 15	4	4	4	4	4
Case 16	4	4	4	4	4
Case 17	4	4	3	3	4
Case 18	4	3	3	3	3
Case 19	3	3	3	3	3
Case 20	4	4	2	4	4

4. Results: Framework of Narrative Storytelling in Architectural Design Studio as a Methodology to Intertwine Various Disciplines

The results extracted from the above study illustrate the correlation assessed qualitatively based on the authors experience while dealing with the process of narrative story telling in the analysed cycles. The relative weights of the breakdown of the categories of storytelling, on the selected cases as well as the below correlation between elements of creative vs. critical thinking, are not aimed to represent a quantitative finding. The graphical illustrations demonstrate how the problem design and the students responses coordinate with the process of using narrative story telling in design studios to elaborate the critical and creative thinking of students. The results presented in ***figures (2, 3, 4)*** demonstrate how the problem definition, design and structure enable the students to embrace the technique of narrative storytelling, in a relatively successful method, although, personal variations are tracked.

While ***table 7***, links the before extracted method of assessing creative/ critical thinking as means of problem solving in architectural studios across the three cycles. The relative weights are given based on the collective experience, the feedback from students and the process evaluation during the three cycle's studies.

The results in ***figure (5)*** demonstrate the levels of engagement with the different points, depending on the nature of the cycle and its key motivator related to the theme selected. Thus, those results will enable a better discussion of the process in the next section.

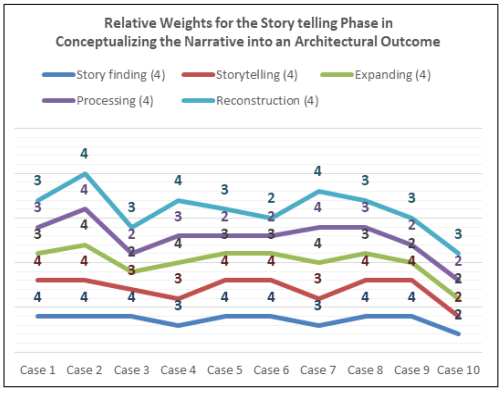


Figure 9. *Graphical Representation of the outcomes of the 1st cycle in relevance to narrative storytelling, Authors, 2023.*

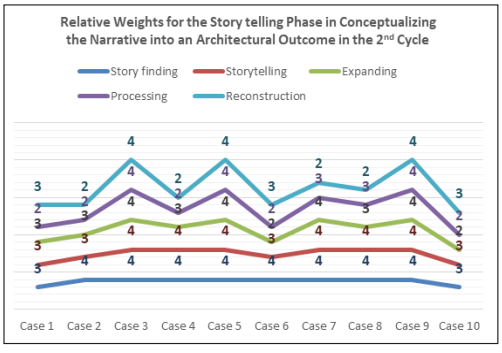


Figure 10. *Graphical Representation of the outcomes of the 2nd cycle in relevance to narrative storytelling, Authors, 2023.*

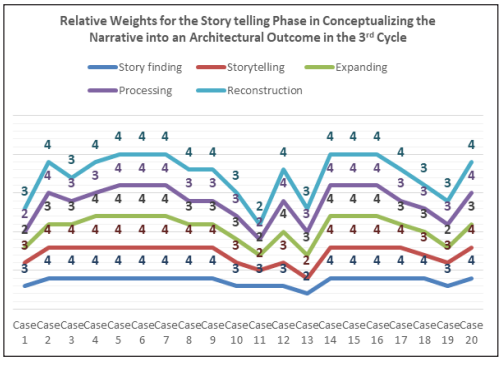
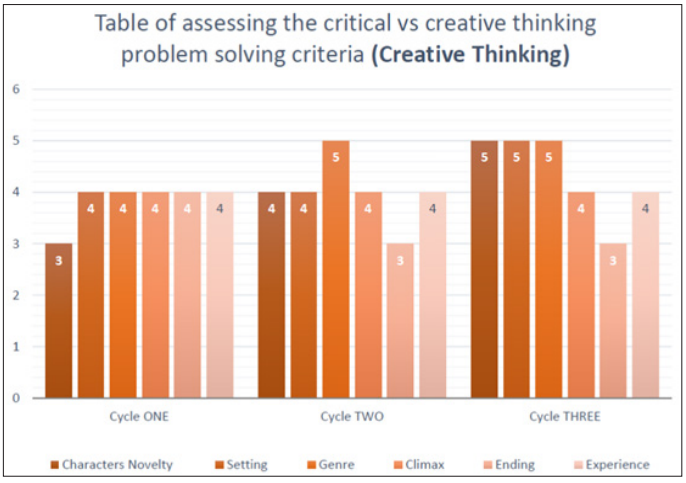


Figure 11. *Graphical Representation of the outcomes of the 3rd cycle in relevance to narrative storytelling, Authors, 2023.*

Table 7. Relative weights assessing the critical vs. creative thinking problem solving criteria in the 3 Cycles, Authors, 2023

Cycle Number	Critical Thinking					Creative Thinking					
	Contextual Knowledge (5)	Heritage Values (5)	Material Science (5)	Climate Awareness (5)	Technology (5)	Characters Novelty (5)	Setting (5)	Genre (5)	Climax (5)	Ending (5)	Experience (5)
Cycle One	**3**	**3**	**4**	**3**	**3**	**3**	**4**	**4**	**4**	**4**	**4**
Cycle Two	**4**	**5**	**3**	**3**	**3**	**4**	**4**	**5**	**4**	**3**	**4**
Cycle Three	**5**	**5**	**3**	**3**	**3**	**5**	**5**	**5**	**4**	**3**	**4**



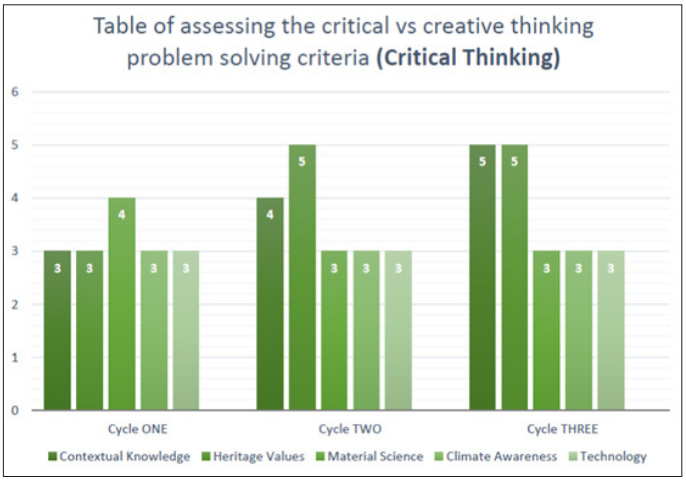


Figure 12. *Breakdown Representation of the 3 cycles according to creative and critical attributes,* *Authors, 2023.*

5. Discussion

As show in the graphical representations from the previous section, there are two main findings that can be concluded from the studio experience analysis. First is the importance of creating a strategic sequential assessment scenario to guide the design studio through. In the analysed cases, the scenario was related to the narrative created by the student and the assessment was the success in breaking down this narrative to adhere to the construction of the experience on the interior and exterior levels. This clear methodological approach helped the students in focusing on small goals at each step in their design process. This is the reason all students succeeded in fulfilling the required outcomes in a manner which reflected excellence, in spite of the individualistic variations stemming from their varying capabilities.

The second finding is related to the success of applying critical vs. creative thinking throughout the process of elaborating the concept statement into an architectural project. The aim of this assessment is to highlight the points of strength and weakness of the adopted approach. Based on the results, it can be observed that contextual and heritage values were highly achieved throughout the three cycles, while less emphasis was subjected to material science, climate awareness and technology. This can be a result of the nature of the studio which starts with the narrative based on the contextual studies. Accordingly, the creative mandates over-rules the critical thinking attributes. This can be used to better enhance the weights of disciplines required to be delivered to students in other studio based projects.

6. Conclusions

The research aimed to highlight a methodological approach adopted to expand the developmental process of students in creating structured storytelling designs in their final graduation studio. Due to the limitation of the research, it was not possible to expose the methodology as applied to all 60 students in the three cycles under study in depth. Thus, the methodology of narrative story telling will be comprehensively analysed on a sample of ten students from the first two cycles, and 20 students from the third cycle. Prospects for future research can be expanded to include all participating students in this studio to be critically analysed and assessed based on the previous discussion. Additionally, conventional studios can be compared to the methodology of narrative story-telling conversion evaluated in this paper. Also, the research can be expanded to include a criteria for technical assessment of the projects outcomes and how the functional, structural and environmental layers contribute in the enrichment and full materialization of the narrative.

The adopted methodology is only one approach among other successful ones, however, being adopted for several years enabled documentation of the process in a thorough method, and thus possible deep analysis could be undertaken. The benefits of this approach are the step by step approach, taking the student into a journey of self-exploration and potential exploration to the theme, the site and the needs to be fulfilled. Then, gradually, transforming the students aspirations merely expressed via a short narrative into a complete scenario. Following that, the engineering and architecturally knowledge of the students are implemented objectively to correspond with the scenario fulfilment.

This gradual movement between disciplines to reach a targeted project and specific vision is best applied on public buildings whose typologies are flexible enough to embrace the approach. This might not be applicable in functional or utility oriented typologies. Although this exercise expands the students imaginative capacities to create full scenarios for their designs.

It is worth mentioning here the enhancements tracked during the analysis and results overview to the pedagogical methodology. The process and outcomes reflect the success of the process to a good extent, yet, some cycles bounced between the stress on context vs. players vs. material science, etc. This cannot be regarded without highlighting the stable fulfilment of the scenario by most students. The other deficiencies relate to the complicated process and the personal variations among students abilities. It is highly recommended thus to apply a smaller experience of narrative story telling approaches throughout the four years of the architecture program, which would enable the students to coordinate the required aspects in a better effective manner in their final design studio.

Additionally, it is recommended to introduce different imaginative thinking strands along the architectural program. This will help students in a methodological approach to fragment the necessary steps fulfilling their visions for a novel contribution in architectural outcomes. Having mentioned so, it is of great importance to embed in the students that their role as architects exceed merely injecting the built environment with additional purposeless additions, but rather to aim to create a comprehensive narrative for the users to experience, and accordingly to change their cognitive awareness of architectural spaces.

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Conflict of Interests

The authors declare no conflict of interest.

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Architectural Space: Where Do We Start? A Way of Thinking the First Approach of an Architectural Design Studio

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CHAPTER IV

The teaching of Architecture, as any other teachings, requires a perception of the present. Today's Architecture student has unlimited access to images and information up-to-the-minute from (almost) the entire world.

When we ask students -who sit for the first time in a Project Studio classroom- to start their first work, it is almost always necessary to start by "dismantling" the "preconceptions" of architecture that they have and teach them how to create "architectural space" that can be identified by itself (for its characteristics and sensations) and not by its materiality or function.

This process can start in different ways. The important aspect is that at the end of the first year of Architectural studies, students will be able to tease "emotions" in those who move through the Architectural space, thus managing the start of their journey to contribute to a more humanized territory.

This study presents an individual approach to the process of teaching Architecture and how this process could interfere and contribute to create an Architectural Mentality in students, and at the same time, contribute to the way they could be able to design the spaces based on the perception of the space.

Introduction

Architectural Space: Where Do We Start?
A Way of Thinking the First Approach of an Architectural Design Studio

1. A beginning for the creation of the Architectural Space – the construction of an Architectural Mentality and a Design Process

On the first day of the Architectural Design Studio I, I tell the students that there are at least three and a half fundamental rules for them to think as architects. At the same time, for them to be able to build their identify with an Architectural Mentality and develop an individually Design Process – two structural elements are required for them to become Architects; also, differentiate themselves in the way they understand the territory, the emptiness and the built spaces – knowing that architecture lives as much from the space that we built as well as from the ones that we leave empty (which allow us to relate to the built space!).

The first rule that the students must know is to learn to OBSERVE. Knowing how to observe and through observation, one builds a critical approach - understanding and knowing beyond what they are seeing

The second rule associates with the meaning of FEEL. Knowing how to feel and reflect on what they feel when they walk on the streets, or when they emerge in to the spaces – the sensations that the architectural space provoke in their minds and body are often what allow them to remember it and with that, build our "individual library" of meaningful images, that help them to create an identity (as well as persons as architects).

The third rule is, to CREATE. Create, starting from the critical reflection about what they build along their journey, their existence, and their reflections – a consequence of what they observe and what they feel.

The half-rule is to COMMUNICATE! It is essential to know how to communicate about what they create, their ideas, concepts and/or purposes - through the drawing, the design, the writing, the speaking or through the conjugation of all this fundamental communications channels!

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Keywords: Architectural Studies; Architectural Space; Project Studio; Education; Architecture

In addition to these three and a half (simple) rules, there are other characteristics that are also (very) important! The CURIOSITY is fundamental! The curiosity walking through the streets, to enter a building, to travel, to draw (endlessly) what they observe and feel, such as, for example, the way that the light works on the walls. As Campo Baeza mentioned: light is the first material in architecture! - An architecture student cannot just look at the screen of a computer, he needs to see the world with his own eyes, go there, and draw it! The place is the first element of a project, of a building and with that, it is the support of our work.
Then, it's essential to add to the CURIOSITY the capacity to live, to think about what surrounds them, to ask when they don't understand, to know how to work in a team and be responsible for their decisions. Knowing that the processes are based on History, Theory and the Systems (architectural and constructive). The most of the tools become acquired throughout the life and throughout the professional practices – with constant changes and evolution of systems that involve the entire architectural process. Lifelong training is fundamental, as it allow us to create new perspectives and new knowledge.

2. From stretch to creation?

The construction of an idea of space - in a student's first contact with the blank paper - involves, most of the time, the transcription of the entire process of living with the world that surrounds them. The teacher's primary job is to deconstruct ideas and teach the students that architecture is built from the sensations that the space transmits and simultaneously, respond to a function.

The value of tutorial teaching in architecture allows students to be given the ability to reinforce their ideas and to be able to interpret their proposals, based on a methodology of (personal) reflections between the Professor and the Student. This process is an authors work, where each Professor put his knowledge and concerns of a lifetime (CONCEIÇÃO, L. 2018).

With this, in the first contact with learning process in architecture, students should be encouraged to understand, interpret and justify their ideas and concepts, that is, their proposals for the architectural space that they idealize and that they materialize through the project design, whether through drawing (sketch or/and technical) or by exploring space through three-dimensional study models built by their hands.

In order to base the general concepts of architecture, students should start building their Architectural Mentality and their Design Process, through the creation of simple architectural objects, where it is important to determinate and understand the value of the structural pathway, the sense of temporality, the organization of the spaces; the light, the textures. All of these occurring simultaneously, develops sensoriality. During their training, students are invited to think about the space based on their "individual library" of sensations, the one that they have been building over time through their observation and their feelings/perceptions? processes!

The emphasis on these sensations and their maturation through the experimentation in design – based on History, Theory and the Systems (Architectural and Constructive), should develop in students the capacity to design and at the same time, to investigate through design with the aim of promoting a progressive approximation to reality. To this process, the students will always have to add the practice of Drawing and Geometry, for a correct exploration of the ideas that they want to materialize in an architectural project.

> *"New organics are taught radically, integrating the various subjects in a structure built by a central nucleus – project, encompassing aspects of composition, construction, and urbanism. History was understood as a positive retreat to the past in the sense of a positive appropriation. Drawing emerges as a sensitive means of perception, as an instrument of critical analysis and, at the same time, of synthesis that broadens the intelligibility of things."*
> *(Alves Costa, 2019)*

Concepts such as scale, function, form, construction, structure and typology are inherent in the design thinking process; even when the students don't realize it. In the first moment of approaching to architectural studies - when students start the first works in Project Studio class - the introduction of concepts like Place and/or Territory, should be taken out of the process to avoid that the students resort their idealization (of a life time) of "house" or "building", which leads to a limitation of the creative act and consequently, of their capacity to concept without rules and limitations. Knowing thus, the importance of the place in architecture!

3. Where to start?

If we manage to identify that the first year of studies in architecture should provide students with general knowledge of architecture and construction, exploring concepts such as form, function and construction (building and structural systems), in an approach to the Design Process and to the beginning of developing an Architectural Mentality, we would have to ask ourselves where to start?

The truth is that probably, in this thematic, there isn't a single (or a simple) answer! Teaching is an "author's work" (Conceição, L.)! Each Teacher structures and defines its own programme of approach.
In Europe. The training in architecture is partially structured by the European Directive that establishes eleven points for the student training:

• Ability to design architectural projects that satisfy the aesthetic and the technical requirements.
• Adequate knowledge of the History and Theories of Architecture, as well as related Arts, Technologies and Human Sciences.
• Knowledge of the Fine Arts and their contribute to the quality of Architectural Design.
• Adequate knowledge of urban planning, planning and skills related to the planning process.
• Ability to understand the relations between the man on the one hand, and the buildings and on the other; between the buildings and their environment, as well as the need to relate buildings and spaces to each other according to needs and the human scale.
• Understanding of the profession of architect and its role in society, namely, through the elaboration of projects that take into account social factors.
• Knowledge of research methods and preparation of project specifications.
• Knowledge of structural design, construction and civil engineering problems related to building design.
• Adequate knowledge of physical problems and technologies, as well as the function of buildings, in order to provide them with all elements of interior comfort and climate protection.
• Technical capacity that allows it to conceive constructions that satisfy the requirements of users, within the limits imposed by the cost factor and by the regulations in terms of construction.
• Adequate knowledge of industries, organisations, regulations and procedures involved in carrying out projects under construction and integrating plans into general planning.

(http://www.dges.pt – 2023.04.16)

It is based on these principles that, in Europe, the architecture schools define their programmes.

When we cross the different plans of studies of the main European schools of architecture we find, generally, the concern of introducing domains such as: the approach to the problematic of architecture; knowledge of the basic instruments of design (technical drawing and sketch); and the initiation to a methodology of spatial composition. Where for their perception and maturation, students are faced with carrying out exercises where the formalization of Space is explored from different perspectives to create their own identity with concepts like mass, empty, interior, exterior, rhythm, light, shadow, balance, unity, dimension, scale, spatial composition, time, symbolism and, naturally, function.

4. Author's work

In this process, the Discipline of Architecture is a synthesis that involve different knowledges and practices. The centre where main different areas of studies intersect themselves and contribute to the develop of the Architectural Mentality and the Design Process.

> *"The teaching and learning of the Architecture Project, contrary to what the designation of the Discipline would suggest, is not a practical application (the project) of a previous theory (the architecture)"*
> *(Providência, P., Canto Moniz, G., 2013)*

It is, therefore, in its quality of "author's work" that the teaching of architectural design studio merges the knowledge of the teacher with the Knowledge of the students, which (naturally) being at different stages, leads to a perfectly individual response to the same challenge.

In this search for definition and introduction to the concepts of architectural space, as a first exercise at architectural design studio, in our school , we invite the students to develop an object with specific characteristics. It must have a hand scale without any specific shape or image that identifies it with any existing object, and done in plasticine with white colour. This exercise has five different steps and the students are only aware of the next step after had completed the previous one (so that the knowledge of the next step doesn't conditionate the work they have to do before).

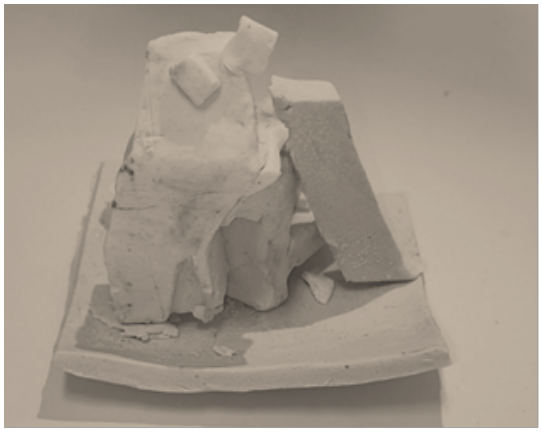
Step 1:
Construct a hand scale object, in white plasticine, starting from the combination of simple geometric solids (cube, pyramid, sphere, ...).

Step 2:
Draw the object from different angles and perspectives, freehand, without using colour, on different supports and with different materials (graphite, pen, Indian ink, pastel, etc.)

Step 3:
Draw the object rigorously (Technical Drawing) using and "finding" its Geometry.

Step 4:
Give a scale to the object and transform it into an Architectural Space, without function or place (it isn't a house, a shopping, a museum, ..., just a space where people can enter a feel for the place). Built this space through a pathway, which generates spaces, border lines, interior and exterior space, built and empty space, light and shadow space, (...).
Explore this space(s) through the design and construction of three-dimensional models (handmade scale models, using simple reused materials).

Step 5:
Represent this Architectural Space through its representation in Technical Drawing and three-dimensional model. Present (communicate) these spaces and the obtained sensations when we go thought its pathways.
More than a result or an answer, this exercise seeks the students to develop the ability to abstract and create a concept that is based on pure space, built to create sensations for those who walk through it and simultaneously, teach students that architecture is about promote sensations to those who walk through the buildings and through the emptiness that they leave in the territory where they are located. It is a good method to start thinking as an Architect!



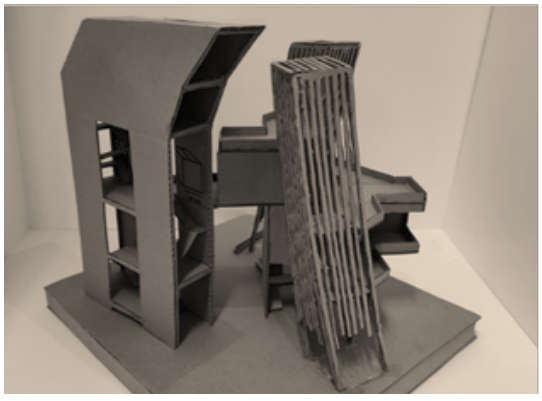



Image 1 to 4. *ISMAT Student Work,*
Joana Paul.



Image 5 to 7. *ISMAT Student Work,*
Iris Nicolau
Project Studio I, 2022-2023

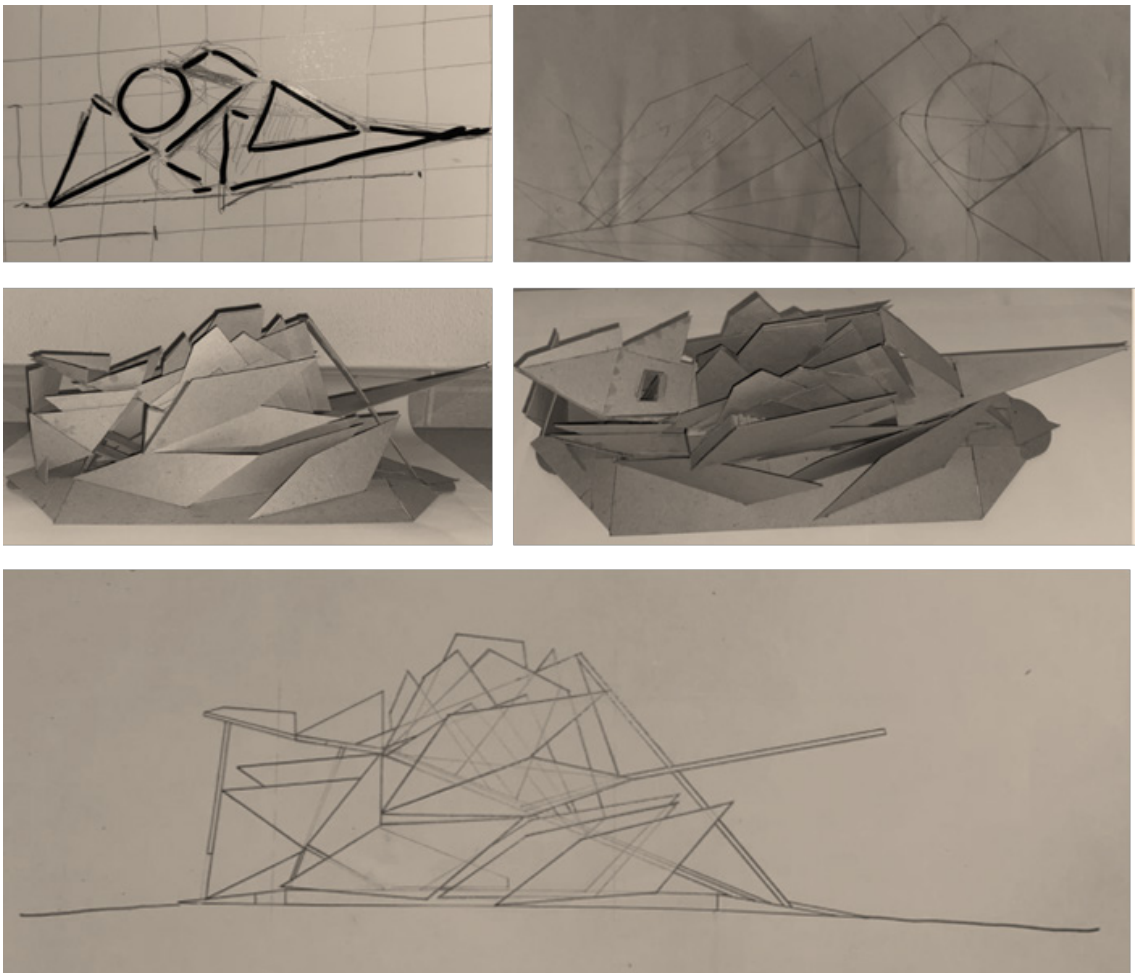


Image 8 to 12. *ISMAT Student Work,*
Diana Filipe
Project Studio I, 2022-2023

The reiteration of these exercises over the years, with small variations, has allowed us to establish a standard of development of a teaching process, in what is one of the most critical moments of teaching/learning architecture - the first moment - and how it is possible to "override" the previous-concepts that students carry with them, that is, the pre-concept of "designing" a house, a building...instead of creating space and the sensations that it should contain and transmit to its users.

Students most know that architecture is a practice that transcends the design of houses or buildings! It includes a process of thinking and feeling that must be based on history, theory and the systems (construction and structural) that relate people to their environment - the territory, the landscape, the ecological challenges and at the same time, with economic, social and cultural concerns. With the development of this exercise, we want that students understand that architecture have an impact in the territory and that every "wall" have an impact and responsibility. Architecture is never an individual matter and architectural education must be a collaborative project. It is important to verify that with this work students start to acquire a "vocabulary" of concepts that they can apply in the future, when they start to develop design projects based on reality (with a programme, a place, and a function. All they are not allowed to deal in its first approach!

Conclusion

As in any other profession, the architect must be ethical, creative, responsible, optimistic, collaborative. He should also have a strong social, environmental, political, and economic conscience, so that he is able to value the human existence, the ecosystems and the landscape (territory), as each action is equivalent to a responsibility!

We all make mistakes! Students are allowed to make mistakes too! The school is the best place to make mistakes, as it is the big "laboratory" where we can try everything, even what cannot be built, used or reused. Learning is nothing more than the process of making mistakes and to learn from and within those mistakes!

For a project, there are no "solutions", there are "answers" and even these are never unique! It is important to think about how to construct these answers. It is necessary to test. It is throughout this that the students start building their Design Process, their Methodology and their Architectural Mentality, but they (we) always must reinvent themselves (ourselves). The first solution is just the first one!

It is important to retain that the architectural work - as an author's work - has always and artistic and an individual component that are difficult to evaluate. So, it is important that each teacher defines his own process and consequently questions that process. The teachers and the students make the schools and stablish the method of approach to develop an Architectural Mentality in them self's and in the society.

The schools must enable its students to a direct contact with the practice of the profession, to ensure the realization of exploratory exercises that can simulate the reality, where History and Theory merge with practice. No School teaches everything! But each school should provide the tools to increase the student's curiosity. It is up to the students what they will do with their curiosity.

Note:

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The Impact of the Use of Computer-Assisted Drawing Tools on the Productivity of Architectural Design Process

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CHAPTER V

This empirical study delves into the architectural design process, focusing on the influence of computer-aided drawing tools (CAD tools) during the initial design stages. The primary objective is to assess quantitatively how the adoption of CAD tools affects design productivity. The research employs the protocol analysis method, conducted in two distinct phases. In the first, third-year architecture students were tasked with two design assignments. The first assignment required traditional freehand sketches, while the second involved CAD tools. The Concurrent verbalization technique was employed to capture design actions and thoughts.

In the subsequent phase, the research involved a detailed description and comparison of the two sets of design protocols. The analysis yielded intriguing findings. Contrary to conventional assumptions, our study reveals that the utilization of CAD tools during early design phases can have unintended consequences. While these tools offer digital precision and convenience, they may inadvertently hinder cognitive productivity. Designers using CAD tools exhibited hesitation and indecision, resulting in extended design timelines, and reduced ideational productivity. These findings have significant implications for architectural education and practice. They underscore the need for a balanced approach to CAD tools integration into design processes. Educators and professionals should consider the potential impact of these tools on the creative process, leading to a reevaluation of their role in architectural design curricula and workflows. Future research could explore strategies to optimize CAD tool usage, aiming to mitigate their disruptive effects on early-stage architectural design. Additionally, investigations into the role of training and interface design in enhancing the synergy between designers and digital tools offer promising research directions.

In summary, this study highlights the complex relationship between CAD tools and cognitive productivity in architectural design, prompting a reexamination of their role in shaping the design landscape.

Introduction

The Impact of the Use of Computer-Assisted Drawing Tools on the Productivity of Architectural Design Process

Every day, new technological tools are created to assist architects in their work, and these tools are revolutionizing the way architects approach design. In the midst of this transformative wave, a spirited debate has arisen within the community of architects, designers, and design teachers. This debate pits the time-honored practice of hand-drawing against the innovative power of Computer-Aided Design (CAD) tools. One camp ardently champions the enduring significance of hand-drawing, asserting that sketching by hand remains not only a cherished tradition but also an indispensable tool, especially in the early stages of design work. They argue that drawing nurtures creativity, allows tactile exploration, and establishes a profound connection between the architect and the design. On the opposing front are advocates of CAD tools who, with equal fervor, contend that digital technologies offer unmatched speed and early visualization capabilities. CAD tools, they assert, streamline the design process, enhance efficiency, and facilitate rapid exploration of design possibilities. This ongoing debate raises fundamental questions about the role of drawing and CAD tools in contemporary architectural practice and education, questions that our study seeks to address through empirical research.

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Keywords: Cognitive productivity, architectural design process, computer-aided drawing tools, design activity, protocol analysis, efficiency.

The architectural design process is currently a focal point of extensive research, driven by the proliferation and diversity of publications dedicated to this dynamic field. These works collectively underscore a profound transformation in architectural work techniques, spurred by the integration of cutting-edge technologies. Among these technologies, the adoption of CAD tools stands out as a game-changer, fundamentally reshaping how architects approach their craft. In this era, traditional tools like tracing paper and pencils have gracefully made way for CAD tools, while drawing boards have yielded to digital screens. Even the concept of archiving architectural plans has transitioned into the digital realm. These technological strides not only substitute traditional tools but also provoke a fundamental reconsideration of timeless design practices, such as drawing, casting a spotlight on their profound influence on the architectural design process itself.

In response to this paradigm shift, researchers have embarked on a mission to scrutinize the role CAD tools play during the conceptual design phase. Their mission is to provide empirical evidence that deciphers the intricate links between CAD tools and architectural design (Putra, A. M. & al., 2022; Fakhry, M. & al., 2021; Heidari, P., & Polatoglu, Ç., 2019; Al-Matarneh & Fethi, 2017; Bilda, Z. & Gero, JS., 2005; Montès, F. & De Biasi, P.M., 2000).

Amidst this vibrant discourse, four pivotal questions emerge. The two first are thematic and the two last are methodologic.

1. Does the introduction of CAD tools during the early stages of the architectural design process affect its cognitive productivity?
2. If yes, in what manners?
3. How would it be possible to quantify this impact?
4. Which method should we use to grasp all the aspects of the design activity?

These questions form the bedrock of our study, signifying its profound importance in the ongoing dialogue about the future of architectural design. They induce two main hypotheses.

1. The introduction of CAD tools during the early stages of the architectural design process affects its cognitive productivity.
2. The impact of CAD tools on the cognitive productivity of the early stages of architectural design process is quantifiable notably through the efficiency measure introduced by Goldshmidt (1995).

Our study is poised to answer these pressing questions and to measure the validity of these hypotheses. It holds immense significance for several reasons. Firstly, as the architectural community increasingly embraces CAD tools, there is a critical need to understand their impact on the cognitive dimensions of architectural design. Architects and designers grapple with the integration of these tools into their creative processes, and our research aims to provide empirical evidence to inform these critical decisions.

Moreover, our findings bear direct implications for architectural design teaching. As design pedagogy evolves in response to technological advancements, our study equips educators with evidence-based insights to refine curricula and instructional methods. By shedding light on the impact of CAD tools on design efficiency and cognitive processes, we contribute to the enhancement of architectural design education. Our research empowers instructors to prepare students for the evolving landscape of architectural practice, ensuring that emerging architects possess the skills and knowledge necessary to harness the potential of technology while preserving the essence of creative design.

Secondly, in an era where technology, including AI, is rapidly transforming various domains, comprehending its implications for creative fields like architecture becomes paramount. The architectural design process, with its blend of artistry and technical precision, serves as a compelling case study for exploring the transformative power of technology. By examining efficiency and cognitive aspects, our study offers a unique perspective on the evolving landscape of architectural design in the digital age.

In summary, our research is poised to illuminate the path forward for architectural design, where CAD tools and technology are becoming increasingly integral. We aim to offer insights that not only enhance the efficiency of architectural design but also foster a deeper understanding of the cognitive processes at play. Additionally, we contribute to the evolution of architectural design teaching, equipping educators with evidence to guide the next generation of architects in an increasingly technology-driven world.

2. Protocol analysis Method

Protocol analysis is an empirical and observational research method commonly used in design research. It has been widely used in design research since its introduction by Eastman in the late 1960s. (Eastman, C.M, 1969) It has proven to be a valuable method for understanding the cognitive aspects of the design process and exploring the influences of various factors on design activities (Craig, D.L, 2001; Jiang, H., &Yen, C. C, 2009; Cross, N., Christiaans, H. and Dorst, K.; 1996). Researchers use protocol analysis to gain insights into designers' thinking processes, problem-solving strategies, and the impact of different tools and techniques on design outcomes.

The process of protocol analysis typically consists of two phases. The first phase involves collecting empiric data through the recording of a designer's overt behaviors, such as verbalizations, sketches, and audio-visual manifestations (Newell, A., 1966), when achieving a design task. These records, known as design protocols, provide a detailed account of the designer's actions and thoughts during the design process. The second phase involves the analysis and interpretation of the collected data. During this phase researchers examine the protocols to describe and analyze the design process, identifying patterns, strategies, decision-making processes, and other relevant information.

By employing protocol analysis in this study, researchers aim to collect detailed data on the design processes with and without CAD tools, enabling a thorough analysis of the impact of CAD on the productivity and cognitive aspects of architectural design activity.

2.1. Verbalization Techniques

Within the framework of design research, the protocol analysis method employs two distinct verbalization techniques: the think-aloud and retrospective. The think-aloud technique involves the real-time verbalization of thoughts during the design process, whereas the retrospective one entails verbalization occurring subsequent to the completion of design work. In their comprehensive examination, Gero and Tang (2001) discerned that both techniques possess inherent advantages and address specific limitations.

Notably, simultaneous protocols, also called think-aloud method, offer a more expansive and nuanced perspective, particularly in the early phases of the design process. This comprehensive insight facilitates the sequential identification and analysis of the designer's thoughts as they naturally unfold. Considering these considerations, we have chosen to adopt the think-aloud technique as the preferred approach for our research study.

2.2. Approaches in Protocol Analysis for Data Collection

In the domain of protocol analysis, a notable dichotomy exists in the approaches employed for data collection and acquisition. These approaches are distinguished as the process-oriented approach and the content-oriented one.

The process-oriented approach is fundamentally oriented towards the comprehensive depiction and elucidation of the design process itself. This entails a meticulous examination of the sequential actions and decision-making procedures undertaken by designers during the course of their work. In contrast, the content-oriented approach directs its attention towards the substantive facets and intellectual content embedded within the design. It seeks to delve into the intrinsic essence of the design, encompassing its cognitive underpinnings.

Given the specific thematic focus of our research, which centrally revolves around the cognitive dimensions inherent in the design process, our methodological selection deliberately leans towards the content-oriented approach. This strategic alignment serves as the foundational framework that underpins our investigative endeavors.

2.3. Protocols Description

To access the extensive information contained within design observations or protocols, we adhere to the well-established protocol analysis methodology, which comprises two pivotal phases: segmentation and codification.

2.3.1. Segmentation

Segmentation, a pivotal facet of the analysis process, involves the dissection of the design protocol into smaller, coherent units or segments, guided by specific criteria. These criteria for segmentation may vary, contingent upon research objectives and the inherent characteristics of the design activity. Segmentation parameters encompass actions, decisions, shifts in focus, or other pertinent considerations. This process empowers researchers to discern and scrutinize distinct stages or phases within the design process, along with the transitions and transformations that occur therein.

The primary aim of segmentation is to break down the design protocol into manageable, discrete units, facilitating separate examination and coding. Each segment constitutes a discrete reservoir of information, amenable to evaluation in terms of its substance, contextual relevance, and interconnections with other segments. (Arrouf, 2012)

Within our context, each segment conveys a coherent assertion or declaration concerning a singular element, space, or subject within the design progression. These segments may vary in length, encompassing a solitary action or a sequence of actions. (Arrouf, 2006)

2.3.2. Codification

Following the segmentation phase, the subsequent step is codification, wherein each segmented unit undergoes individual processing. Codification entails the assignment of designated codes or labels to each segment based on pre-established categories or thematic frameworks. Segmentation and codification work in concert, serving as complementary stages within the protocol analysis methodology. Segmentation delineates the units of examination, while codification provides a structured framework for the categorization and analysis of the segmented elements.

The fundamental purpose of codification is to systematically categorize and structure the segments in alignment with their intrinsic content or distinctive attributes. This systematic codification process equips researchers with the means to methodically dissect the data, identify recurring patterns, establish correlations, and unveil overarching themes within the design process.

By adhering to the conventional protocol analysis methodology, researchers attain a systematic framework for structuring and dissecting the amassed observations. The meticulous segmentation and codification procedures serve as the linchpin for comprehending the data, extracting pertinent insights, and unravelling the intricate facets of design activities, strategies, and cognitive processes at play.

It is pertinent to acknowledge that variations of the standard protocol analysis methodology may be applied by researchers in accordance with the specific objectives and contextual nuances of their research. The paramount objective remains the structured organization and coding of data, thereby facilitating meaningful analysis and interpretation.

To code the collected protocols, researchers often employ a coding scheme that varies based on the research goals and objectives.

2.3.3. The coding scheme

To delineate the comprehensive observational compendia, Arrouf (2012) devised an intricate coding strategy, drawing from cognitive science insights into the perceptual and conceptual dimensions of human cognition. Inspired by the coding systems advanced by Suwa and Tversky (1997); Suwa, Gero & Purcell (1998), and McNeil et al. (1998), He constructed an elaborate coding scheme that encompasses eleven distinct informational categories, each associated with a specific cognitive level. This meticulously crafted scheme facilitates a thorough and nuanced codification of the cognitive intricacies inherent in the design process. Arrouf (2012) defined these categories as follows:

1. External Perception Category (PE)
It belongs to the cognitive level of perception. It records actions of perception of the design setting data and the designer's interpretations.

2. Internal Perception Category (PI)
It also belongs to the cognitive level of perception, but it focuses on the perception that takes place within the design process.

3. Sense figuration category (FS)
It records the actions of figuration of sense which produce abstract and ambiguous figures.

4. Morphic Figuration Category (FM)
It regroups the actions of figuration of the object under-design shape and the actions which allow the passage towards this shape figuration.

5. Prior Knowledge Reference Category (RE)
This category of actions, as its name suggests, calls on the prior external knowledge of the designer.

6. Internal Knowledge Reference Category (RI)
It allows the designer to create references and to use them, by constituting a reservoir of knowledge specific to the design situation.

7. Sense Production Action Category (CAS)
This category belongs to the semantic cognitive level. It serves to give and produce sense throughout the design process.

8. Abstract Design Actions Category (CA)
This category also belongs to the semantic level and records six types of actions, which are about strategies, relevancies, goals, and decisions.

9. Morphic Design Actions Category (CM)
It brings together actions like those of the abstract design category, but which are now of a morphic order.

10. Internal Knowledge Reuse Actions Category (RCI)
This category allows the designer to go back very far in the time of the process to reuse previously generated information or knowledge.

11. Evaluation Actions Category (CR)
The actions in this category evaluate the different morphic productions in relation to goals, strategies, and relevance previously produced.

3. Experience

The protocol analysis method encompasses a two-phase experiment, as elucidated by McNeill et al. (1998). The initial phase, known as the preliminary exercise, involves the experimenter acquainting the subjects with the verbalization technique. This phase includes addressing any inquiries to ensure a thorough comprehension of the process. Subsequently, in the second phase, referred to as the experiential phase, the subjects actively participate in a 45-minute design session.

3.1. Participants

The experiment engaged the voluntary participation of four third-year architecture students, comprising two male and two female individuals. The primary objective was to gather data through two distinct design sessions, each focusing on a specific design task.

3.2. Design task

The participants were asked to complete two design tasks: one employing freehand drawing and the other utilizing the ArchiCAD® drawing software. Each design session had a duration of 45 minutes, with separate sessions dedicated to each task on different days.

Throughout the experiment, participants were instructed to engage in verbal thinking aloud while designing, articulating their thoughts and actions. The experimenter consistently reminded them to vocalize their thought processes throughout the experiment.

For the freehand design task, participants were assigned the challenge of designing a house on a 300 m2 plot. Their design brief encompassed creating a two-level house that included specific elements, such as a small garden, a garage, three bedrooms, two bathrooms, two toilets, a kitchen, a dining room, a living room, and an office. To facilitate the task, participants were provided with a spacious table equipped with an array of drawing materials, including pencils, markers, colored pencils, and tracing paper ***(Fig. 1).***

Figure 1. *Photos taken during freehand work, by authors (2013)*

In contrast, when working with ArchiCAD®, participants exclusively relied on computer tools, completely replacing traditional drawing materials. For this particular assignment, students were instructed to design a prestigious restaurant in proximity to the university. The restaurant's design parameters encompassed various functional areas, including a reception area, a dining room, a pantry, a cloakroom, customer restroom facilities, a kitchen, storage areas, a manager's office, a staff area, restroom facilities for staff members, a service courtyard, and a terrace that served as an extension of the dining room ***(Fig. 2).***

Figure 2. *Photos taken during work with informatics tool,* by authors (2013)

3.3. Data collection technique

To document the design activities, a dual-camera setup was employed. During the freehand task, one camera was positioned in front of the subject, while the other was focused on the worktable, providing a clear view of the produced drawings ***(Fig. 3).***

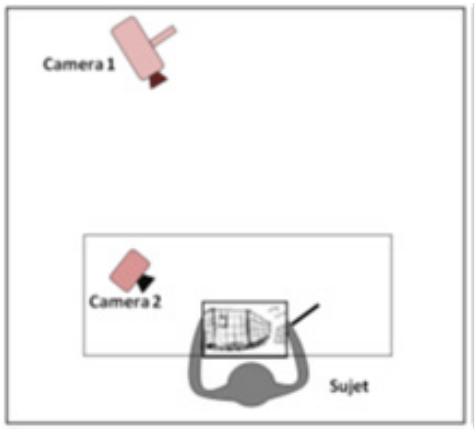


Figure 3. *The experimental setting for the free-hand session,* by authors (2013)

Conversely, during the software-based task, one camera was situated in front of the designer, while the second camera was positioned above the designer's shoulder to capture the screen and display the digital drawings ***(Fig. 4).***

Figure 4. *The experimental setting with CAD tools,* by authors (2013)

3.4. Collected data

The experiment yielded two types of data. The first type comprised graphic productions collected on paper for the freehand session ***(Fig. 5)*** and digitally saved for the software-based session ***(Fig. 6).*** The second type encompassed verbalizations and gestures made by the designers, which were subsequently extracted from the video recordings by the experimenter.

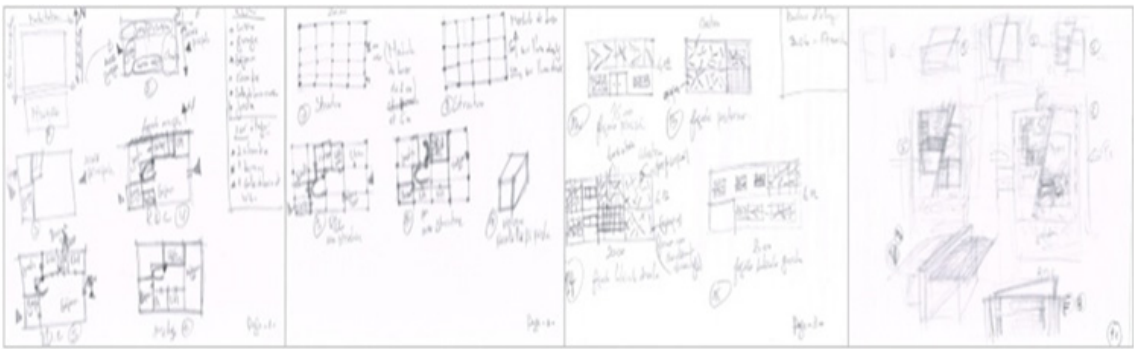


Figure 5. *Some collections from the first design task (individual house),* (2013).

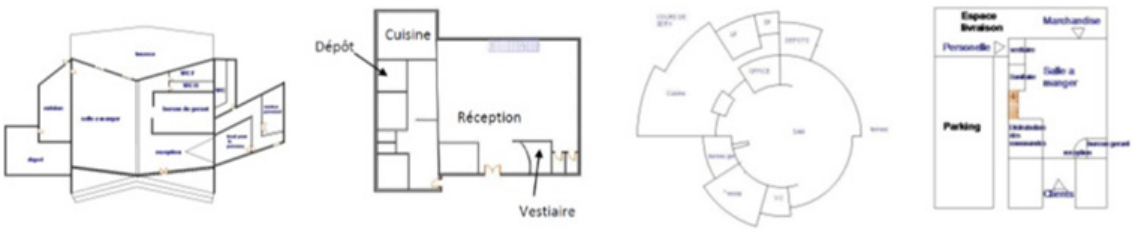


Figure 6. *Some collections from the second design task (a restaurant of high standing), (2013).*

3.5. Description of the collected data

Post-experiment, a comprehensive review of the recorded videos was conducted to transcribe the verbalizations of each participating designer. This transcription process culminated in a text corpus, which was subsequently segmented and codified in accordance with our predefined coding scheme ***(Table 1).***

4. Results

To measure cognitive productivity, we adopt concept of efficiency as echoed from Goldschmidt (1995).

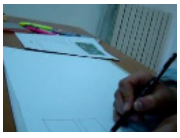
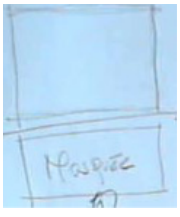
4.1. Efficiency Assessment

Goldschmidt's conceptualization of efficiency is rooted in the optimization of design actions and the minimization of the path length required to attain the intended outcome. In order to operationalize this concept, we undertook an assessment of efficiency within the design process at two distinct levels.

4.1.1. Efficiency at the Cognitive Path length Level

In the initial level of analysis, we conducted a comparative evaluation of the "cognitive paths" within each design process. To execute this assessment, we considered both the number of segments and the duration of the design activity. Specifically, we compared the lengths and durations of two key components: the global path, representing the entirety of the design process, and the elementary paths, corresponding to the individual segments, within each of the eight design processes.

Table 1. Description model (codification of the segments number 1 and 2, excerpt of subject 2 freehand work -SSO2-).

Time	N. Segments	Verbalizations and Actions	Graphic Production	Action Category	Explanation
2.09'	**1**	Depending on the plot of land the project can have 4 façades.	 	**PE** **CAS** **RI** **FM** **RE** **CA**	Interpretation Of project data «Land to Façades ». Introduction of a conceptual notion "façade". Creation of a reference Of conceptual notion. Represent and visualize the conformation of the land and the idea of the 4 façades. Refer to the substantive knowledge of the field. Identify an abstract relevance "know the number of façades"
2.11'	**2**	We note the presence of a mosque.	 	**CA** **RI** **FS** **FM** **PI** **RI**	Identify an abstract relevance « the existence of a mosque ». Creation of a relevance reference. Producing non morphic abstract figures «Writing: mosque» Represent the Conformation of the object. Visual perceptual interpretation of visual data. Use of internal references Previously generated

• The Length of Design Processes

Table 2. Number of segments and duration in time, of the processes of all subjects.

The Process	Number Of Segments	Duration	State of The Design Task
SSO-1-(Subject 1 without CAD)	53	28':47	Complete
SAO-1-(Subject 1 with CAD)	35	45':00	Incomplete
SSO-2-(Subject 2 without CAD)	113	41':07	Complete
SAO-2-(Subject 2 with CAD)	60	45':00	Incomplete
SSO-3-(Subject 3 without CAD)	112	34':12	Complete
SAO-3-(Subject 3 with CAD)	94	45':00	Incomplete
SSO-4-(Subject 4 without CAD)	98	44':51	Complete
SAO-4-(Subject 4 with CAD)	40	45':00	Incomplete

The table presented above delineates the process length data for the eight analysed collections, denoting the count of segments within a designated time frame. A comparative analysis of these eight processes reveals noteworthy distinctions. Notably, when CAD tools were employed, participants did not manage to conclude their designs within the allocated 45-minute time-frame, in contrast to the manual sketching sessions, which featured a higher number of segments ***(Table 2).***

These findings signify a palpable influence of CAD tool utilization on the temporal dimensions of the design activity. Specifically, CAD tools exhibited a propensity to diminish the number of segments while concurrently extending the duration of architectural design work. This phenomenon underscores the deleterious impact of CAD tools on the productivity of the architectural design process, primarily through the elongation of task completion times.

The observed effects on process length and completion time serve as a pertinent reminder of the imperative to consider the ramifications of CAD tool integration in architectural design practice. Design professionals must remain cognizant of potential work-flow disruptions associated with CAD tools and pro-actively institute measures to optimize their processes, thus mitigating any adverse effects on productivity.

• Average segment length analysis

As previously elucidated, the cognitive efficiency of the design process hinges on the intricate interplay between its duration and productivity. Efficiency, in this context, manifests in the ability to generate solutions and ideas within a compressed time-frame. In our study, we have adopted an intention-oriented segmentation approach, wherein each segment represents a novel intention, idea, or manipulated object within the design process. Consequently, the quantity of segments not only signifies the volume of ideas under the purview of the process but, when coupled with the average segment length, affords valuable insights into the efficiency and intensity of cognitive exertion.

Figure 7 serves as an illustrative representation of our findings, spotlighting the disparities in average segment lengths between processes involving CAD tools and those executed in a hands-free manner. Several factors contribute to this disparity. Firstly, the proclivity for indecision and fluctuating intentions is conspicuous in CAD-driven processes, leading to frequent alterations in decisions and strategies without crystallizing a definitive idea. This vacillation invariably prolongs the segment lengths, as the design process grapples with the quest for a precise direction. Secondly, the temporal investment necessitated by CAD software operations, encompassing activities such as level adjustments, object creation, and drawing element selection, contributes substantially to the elongation of segment durations.

The integration of CAD tools, as evidenced by these findings, engenders inefficiencies within the design processes, accentuated by heightened hesitancy, fluctuation, and temporal demands. Consequently, the design workflows involving CAD tools tend to exhibit reduced fluidity and diminished intensity in comparison to hands-free processes. This accentuates the imperative of comprehending the implications of CAD tool utilization on cognitive efficiency and underscores the incumbent responsibility on designers and teachers to acknowledge these constraints, thereby augmenting their design processes and those of their students.

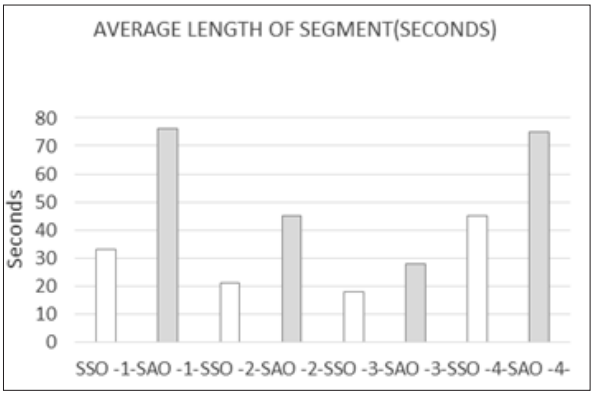


Figure 7. *The average length of segments (seconds),* by authors (2013).

• The average length of the first five segments analysis

Throughout our experimental endeavours, an intriguing pattern emerged concerning the generation of effective ideas within the design processes. We consistently observed that, irrespective of whether CAD tools or free-hand techniques were employed, the inception of effective idea generation uniformly commenced at the fifth segment. However, upon delving into the examination of the average length of these initial segments, a noteworthy divergence materialized—processes involving CAD tools exhibited considerably lengthier segments in comparison to their counterparts employing free-hand techniques, as delineated in ***Figure 8.***

This observation implies that design processes reliant on CAD tools grappled with a slower commencement. The prolonged segment durations signify that designers employing CAD tools invested more time in the cultivation and refinement of their ideas before embarking on the phase of generating effective solutions. This delay could be attributed to various factors, encompassing the learning curve associated with CAD software or the intricacies inherent to navigating through the multifaceted design features imposed by the tool.
In summation, our findings substantiate the notion that design processes involving CAD tools tend to experience a more sluggish initiation concerning the generation of effective ideas in comparison to their free-hand counterparts. Consequently, it becomes evident that if the primary objective of the initial five segments is to instigate the design activity, achieving this objective is notably more arduous in computer-based processes. Consequently, we can infer that CAD tools introduce inefficiencies at the outset of the design activity. This phenomenon may be attributed to the immediate freedom and flexibility afforded by free-hand techniques, enabling designers to manifest their ideas in a more intuitive and spontaneous manner.

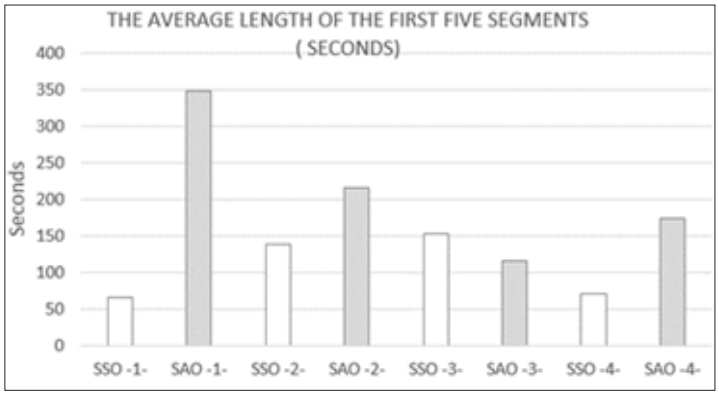


Figure 8. *The average length of the first five segments,* by authors (2013).

• Number and percentage of ideas in each process analysis

As previously noted, the juxtaposition of the number of segments in processes conducted without the use of CAD software (SSO1, SSO2, SSO3, and SSO4) and those employing CAD tools (SAO1, SAO2, SAO3, and SAO4) reveals a discernible dissimilarity, with the former exhibiting a greater abundance of segments. To delve further into the ramifications of software utilization on the character and content of these segments, we conducted a meticulous examination of the number and proportion of segments dedicated to design ideas, as depicted in ***Figure 9.***

Figure 9 conspicuously illustrates that processes devoid of CAD tools manifest a significantly higher count of ideas. This observation underscores that the use of CAD tools appears to curtail the generation of ideas within the design process. To ensure that the upsurge in the number of ideas within software-free processes is not merely a consequence of their larger segment count, we calculated the percentage of ideas for each process.

The percentage of ideas corroborates the earlier observation that processes conducted without the aid of CAD tools engender a substantial quantity of ideas in contrast to those reliant on CAD tools. This substantiates the proposition that the incorporation of CAD tools exerts a dampening influence on ideation productivity throughout the design process.

These findings underscore the profound impact of CAD software on idea generation and intimate that its utilization may constrict the quantity of ideas generated during the design process. It is imperative to acknowledge that additional factors, such as the designers' familiarity and proficiency with CAD tools, may also contribute to the observed disparities. Nevertheless, the data depicted in Figure 9 lend credence to the assertion that the integration of CAD tools can impose a constraining effect on ideation within the design process.

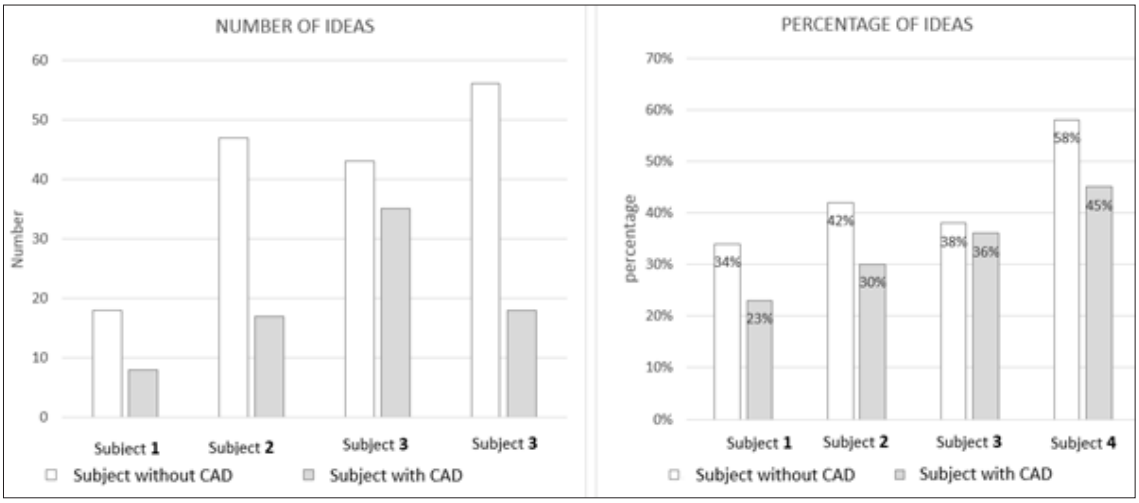


Figure 9. *Number and percentage of ideas for the eight analysed processes),* by authors (2013).

- **Number of actions and Number of actions by segment in each process**

Table 3 presents a comparative analysis of the number of actions expended in each process, both with and without the utilization of CAD tools. The table encompasses the total count of actions as well as the average number of actions per segment for the eight processes under scrutiny.

Consistently, it becomes evident that both indicators register higher values in the processes conducted without the aid of CAD tools in contrast to those incorporating them ***(Figure 10)***. This discernible trend underscores that the incorporation of drawing software effectively curtails the number of design actions across all categories.

It is worth noting that when considering the average length of segments in free-hand processes, which is typically less extensive than that of segments in processes employing software, the overall reduction in the number of actions points toward a decline in the intensity of cognitive activity within these processes.

These outcomes substantiate our prior findings and underscore that the utilization of drawing software leads to a reduction in the intensity of cognitive activity in the design process, consequently diminishing its cognitive productivity.

Table 3. Number of actions and Number of actions by segment for the eight analysed process

The Process	Number Of Actions	Number Of Actions/Segments
SSO-1-(Subject 1 without CAD)	254	4,79
SAO-1-(Subject 1 with CAD)	158	4,51
SSO-2-(Subject 2 without CAD)	647	5,72
SAO-2-(Subject 2 with CAD)	314	5,23
SSO-3-(Subject 3 without CAD)	554	4,94
SAO-3-(Subject 3 with CAD)	397	4,22
SSO-4-(Subject 4 without CAD)	513	5,23
SAO-4-(Subject 4 with CAD)	170	4,25

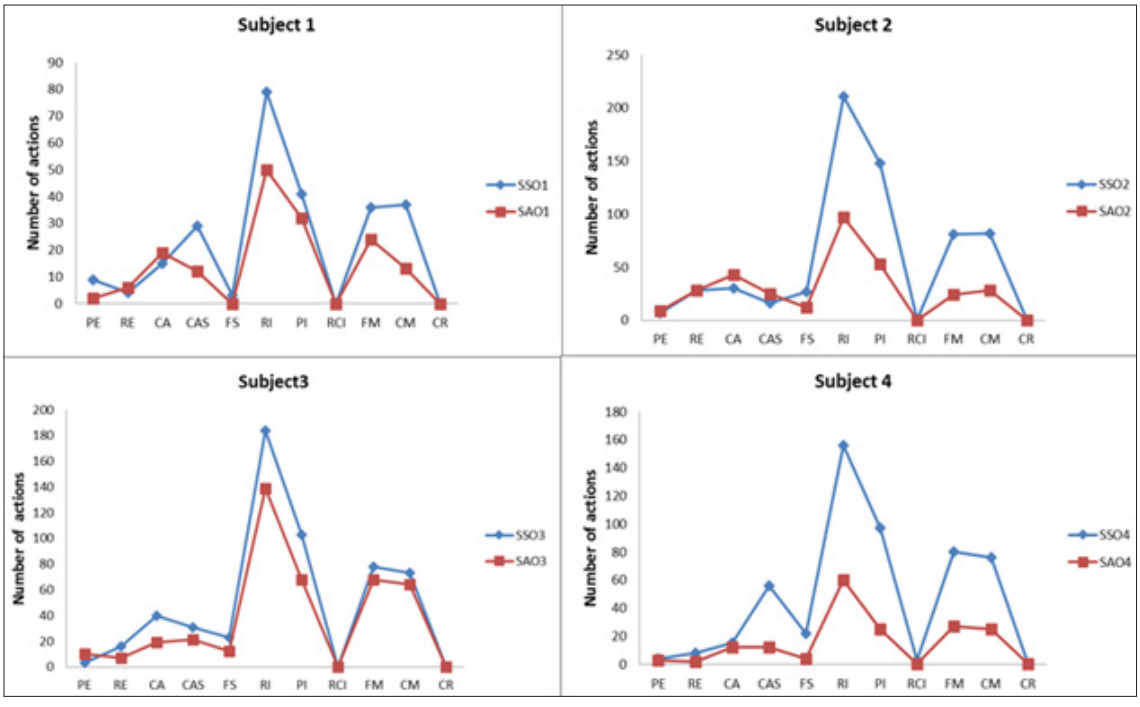


Figure 10. *Number of actions of the eight design processes without software (SSO1), (SSO2), (SSO3), (SSO4) in blue, and with software (SAO1), (SAO2), (SAO3) and (SAO4) in red,* by authors (2013).

5. Conclusion

The principal objective of this research was to assess the influence of computer-assisted drawing tools on design process productivity. The study employed the protocol analysis method, facilitating data collection and the examination of the work undertaken by four architecture students. Each student was tasked with completing two design assignments: one utilizing freehand sketches and the other employing CAD tools.

The investigation has divulged that the integration of CAD tools in the early stages of the architectural design process leads to decreased productivity. This decline can be ascribed to diminished efficiency, resulting in a protracted design process characterized by hesitancy and indecision. Furthermore, CAD tools negatively impact ideational productivity, culminating in a reduction in the intensity of cognitive activity.

These findings have brought to the forefront the challenges associated with CAD tool deployment, including heightened hesitancy, instability, and time consumption. Design processes involving CAD tools lack the fluidity and intensity observed in their freehand counterparts. It is imperative for designers to recognize these constraints and consider their implications for cognitive efficiency to optimize their design work-flow.

Additionally, the study underscores that design processes incorporating CAD tools experience a slower initiation and encounter greater difficulty in generating effective ideas. This disparity can be attributed to the immediate freedom and flexibility offered by freehand techniques, enabling designers to express their ideas intuitively and spontaneously. CAD tools, conversely, may introduce constraints and require additional time for familiarization, which can impact the initial ideation phase.

Considering these findings, we recommend architects and architecture students initiate their design work manually. Once ideas are sufficiently developed, designers can harness computer-assisted drawing tools to facilitate technical drawing, model visualization, and the execution of mechanical or repetitive tasks. By being cognizant of these challenges and making informed decisions regarding tool selection, designers can pro-actively address them and enhance their overall design process. It is equally advisable for architectural design educators to take note of these results and incorporate them into their teaching, emphasizing the value of beginning design work by hand and without CAD tools.

5.1. Limitations of the Study

As with any research endeavour, this study has its limitations. The primary constraint is the sample size, with the experimental work restricted to eight collections (four created manually and four with computer tools) due to practical considerations related to the research's time constraints. Expanding the dataset would undoubtedly strengthen and enhance the reliability of the results.

The study's second limitation pertains to the utilization of a single computer-aided drawing software, specifically ArchiCAD. Incorporating various CAD tools could potentially yield more comprehensive and nuanced results.

5.2. Future Perspectives

The methodology adopted in this study has proven effective in achieving our intended objectives, motivating us to explore several future research avenues to further our understanding of the impact of computer-assisted drawing tools on architectural design. Our forthcoming endeavour include:

1. **Expanding the Corpus:** Broadening the dataset to deepen our analysis and improve the generalizability of results.

2. **Varied CAD Tools:** Investigating the impact of various computer-aided drawing software programs to gain a more comprehensive perspective.

3. **Full Design Process Assessment:** Assessing the influence of computer tools throughout the entire architectural design process, from initial sketches to final projects, to pinpoint the stage at which computer tool usage becomes advantageous.

4. **Collaboration with Computer Scientists:** Collaborating with computer scientists to develop intuitive computer tools that align more closely with freehand work, particularly in the early design phases.

These future perspectives aim to provide a more comprehensive understanding of the intricate relationship between computer-assisted drawing tools and architectural design, ultimately contributing to improved design processes and outcomes.

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Learning For changing Our World
FAR | Methodological Approach in Architectural Education

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CHAPTER VI

Architectural education as a topic was constantly under investigation by researchers who believe the advancement of the built environment will not be implemented unless future architects are subjected to the necessary knowledge and experiences. Alongside this, the architectural design studio has been presented via educators as a real-life simulation for career expertise. However, the various disciplines necessary to inter-twine with the design process are usually taught in stand-alone islands. This already presented a complex process, but future challenges our communities will face are different from any previous era, and need a strategic perspective from future architects. The research aims to explore a design methodology introduced for six cycles of design studio named “FAR, Future Architect Role”. This studio is an experimental elective course tutored at Cairo University. The strategy of the studio is to apply the ideas and methodologies of “Education 3.0”, based on deep research, experimentation and problem formulation between the tutor and the students. The outcomes reflect applied projects to expand the boundaries of experimentation for future architects to react in unprecedented ways to complex problem-solving. Results of the previous cycles will be critically analyzed exposing the criteria of comprehending and responding to futuristic issues, then highlighting the strengths and weaknesses of previous cycles. The implications of the study represent an enhanced framework for developing the architectural educational process, which will benefit educators not only limited to architects.

Introduction

Learning For Changing Our World
FAR | Methodological Approach in Architectural Education

Architecture as a discipline is related to all aspects of life. It has a direct impact on the quality of life for communities. The architect beholds a responsibility towards the community. Stemming from this, it is of extreme importance to prepare the architects of the future for this role. This theoretical approach has been debated by scholars correlating architectural knowledge with problem-solving, (Salama, 2007), Kurt (2009, 2011), Lukman et al. (2012). Creative approaches in architectural pedagogy have been also the emerging debate in recent years, with the need to rethink our goals and aspiration regarding the graduates (Crowther, 2013). Reason-rooted solutions are required to avoid turning architectural education into a subjective strategy, (Ciravoglu, 2014). Additionally, in a challenging era of unplanned development, where architecture plays a crucial role in taming chaos, it is urgent to inject the methodology of architectural pedagogy with the 17 UN SDGs; Sustainable Development Goals.

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Keywords: Built Environment Education, Future Architects, Design Studio, Futuristic Architecture

Additionally, the existing and unjustified conflict between globalization and identity, where the concept of globalization is still straying among two groups. First group claims that the enormous development in science, technology, and spread of culture, would not happen without the act or role of globalization. While the other group accuses globalization of destroying national and cultural identities and fragmenting states and entities of weak and poor countries, and dominance of the consumer culture as well. Now, identity is used as a trading commodity, and becomes a superficial, and sometimes, sarcastic value. Until the gap between the concept and application become deeper than it can be imagined.

The future holds a tragic challenge for those who study now, based on the report of the United Nations Education Commission stating that by 2030 half of the world's employees (about 2 billion people) are at risk of losing their jobs. This was explicitly announced in 2017 pointing out to the shocking result that today's generation of young people are facing a radically changing world. Many jobs will be automated and the human element will disappear, besides that only higher skills will be required. Those with medium and low skills will not be guaranteed a job. Thus, only quality education for all can generate the necessary skills, prevent inequality from worsening and provide a prosperous future for all. Since man stepped on the earth, he added to it what has been inherited and became a source of pride. On the other hand, several problems were created which accumulated over time and became overlapping problems. Those problems are essential to solve according to our different specializations. While reflecting carefully on the role of the architect, it is observed that his role is simply to create spaces that allow people to be creative or disruptive to what is around. From here, the responsibility of the architect is manifested, which goes beyond the direct role, to an extended role in advancing the built environment and how to create spaces that achieve happiness for users and help them move towards the future. Thus, create a cultural architectural product which deserves to be considered heritage in the future.

Historically, the beginning of the design studio was based on a group of distinguished architects who have a school of thought, to whom students go to learn the design experience. Then the specialized study materials that the architecture student needed to study appeared. Which, with the passage of time and the increase in the number of students, began to separate little by little, until the student became studying a group of academic subjects in isolated islands that are scientifically integrated, but practically diverged. This made the students intellectually dispersed and lost the link between those subjects, enduring an effort that is often wasted past and study what is happening in the present for this purpose.

The name of the course was selected as the "FAR | Future Architect's Role" to raise awareness of the future architects to meet the challenges of the future. The design of the course was not a directed not merely to teach about architecture, but rather to create a movement for changing the world. In order to achieve this, the learning outcomes were decided upon to strategically cover the above intentions through a series of "Knowledge and Understanding", "Intellectual", "Professional" and "General" skills. Those skills are listed in the table below (Table 1), to provide a brief of the expectations of the outcomes and further relate the course outcomes with the learning outcomes in order to create a comprehensive learning approach in architecture.

The design studio should follow an integrative approach that properly integrates all supporting course in the architecture studio to ensure meaningful learning. So that was the main goal of the course as a regeneration to a new design studio methodology, which can direct students to the right path to learn architecture in an effective way. Through interacting with three main pillars which are critical, creative and pragmatic. The integration between the three pillars is very important in the Design Studio learning methodology adopted.

Table 1. Expected Learning Outcomes of "FAR", Author, 2023.

A- Knowledge and Understanding
Through knowledge and understanding, students will be able to:

- Understand how to shift methodologically from teaching to learning.
- Understand the position of the dramatic facing the labor markets in the future, especially those who are studying now.
- Understand the relationship of architecture (teaching and occupation) to the future of the labor market in the world, and comprehend the futuristic problems associated with the dramatic decrease in the labor markets, expected in the future.
- Apply knowledge from inter-disciplinary courses to blend with architectural design in order to support and develop architectural discipline.
- Understand the new definition of public buildings and spaces (like museum, library and school), and how create new typologies and deal with them architecturally.
- Differentiate between the different levels of community participation in urban and architectural projects.
- Design of the design: Understand that every project has design process that need to be designed in itself, to get the product (project) that achieves the goals.

- Understand architectural thinking, from the approach of "six thinking hats", and applying the process in designing a design problem.

B- Intellectual Skills
Through intellectual skills, students will be able to:

- Design a new role for Futuristic Architects.
- Develop skills in various approaches.
- Develop the ability to analyze how projects solved problems and use critical thinking in practical problem solving.
- Suggest new developmental goals for (2045) based on analyzing the current SDGs and MDGs.

C- Professional Skills
Through professional and practical skills, students will be able to:

- Identify opportunities and how to invest them.
- Create strategic plans to deal with the Era challenges.
- Design to allow for better interaction with the community using traditional technique and local materials (domes and vaults).

D- General Skills
Thrugh general and transferable skills, students will be able to:

- Create ideas and develop the ability to present the ideas using different media.
- Develop scientific / critical writing skills.
- Independently seek knowledge, set aims, targets, objectives and plan to meet them with a deadline (time management). Listen and critically respond to the views of others.

2. Materials and Methods: FAR Learning Methodology and Work Progress in the Studio:

The materials used in the following analysis are some selected outcomes of six cycles of introducing the course at Cairo University, Architecture and Environmental Technology Program. The six cycles have been offered during the past four years (2019-2022), where each cycle adopted a varying theme. The outcomes of the students' group work will be critically assessed in the next part in shadows of the methodologies explained.

The design of the course depended on achieving the previously discussed aim through a strategy depending on creating a mutual platform for ongoing teaching and learning. The course was offered throughout 14 weeks, and each session has a certain topic to discuss. The class capacity average was 35 students, divided into groups in the workshops and projects. Some of the topics discussed during the weekly talks are Understanding the "New Normal", "Responsibility – Dimensions of Architecture – Cultural Products", "Future Architect", "Community Participation", "Complex Problems", "Public Buildings", "Design process – Six thinking hats – Geometry – Structure", "Future Goals", "Architectural Language", "Architectural Thinking", "Globalization and Identity".

The methodology of the course depended on a brief talk on one of the topics listed above to introduce the theoretical understanding necessary to build up logical thinking. Following that, a critical class discussion was encouraged to methodologically encourage peer-learning techniques. Each session ends up with a group class activity, either an application on the topic discussed, or an incremental process for design and discussion related to the theme of the final project assessment. The methodologies applied were qualitative assessments and critical reviews. Those methodologies are used to contribute with different interpretations for the terms "Future, Architect, and Role".

The main methodology of the structure of the course explained above reflects the role of the educator/instructor in transforming the process of teaching into a process of learning (figure 1). This essential transformation prepared the students to indulge in a non-stop process of learning and self-learning. As a metaphoric resemblance; this expected role of the instructor is to expand the radius of knowledge in each meeting by increasing the radius of a hypothetical circle drawn on the margin of a pure shape (figure 2). Thus, by the end of each meeting, the range of knowledge gained by the students expands. The expansion is the genuine learning asset from the creativity and the added value by the students themselves. Accordingly, the main target is increasing the radius of knowledge to transform the circular loop of teaching into a spiral loop.

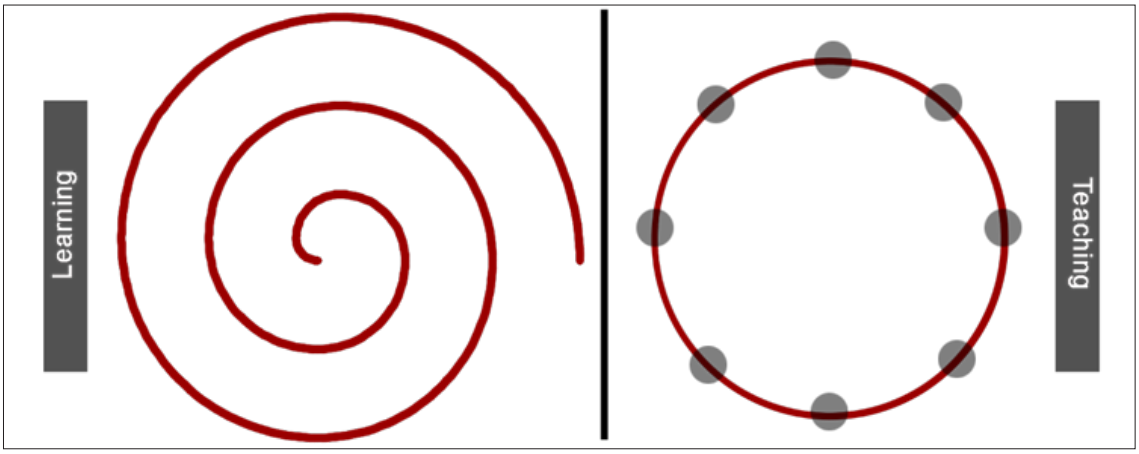


Figure 1. *Teaching Cycle Vs Learning Loop,* *(Author, 2023)*

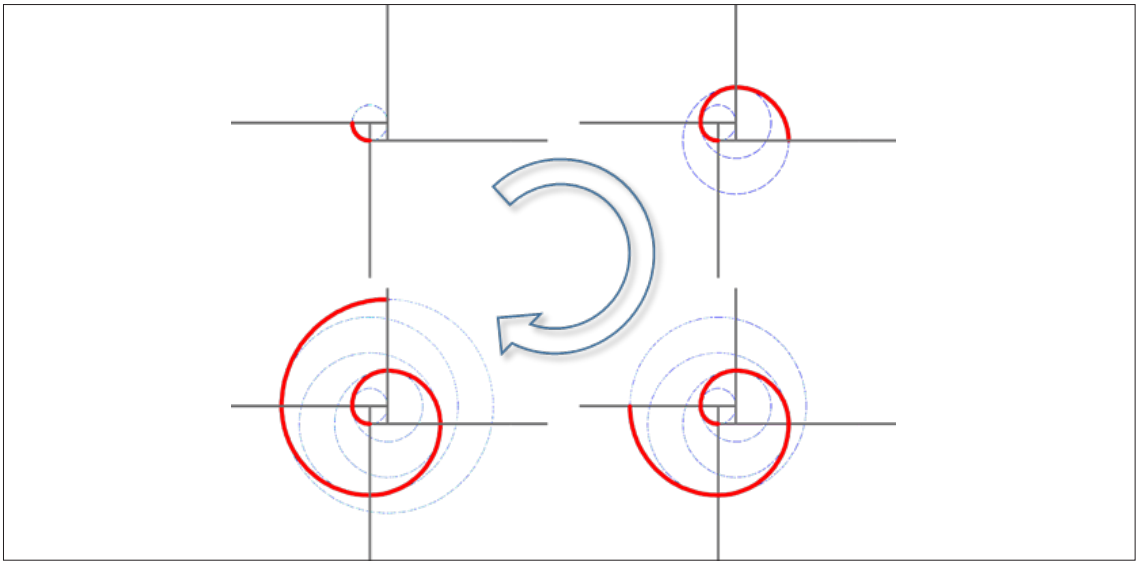


Figure 2. *Expansion of the Teaching Cycle to Transform Methodologically into a Learning Loop,* *(Author, 2023)*

The methods of learning were encouraged by the following:

- Hypothesizing the beginning and the end of frames of time, Past, Present and Future, pre-future & post future and the time-lapse between each.
- Discussing the responsibility towards the world in each time frame.
- Understanding how to shift methodologically from teaching to learning and practically from group to team.
- Introducing education systems: "EDUC. 1.0 – EDUC. 2.0 – EDUC. 3.0".
- Determining the challenges of the current era of technology and automation.
- Digging into the architecture of the past and perceiving the architect as the coordinator among all disciplines.
- Determining how to think architecturally with a purpose and in different dimensions.
- Recognizing the top 10 skills of 2015 and anticipating how they changed in 2020, then discussing what is expected of them in 2025.
- Defining the "emotional intelligence" skill and how to impact people, drive their behavior and manage their emotions.

For each cycle, a different theme was selected to reflect on the challenges of the future. The six cycles offered up till now are listed below:

- The first cycle "Spring 2019": Theme: Egypt without billboards
- The second cycle "Spring 2020": Theme: Bridging the gap
- The third cycle "Fall 2020": Theme: To achieve a methodological Paradigm shift
- The Fourth cycle "Spring 2021": Theme: RE- Belonging
- The fifth cycle "Fall 2021": Theme: RE-Humanitarian
- The sixth cycle "Fall 2022": Theme: Culture-verse (Cultural-izing our solution)

The following part will provide critical qualitative analysis for the themes explored and the methodology of teaching adopted.

2.1. Class activities as an Integrative Studio Experience between knowledge based solutions and creative futuristic ideas

During the class activities which were considered a crucial constituent of the learning methodology, (figures 3-9), the students were required to apply the understanding of the talks and discussions through a hands-on learning technique. This includes their imagination of future as they aspire to it to look like it in terms of architecture and all patterns of life. They were required to find an architectural/urban problem in Egypt, analyse it and discuss this with the teaching assistants. They analysed some Agha khan awarded projects and add their own reflection as a review for the project. They worked on determining how to have a sustainable mechanism to achieve SDGs. Additionally, anticipate how the themes of their project are chosen. They held discussions on how to make problems complex to address the different needs of the community and how the whole process can contribute to achieving a methodological paradigm shift. In other sessions, students were required to work on their projects, determine their location, and mature their vision, objectives, and goals.

In the course, a number of guest lecturers are invited, who give lectures in different disciplines, with the aim of the students receiving different and rich information from different visions of the lecturers. In order for students to understand the importance of the interrelationship of different fields with architectural design, followed by holding workshops with students on these topics.

In workshop sessions they were required to work in groups, one time to build a vault using bricks and trapezoidal pieces of wood instead of mortar, or to anticipate what will be the SDGs of 2045. In some workshops held the students were required to work in groups of 2-3 and change the façade of some building using the method of (shape-grammar) by articulating some specifically given shapes.

For the final project, students were required to work on a team project, choose one land plot, integrate their thoughts, and develop a comprehensive vision, objectives, and goals. The main goal was how to use architectural and urbanism as solutions to solving complex problems, then anticipating how the crisis can be the threat and the opportunity and how to turn challenges into chances. Students begin by defining the problem they have chosen, analysing the site, and choosing the architectural typology that they will design. While motivating them to be a new typology that is commensurate with the challenges of the era, and they define it and choose the appropriate architectural program.

2.2. "Design of the design" as a constituent learning approach in Education 3.0

In the course, it is aimed for students to understand that there is a design process, which differs from one project to another. In introducing Education 3.0, students have to define the methodology they will follow to achieve the goal of the project and relate to the problems they seek to solve. This is the conceptual approach of implementing design of the design strategy.

Figure 3. *Samples of Class Activities, Discussions, and Workshop,* *(Author, 2023)*

2.3. The Smaller Parts Building Up the Puzzles, Projects Overview as an Outcome of the Built Up Learning Process

This part of the analysis is concerned with exploring the outcomes of the students in the final phase which is considered the major assessment of the course. The presentation of the final project relied on an idea which complements the main goals of the course. Students work in teams, where they are free to present their project. The studio space is divided into pavilions, each team takes a pavilion and asks them to express the experience of the project in.

The selected cases below are categorized to display the theme, the response to the challenge selected and the project vision introduced. This will help in criticizing the outcomes and to what extent the course succeeded in delivering its messages.

2.3.1. Projects Overview in Relation to the Theoretical Framework and the Students' Outcomes

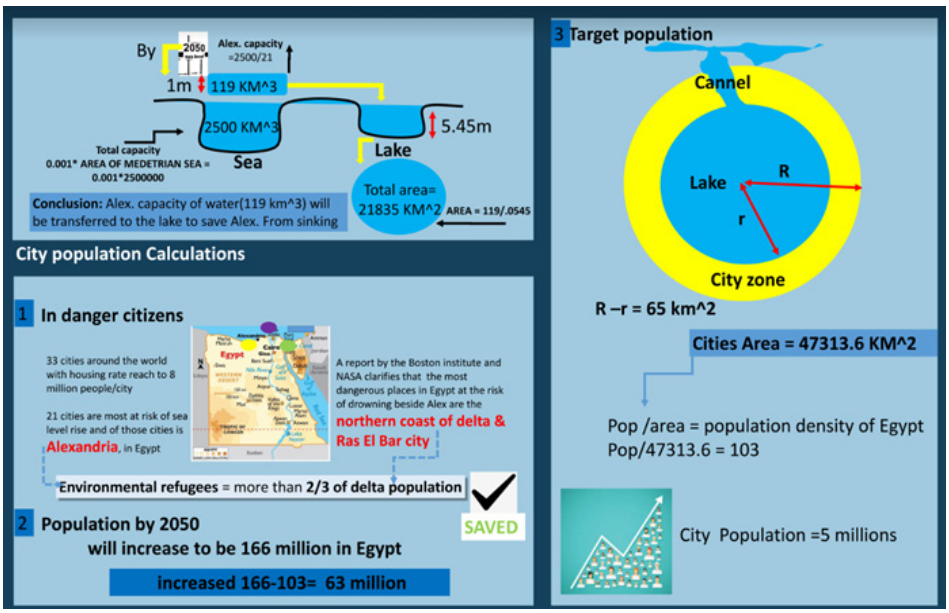
The following table ***(Table 2)***, showcases selected outcomes of the six cycles to correlate the problem definition to the problem formulation.

Table 2. Selected Class Activities (Author, 2023)

Cycle/Project	Complex Problem	Description	Critique
Cycle (1) Spring 2019 ***Egypt without billboards***	The problem of billboard in the streets and their negative impact visually, in addition to the crisis of poor structural design and the risk of cracking. The challenge was: what will be the visual image if the ads are removed?	The project presented a solution to take advantage of the materials of the Billboard, and re-employ them in building a cultural centre under the slogan of Egypt without the Billboard. The project aims to build a healthy community culture.	The solution presented by the students is unique in reusing materials in a way that has a clear message. The negatives were in not realizing the structural dimensions sufficiently, which created some deficiencies in the solution.
   A very important note: During the current month (June 2023), what was expected in 2019 happened, and a lot of the Billboard fell due to wind.			

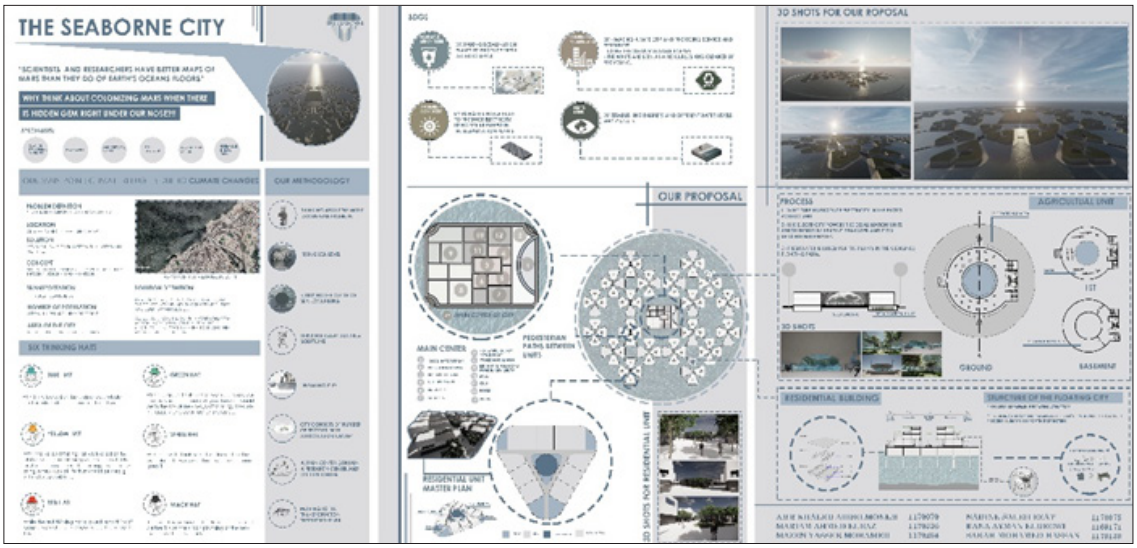
(BE'DAYA) Billboard Cultural Centre

Cycle/Project	Complex Problem	Description	Critique
Cycle (2) Fall 2020 ***To achieve a Methodological Paradigm shift***	The challenge of rising sea levels and the danger of submerging cities.	Climate changes have a direct impact on the rise in sea and ocean water levels, threatening many areas with drowning in the world, including parts of Alexandria and the northern coast of Egypt. The idea of the project is based on the formation of a huge lake in the Western Desert that absorbs a large part of the water increase in the Mediterranean through a channel linking the sea and the lake. And then planning cities on the lake.	The students presented a clever solution that defies the danger of cities sinking, and creates cities that live on the excess water of the seas after creating a lake in the desert. One of the gains of this project is the students' realization that solving the problems that threaten the world requires the cooperation of all, as they made recommendations that the Mediterranean countries implement the same solution, but they neglected the importance of making dams at the entrances to the Mediterranean to ensure that the water level does not rise, or that all countries The world is making the same solution on the coasts.



PROJECT 1
" Saviors "

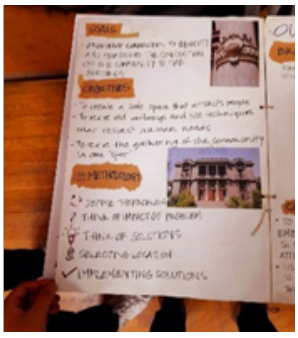
Cycle/Project	Complex Problem	Description	Critique
Cycle (3) Fall 2020 ***PROJECT 2 "DYSTOPIAN"***	The challenge of rising sea levels and the danger of submerging cities.	The idea of the project depends on the design of floating cities with full services, and the ability to generate energy and food.	The students presented in this project an idea that deals with the expected reality of the sinking of the planet, by designing floating cities in the seas and oceans with solutions to generate energy and food, but they neglected the situation of the cities that will sink.



PROJECT 2 "DYSTOPIAN"

Cycle/Project	Complex Problem	Description	Critique
Cycle (4) Spring 2021 ***RE- Belonging***	The negative effects of globalization on identity.	The main idea of the project adopts the idea of re-function heritage buildings, using activities aimed at Re-belonging to the community to its culture and identity, which has been removed from it due to the negative effects of globalization.	The idea of reuse is very useful because it preserves the heritage buildings, and the proposed uses are very suitable for the area and the surrounding community.





PROJECT 1
"AMEEN'S HOUSE"

Cycle/Project	Complex Problem	Description	Critique
Cycle (5) ***RE-Humanitarian***	Global food crisis.	The project presents a new idea to treat the food crisis in the world, through an agricultural and knowledge-based housing complex, which mainly depends on saving on agriculture in an innovative way and teaching children these ways to spread the culture to grow what will be consumed in addition to providing for the housing complex itself	Linking agriculture to children's education is a useful idea, and they used agriculture as an educational method, adding to the project other positive dimensions.

PROJECT 1
"TIFFIES "

2.3.2. External and Internal Jurors Reviews Process as Part of the Learning Experience

The review process is considered a critical constituent of the learning methodology. During the final assessment, the teams of students working on each project create a pavilion for exposing their strategic thinking process to solve the complex problem under investigation, ***(figure 4).*** A jury made up of two members is invited to evaluate the projects, during which each group is free to deliver their message through any media they desire. The jury discussions are also considered part of the learning process since it adds a layer of whether they are convinced or not by the building up of the rationale behind the solutions.
The students themselves are encouraged to critique one another. They assess each other's work and their grading is given a relative weight in the final grade. This helps in providing an atmosphere where collaboration and participation are introduced as a lifestyle.

Figure 4. *Jury Day showing Pavilions and Discussions,* *(Author, 2022)*

3. Results and Discussion

The results of the analysis of the six cycles discussed above represent a set of strengths and weaknesses of the experience. The strengths were showcased in the outcomes of the cycles analysed above since all groups were engaged in a different approach to thinking and creating architecture.

This resulted that no solution was repeated and all work was genuinely the strategic intelligence of the teamwork. The strengths also lie in the spirit of creativity, participation, collaboration, and deep analysis experienced during the class sessions. However, the main weaknesses observed were the deficiency of some groups to fully express their thoughts due to the lack of some practical skills. Additionally, it is required to introduce more inter-disciplinarily strands in the course, for instance, structural analysis, waste controls, and administrative and legislative knowledge. This will help the students in the future to come up with more concrete solutions for futuristic complex problems. The limitations of this study was inconsistency of the number of students enrolled in each cycle, which led to unbalanced quantitative outcome of projects in each cycle, therefore statistical relevance could not be conducted. Moreover, with the widespread of Covid-19 in 2020, the challenges faced in the transformation from face to face tutoring to online tutoring resulted in a modified learning experience which was managed but could have been enhanced if given room for more experimentation.

In each cycle of the course, the weaknesses that appeared in the previous sessions are treated, and that's what was reflected on the last one ***(cycle 6)*** which is not covered in this article. More topics were added to the course such as allocating the part of local and international architectural institutions and making simulations among students through working groups, with the aim of realizing and understanding the goals of these institutions and how they can have a role in solving complex problems. Accordingly covering the gap between theoretical realm and practical practice.

The main results from a strategic point of view can be summarized in ***(figure 5).*** The approach adopted provided room to introduce the role of architecture in a novel approach. Accordingly, it provided a change in the mindsets of students regarding how to think strategically in solving complex problem. This will be beneficial for educators and architects to provide a different approach in dealing with design studios now and in the changing world of the future. The main approach is to depend more on what the machine could not create. This is for instance the process of thinking, creative ideas, and formulating challenges, foreseeing the future of communities, interacting and learning from one another.

This is an affirmation of two main issues. First is that over time, human interventions have caused problems on planet Earth, which have become complicated over time until human interventions need to seek to treat them. The second is that the architect, besides having a role, has a responsibility towards solving the complex problems that have been formed, through the tools owned. Here, architecture and planning appear as a means of solving complex problems, and before that, success in defining the problem itself.

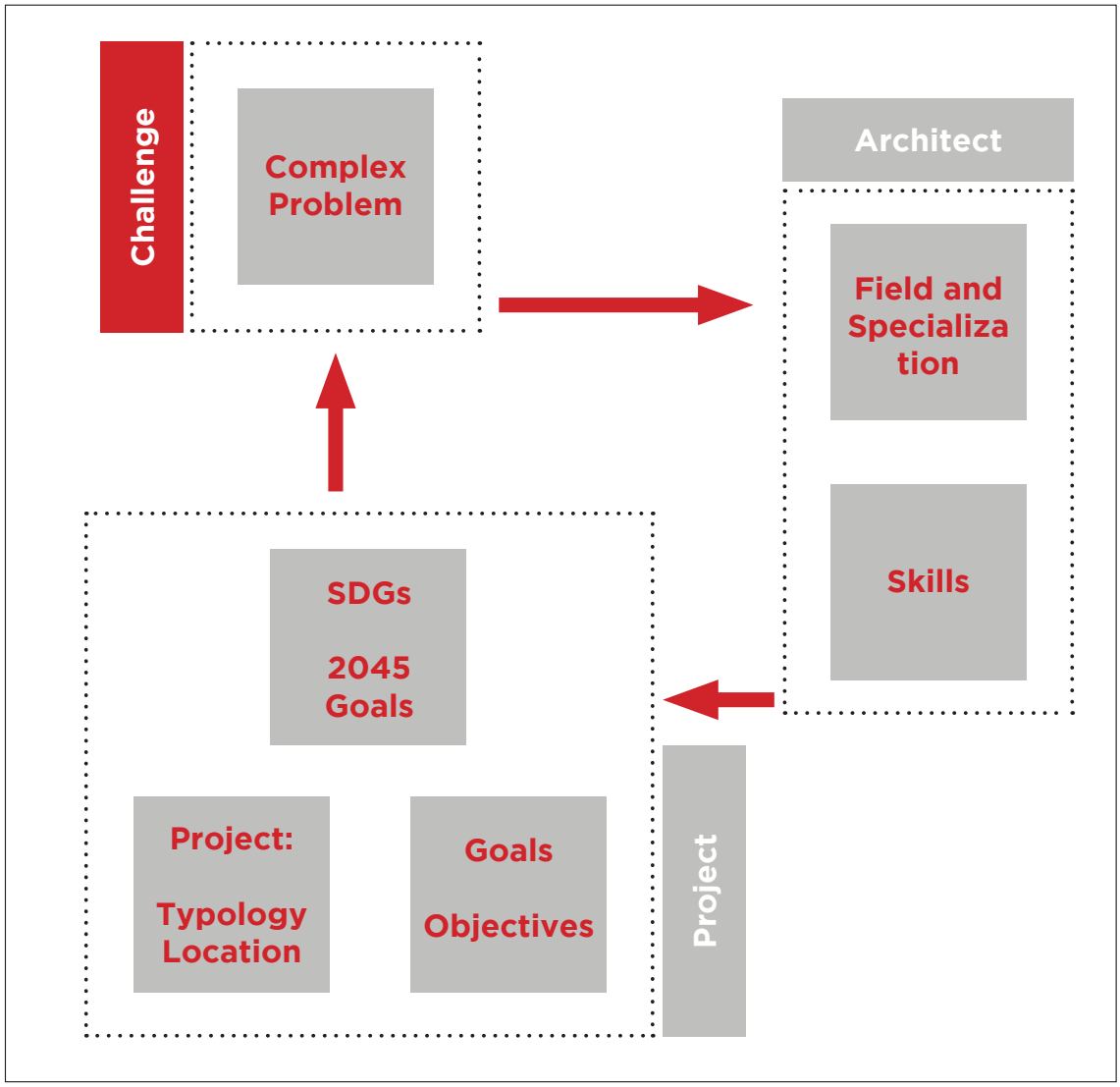


Figure 5. *Methodology of Architectural Learning to Face Future Challenges,* *(Author, 2023.)*

4. Conclusion

The conclusion remarks the paper delivers are a set of future recommendations for architectural education. It is important to understand that in the near future, the architectural profession will change. Accordingly, educators need to change their pedagogical approaches to prepare the coming generations for such changes. The aspired platforms for architectural education are required to provide a space for imagination, discovery, strategic thinking, and learning by doing, self-exploration, the ability to correlate solutions, and self-critique. Without those attributes, the future architect no matter how talented or mastering various tools and software, will not fit in the next paradigm of the future.

It is crucial to prepare future architects to their role in the future. The course studied here aimed to create a model to train future architects on the process of defining the problem before it occurs. The problems can be highlighted into the three stages of: the pre-future, future, post-future. The present one is witnessing is the pre-future, tomorrow is the future, while what is expected to come next is unpredictable but known (the post-future).
The focus in the course was learning about the future, and gaining the tools to be prepared for any problems in the post future. The challenge is to address the matter of targeting the dimension of time in a relative learning cycle. Thus, in the journey of moving towards the future, students learn through getting ready for the future.

The research main concluding recommendations are listed below, to reflect on the next phase of tailoring architectural courses and studios, providing a wider perspective on architectural and engineering education, and finally to present a recommendation for embedding the framework studied in a global agenda. The recommendations resulting from the study are;

1- On the scale of the course structure development: it would be more effective for the students and the outcomes of the course if the framework presented would be merged to collaborate with design studios for Senior I and/or 2 levels. This will result in an effective outcome of the methodological approach studied. Since this collaboration would spare the students from experiencing double studio-oriented courses in the same academic term. Thus, concentrating their efforts in a comprehensive studio would result in deeper results for the complex problem they are adopting.

2- On the scale of re-formulating the "Design Studio": there is a necessity to re-address the current conventional design studio into a critical transformation to what can be named "Comprehensive Studio". This type of various knowledge, dwelling-in strands studio can act as an actual simulation to real life challenges. It can be further studied how incremental complexity of the problem ought to be introduced in the ascending years of architectural education to incrementally introduced different knowledge disciplines inter-twined in a studio-based forum.

3- On the scale of engineering education: the effective bonding of different engineering disciplines would greatly help in encouraging trans-disciplinarily knowledge formulation. Accordingly, this bonding in creative and complex problem solving would result in grounded solutions, which would effectively present feasible logic and realistic additions to the body of knowledge.

4- Finally, on the scale of the recommendations related to the enhancement of the realm of architectural engineering tied to the Education Commission accreditation entity like UIA or RIBA; it would be beneficial for accreditation entities to regard the importance of introducing methodological oriented design studios which target training the students to face futuristic challenges. This would enhance the well-being, sustainability and resilience of future architectural outcomes, and enable the future communities to struggle less.

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Exploring Mid-journey's Outputs and Analysing its Result for a New Design Approach in Architecture

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CHAPTER VII

In the era of Metaverse, as a concept of a persistent, online, 3D universe that mixes various virtual spaces, the Mid-journey is an interactive bot that plays a significant role in Architecture. It is a machine tool that uses artificial intelligence to produce unique images based on the text input given by the user. It uses a machine learning algorithm trained on a massive amount of image data to create images. It converts what architects want to see in their minds through visuals. 'Unfortunately, the Metaverse concept is not well known to most architects, and the Mid-journey's Outputs in the architecture are also unknown. Therefore, there is a need to explore such concept outputs in architectural design, which is the main aim of the study. In other words, the study designs examine the possibilities of Artificial intelligence (AI) technologies and combine them with Architecture design to identify a new design approach. Consequently, the critical aspects of the study methodology used Quantitative study to achieve the study aim in addition to reviewing and analysing some designs that were generated using the Mid-journey concept and created by different Architects and explorers, examining how they work and how they could be used in the architecture field. The significant results of the study will bring attention to a new design approach contribution to the architectural areas, which will expand the architects' imaginative powers.

Introduction

Exploring Mid-journey's Outputs and analysing its result for a new design approach in Architecture

With the acceleration of time, the world around us is developing rapidly. Most industries have switched to the digital world using many technologies that are about to replace human work and skills. Defining "Artificial Intelligence" is one of the technologies that revolutionized the world. In other words, it is a technology that simulates human intelligence to accomplish specific jobs and can repeatedly enhance itself based on the information it collects. This term has come to include applications that perform complex tasks that require human input. The emergence of AI-based resolutions and tools means that more corporations can benefit from AI at a minor cost and in a shorter period. Off-the-shelf AI depends on using solutions, tools, and software with built-in AI competencies or automated algorithmic decision-making. Ready-to-use AI can perform anything from self-repairing databanks, which self-heal using machine learning, to pre-built replicas that can be performed to a diversity of databanks or datasets to resolve challenges such as image recognition and text analysis. It could be defined that Mid Journey is one of the AI image generator tools that can convert text to images using a machine learning algorithm. This tool has benefited many fields, such as art design and Architecture.

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Keywords: Mid journey; Artificial intelligence (AI); Architecture Design, Imagine.

This research investigates how the Mid-journey technology can improve Architecture Design outcomes by exploring its outputs in this field to identify a new design approach. A literature review will be done on this topic, followed by a qualitative study through questionnaires and interviews with Architecture students and specialists in the program. The result of this study will show the benefit of the Mid-journey tool in Architecture design and how it can be used effectively. As a result, this research is divided into main four sections. The first section introduces the Mid-journey tool and reviews some studies that explore and analyze the same technology. Then investigates how this tool can enhance the Architecture design projects. The second presents the analysis methodology based on a Quantitative study. The third section considers the results of the study and, finally, a discussion of the main findings of this research.

This research tries to resolve the problem of the low level of awareness of the Mid-journey and the application of AI in designing. It is recognized from the primary survey that designers find themselves lost in the Architecture and interior designing environment and need clear guidelines for their professional works due to the rapid technology, high amount and value of information and data, and the significant changes that cannot capture or distinguish. Therefore, scientists and specialists in design must think about a method that helps designers generate new concepts and ideas. This study's problem is identifying a new design approach in Architecture using technology by investigating Mid-journey technology to improve Architecture Design outcomes. Accordingly, the significance of this study is due to the substantial rapid development in the design process and technology that shows the need to benefit from the Mid-journey tool in Architecture design and explore how it can be used effectively. Consequently, the Hypothesis of the study is that the Mid-Journey as a design tool can improve the design process and enrich the design experiences that will benefit many fields such as art design and Architecture. Therefore, this study aims to explore the use of AI Mid-journey tools in Architecture and Interior Design and discover its impact on such fields. Accordingly, by answering some questions the study will achieve its aim. The study questions are:

- How can mid-journey technology improve Architecture Design outcomes?
- What are the benefits of Mid-journey tools in Architecture and Interior Design?
- How can this tool be used effectively in Architectural design?
- What is the future of AI in the field of Architecture?

2. Mid-journey tool

2.1. Definition of Mid-journey and how it works.

There are many AI image generators that use artificial intelligence algorithms based on a large dataset of images and their corresponding descriptions to turn text into graphics. These AI tools can visualize your thoughts and ideas and transfer them from text to pictures in a couple of seconds. It can be used for a variety of things, such as generating inspiration for new projects, investigating various concepts or scenarios, or just for fun (Easton, 2023) One of these AI image generator tools is Mid Journey. It is an AI application that uses human input (text prompts and parameters or other images) to generate original photographs using a machine learning algorithm that has been trained on a massive amount of image data (Dennis, 2022). Mid-journey AI also can be defined as a highly imaginative program that assists users in making creative images using their imaginations through text (Sharma, 2023). This tool can help users from different fields enhance their creativity and convert their imagination to a visual picture, especially in design industries such as Architecture and Interior Design.

Mid-journey uses text provided by architects or users as input to generate images that meet their needs using machine learning algorithms. Murphy (n.d) states the process of using the Mid-journey tool as follows. First, a prompt to Mid-journey is provided by the user; it might include details and a description of what you want to get. The more details are written, the closer the image is to what in your mind you get. Second, a new design will be generated every time after the users provide some feedback to Mid-journey on what they want and don't want in the design to give a closer view of their vision until they are satisfied with the final product.

Mid-Journey, created by David Holz, is run via a discord bot that refers and accepts calls to AI servers. You should have an account to run the program, and you can start typing your text to get four images for each attempt. After entering the prompt, it takes around 1 minute to produce your images. You then can upscale any of the four images by selecting (U + no. of image) or creating four more variations of each image by clicking (V + no. of image). The AI even learns from this, as millions of users select the best results, which teaches the AI what works and what doesn't.

2.2. Exploring Mid-journey Outputs

Dennis (2022) explores the output he gets from the Mid-journey tool based on the inputs he gives, search for patterns, and make predictions. Although it might not improve comprehension of the system's functions, it might improve the ability to use it. Dennis selects a circle as a simple model to test the primary output by comparing a hand drawing for a circle with a simple prompt "A circle" in the Mid-journey generator. ***Figures 1 and 2*** show the result of a circle drawn by a person using a pencil, while Figure 3 shows the output of a circle using a Mid-journey. As can be seen, Mid-journey fills in a lot of gaps around the picture that humans usually leave blank. If the same prompts run several times, the system will show different images with different aspects but some similar traits.

Figure 1. *Prompt: "A simple pencil outline of a circle on white research"*

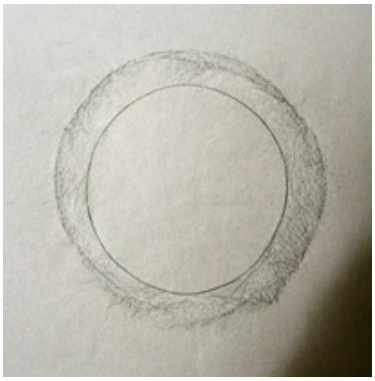

Figure 2. *Prompt: "A pencil line drawing of a circle"*

Figure 3. *Prompt: "A circle"*

Then, Dennis explores the circle with different types of materials, moods, mediums, environments, and artists. It was observed that Mid-journey can simulate different types of materials and understand their properties, forms, and colours. ***Figures 4 -6*** show the results of other materials from the given texts. Also, more results have been obtained by adding different text for various modes, such as mysterious, evil, and blossoming, represented in ***Figure 7***. Moreover, Dennis tried the same with different mediums, environments, and artists every time and got excellent results.

Figure 4. *Prompt: "A circle made of branches, bronze metal and grass".*

Figure 5. *Prompt: "A circle made of ice, emerald and gold, and embers and ashes".*

Figure 6. *Prompt: "A circle made of liquid gold, wood, and feathers".*

Figure 7. *Prompt: "A mysterious circle", "An evil circle", "A blossoming circle"*

It is also noticed that Mid-journey can read the aspect ratio of the images. For example, if you want to get an image with a specific size or standard ratio that can be used as a poster or for phone or desktop background or any other needs ***(see Figure 8).***

Figure 8. *Prompt: "A circle" in (9:16) and (16:9) circle"*

Note. Figures are generated through the Mid-journey tool by Dennis (2022)

2.3. Exploring Mid-journey Outputs in the Architecture Field

"Generative AI is an incredibly powerful approach that can be used to solve complex problems across many industries" It can assist architects in designing structures that are not only practical and visually beautiful but also satisfy the demands of the users. Mid-journey is one resource that architects can use to advance their design thinking (Murphy, n.d). A study by Rozdolska (2022) explores the Mid-Journey generative tool as part of creating an architectural form. This study shows that when artificial intelligence is appropriately applied, it can be a valuable tool for architects and support the process of creative thought. However, the current study will explore these uses and investigate how people are aware of Mid-journey and its benefits in their field and whether they are able to use it and show how it will affect their designs.

Mid-journey has been used by architects and architectural firms, who have found that it facilitates the speedy creation and modification of design concepts. The Zaha Hadid Architects firm also employs AI to show their clients renderings of the finished product. Many other Architects and Architecture firms have started using Mid-journey and other AI tools to quickly create and modify design ideas for their clients. A well-known architect may inspire the design of the project to create similar vibes; some examples of Mid-Journey Prompts for Architecture Design inspired by known architects are shown in Appendix D.

One of the famous Mid-journey creators is Hassan Rajab, who is an interdisciplinary designer with an architectural and computational design background highly interested in visual arts. He tried many prompts to generate Architecture design images using the Mid-journey tool. He believes that this tool can benefit the Architecture field as it can expand the limitations of inspiration (PA Next Team, 2022); he clarifies, "I'm really interested in designing facades and having weird, or very interesting shapes interact with it" adding that he occasionally explores other areas of architectural design, such as interiors (LTD, 2022).

2.4. Experts' Opinions and Experiences with Mid-journey

Diego Castro Posada, a Managing Director of the architectural rendering studio (M.O.N.O.M.O, London), compares Mid-journey with DALL. E 2, he noted that DALL. E 2 lacks realistic quality and produces unclear images, while Mid-journey represents ideas in an artistic way and gives better results than DALL. E 2. It is also much simpler to use and easy to teach; users can generate fantastic images on their first try (LTD, 2022).

Chhavi Mehta, an Architectural Assistant at Zaha Hadid Architects, said that Zaha Hadid tried to work with both DALL·E 2 and Mid-Journey in the design projects at projects in their office. These tools help them generate images that represent their identity based on the massive database of Zaha Hadid images (LTD, 2022).

Hasan Ragab found that Mid-Journey lack diversity in Cultural Representation; he faced some challenges when dealing with non-western architecture. He tried working with different architectural styles in Egypt, but he didn't get the expected results, so he added irrelevant text to generate images that were close to his mind. He also noted that users need to control the outputs they want through the text they provide (LTD, 2022).

2.5. Benefits and drawbacks of Mid-journey

Murphy (n.d) presented some benefits of the Mid-journey tool these are as follows: 1) Mid-journey helps architects save time in the design process stage, which allows architects to concentrate on other project aspects, 2) Mid-journey can generate high design quality that satisfies clients' needs, 3) It increased creativity and lead to more successful projects, 4) Using Mid-journey can be cost-effective, as it requires less time and money to produce high-quality designs.

As with many other technologies, each tool has some benefits and drawbacks. The negative aspects of mid-journey are that it must be used with Discord pot only and it produces visuals that can be used as inspiration but not as 3D models with specific dimensions. In addition, this tool is only available in the English language and doesn't support other languages. And as Hassan Ragab said, it lacks diversity in some cultural representations.

3. Material and Methods

Qualitative study uses specific methods to understand people's experiences and perspectives, study people's behavior in their natural settings, and listen to their stories. This kind of study allows you to identify issues from people's points of view and understand the contextual influences on the study issues (Hennink, Hutter,& Bailey, 2020). A specific set of methods can be used in qualitative study, such as in-depth interviews, focus group discussions, observation, content analysis, visual methods, and life histories or biographies (Hennink, Hutter,& Bailey, 2020). On the other hand, quantitative data is the worth of information that is expressed as counts or numbers, where each data set has a distinct numerical value. Any quantifiable information that researchers can use for statistical analysis and mathematical computations is considered this data, and it may be used to support any judgments that are based on the results of these computations in the actual world.

Quantitative methods are used in this study based on the literature review that was focused on previous studies about the Mid-journey tool and explored how this tool works and how people use it in different disciplines, especially in Architecture and Interior design. It also looks at Architects' and experts' opinions on using the mid-journey tool and represents some examples of expert outcomes with this tool.

The Quantitative methods used in this study are Questionnaires and one-on-one interviews. In the past, surveys were carried out using research-based techniques, but they have gradually transitioned to online platforms. These surveys frequently include closed-ended questions since they are better at gathering data. The questionnaire of this study was conducted online by sending emails to students, staff, and specialists in the field. Also, the survey form was spread on social media such as WhatsApp and Instagram to get more responses. The survey consisted of 13 questions and was spread using Google Forms starting with a brief introduction about the topic and the objectives of the study followed by the questions (sample of the questionnaire questions and results are shown in Appendix A and D). The aim of the Questionnaire is to investigate how far people are aware of mid-journey tools to enhance their understanding of using these tools effectively. In addition, the Questionnaire is used to explore the possibility of a mid-journey generator in the Architecture and interior design field and to identify the benefits and drawbacks of this tool.

The one-on-one interviews were conducted with students who used Mid-journey tools to know how participants think about the importance of the topic, how far they used the mid-journey tool and why, how it affected their work in their experience, and how it impacted the future. The interviews were conducted online through MS Teams, and each of them took around 15 - 20 minutes to complete. Students are selected as participants to focus on the use of the Mid-journey tool during the study of Architecture design and explore how it will affect their design when it is applied as part of the design process in the early stages. **(Samples of Interviews including questions and answers are presented in Appendix B and C)**

4. Results

It was found from the literature that the Mid-journey tool has many uses in different disciplines and industries, including the Architecture and interior design fields. The use of this tool increased in recent years by different users such as architects, designers, engineers, artists, and even students. The most used of these tools were as inspiration tools or for generating ideas in the design process stage. It also gives a 3D visualization of the space to the clients to show an idea of how it could look like. This tool can save time and costs for both designers and clients. The Questionnaire got 54 respondents and shows that around 20% of the participants were not aware of the mid-journey tool, and even if they knew about it, they never used it or tried how it works (more than 60%). Some participants are aware of other AI tools that have similar characteristics, such as Dall E, Binge, Roomai, RoomGBTm EvolveLab, etc. In addition, it was a challenge to decide whether this tool could replace human skills, maybe or not, as the participants were divided into two groups (agreed, maybe) or (not agreed), and both groups gave almost similar numbers of respondents. Also, most participants agree that this tool can benefit designers and Architects in their projects for inspiration, generating concepts, and getting new ideas.

Interviews were conducted with interior design students who tried exploring the mid-journey tool and got great inspiration. They tried many interesting things, including Art, Graphics, fashion, and interiors. The best result was with the interiors. As much as you write text, the more details, and realistic images you get. Some benefits of the mid-journey were provided by the participants, such as generating ideas quickly, giving more inspiration and helping in brainstorming, being easy to use, open to the public, and having endless variations with different sizes and ratios. There are also some drawbacks that users talked about, which are that this tool is not able to generate a space with specific dimensions and detail, and people may stop thinking and depend heavily on this tool.

5. Discussion

The first two questions of this research were asked about how mid-journey can improve Architecture and Interior Design outcomes and its benefits in such field. The research found that Mid-journey can help architects and designers in their projects because of the excellent quality image that they get, which is also close to what they have in their mind and save their time in preparing 3D visualizations using different software. It increased creativity and improved design quality by learning from feedback provided by architects and generating designs that meet their needs. Many Architects and architecture firms are using this tool because it can be cost-effective, as less time and limited resources are required to create high-quality designs.

The third question was how this tool can be used effectively in Architectural design. As was shown from the survey many respondents are not aware of the Mid-journey tool and how AI generators can affect their design and improve their skills. Therefore, one of the major points that need to be considered in the Architecture and Interior design study is applying these kinds of tools during the design process. These tools also need to be highlighted for graduates and specialists in the field to have a valuable impact on the industry by providing workshops or courses on these topics. In addition, AI skills can be added as a part of the required qualification to get a higher degree in the field.

The last question of the research was about the future of AI in the field of Architecture. It was found that Mid-journey can be improved a lot in the future as Vanucci (2022) says, “The images created are only graphic illustrations. There’s no inventive file to measure, extract shop drawings, or 3D print. However, it’s not difficult to imagine how this smart technology can be improved or implemented to more precise and clear outputs”. However, there is a limitation in creating visuals for drawings with actual dimensions created with CAD/CAM technologies. The file we use for designing can be conveyed to a machine for making. Also, Hassan Ragab says, “We should learn to harness this technique to our benefit by learning how to utilize it, by being updated, and keep following such technology. It is important to be able to discuss a lot of concerns regarding the usage of these tools without prejudice or bias and with an open mind. Kevin Abanto says, “It is possible for AI to replace manual 3D modeling workflows. Imagine that AI generates results in three dimensions, and you can edit it as you wish”. So, there are many expectations for AI tools that will be seen soon. Engineering societies should be responsible for introducing and improving AI skills to architects and designers to get the maximum benefit from It in their field.

6. Conclusions

The AI world is improving rapidly and affects many disciplines; the generative text-to-image tools encourage designers to explore design possibilities more from different perspectives. This study aimed to explore the use of the AI Mid-journey tool in Architecture and Interior Design and discover its impact on such fields. It was done through different quantitative methods such as questionnaires, and interviews. The study proved that AI tools will make a significant shift in the world of architectural design and the design process, and it can improve design outcomes in two areas: Academically and professionally. Academically, this tool can improve students' creativity and imagination skills within less time. Teaching AI tools to students as future designers will enhance the output of design projects. Professionally, architects and designers can generate ideas quickly for their clients while clients can also generate their own preferred ideas and present them to designers in a visual way for better understanding between the designer and the client. This research also found that there are many benefits of using mid-journey tools in the field of Architecture and Interior Design. Many Architects and Designers are already experimenting with these tools, and they benefit from them to explore complex issues and provide ideas for their clients. Others are combining architectural with contemporary design to explore the nature of design trends and technology. Moreover, it can generate high-quality designs in less time and cost-effectively with limited resources. However, Architects and designers should be careful about over-extreme imagination and expectations as this may cause a lack of reality in the design.

On the other hand, there are some limitations to the Mid-journey tool. First, the outputs of Mid-journey are only shown as visual representations of the generated ideas, but it is not real 3Ds with specific dimensions and correct scale. However, this may improve rapidly in the near future, and it may replace 3D modeling by generating three-dimensional designs in a few seconds. Second, this tool only works with one language, which is English, and this may not give us the expected results that we want because some words in Arabic or any other language cannot be translated to English with the exact meanings. Moreover, one of the limitations of this study is that this tool was not explored personally by the author to check personal ideas and what kind of results will be given. This is due to time and cost issues as this tool was open to the public for free, but just last month, it needed some payment to subscribe. However, further studies need to be done to continue with this study by exploring this tool personally and comparing it with other AI competitors' tools to discover the best results. Also, more investigations and interviews could be done with specialists in the field to explore if AI tools are used in architectural companies and firms and how they can benefit from it.

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Figures References

- **Figure 1:** Prompt: "A simple pencil outline of a circle on white". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 2:** Prompt: "A pencil line drawing of a circle". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 3:** Prompt: "A circle". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 4:** Prompt: "A circle made of branches, bronze metal and grass". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 5:** Prompt: "A circle made of ice, emerald and gold, and embers and ashes". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 6:** Prompt: : "A circle made of liquid gold, wood, and feathers". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022 Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 7:** Prompt: "A mysterious circle", "An evil circle", "A blossoming circle". Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

- **Figure 8:** Prompt: "A circle" in (9:16) and (16:9). Adopted from "Exploring Midjourney's AI art style using circles -" by S. Dennis, 2022, Towards Data Science. Retrieved from June 6, 2023, from https://towardsdatascience.com/exploring-midjourneys-art-style-using-circles-a461a78e7196

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Appendix
Appendix A: Questionnaire format:

The questionnaire will start with a brief introduction about the topic and the objectives of the study. This will give an idea about artificial intelligence (AI) technology for those who are not aware of it. Here is a sample of the questionnaire introduction and questions to show what it will look like.

Introduction to the topic:
Exploring Mid-journey generator as a new design approach in Architecture
Mid-journey is an artificial intelligence program, that can create images and art from a text description. You can describe what you want as a text, then watch the artificial intelligence (AI) text to image generator bring it to life in seconds. This survey is conducted by a PhD student from University of Bahrain. It aims to investigate knowledge of the Mid-journey tool and explore its impact on the Architecture and interior design field.

General information:
- Age – range (below 18 / 18 – 25 / 26 – 40 / above 40)
- Gender (male / female)
- Major
- Job
- Interest area

How far are people aware of mid- journey tools (awareness – knowledge)
- Did you hear about AI (Artificial intelligence) and mid-journey tools - an image generator? (yes/no) if yes how did you know about it?
- Did you use mid-journey tools before? (yes/no)
- If yes, how far do you use this tool? (Multiple choice)
- Do you know any text-to-image tools that are similar to the mid-journey tools? Please mention.

The possibilities of mid-journey generator in the Architecture and interior design field

- What is the purpose of using this tool? from your point of view (Multiple choice)
- What are the uses of this tool in architecture and interior design? (open-end)
- Do you think this technology can replace human skills and ideas? And why? (open-end)
- Imagine how will be the future of architecture and interior design with these new technologies? (open-end)

The benefits and drawbacks of using mid-journey tools (positive and negative)

- Do you think this tool is helpful in the architecture and interior design field? (yes/no) if yes, how? (open-end)
- What are the benefits of using the mid-journey tools?
- Do you think mid- journey has any drawbacks? Explain.

Appendix B: Interview 1

General information:

- Age – range (26 – 40)
- Gender (Female)
- Major (Interior Design)
- Job (student)
- Interest area: Art & Interior Design

- How did you know about the mid-journey tool, and what encourage you to try it?

I heard about it from my colleagues, and I did some search to learn about it and how it is used. The reason that encourages us to try AI – mid-journey tool is that my friend had a dream, and she wanted to discover what the background of the dream looks like, and she got a quite similar view of what we saw.

- How far do you use the mid-journey tool, and why did you use it? (What is the purpose of using it?)

Few weeks ago, I started experience the mid-journey with my friends and I like this tool and we are trying to explore it more. We used it to see different results of what we have in our minds. Currently I resister for Mid-journey tool with my friend. It costs a small amount monthly.

- **How does this tool used in architecture and interior design work and how does it affect their work?**

In Interior spaces, it is much more successful.
It gives the same vibes of the overall image, it can be used as inspiration for interior, to imagine and transfer what in your mind. Some image can be applied in real life as a 3D visual. There is a problem with the ceiling always giving high ceiling.

- **Give some examples from your experience in using this tool personally and how you used it to benefit from it.**

we tried many interesting things include Art, Graphics, fashion and interiors. The best result was with the interiors. I found that as much as you write text, the more details and realistic images you get .. there is also filtering options for more realistic details such as painting effects or any other details / we can also use reference photo but the result not that much perfect appear not realistic.

- **Did you use any other AI tool like Mid-journey?**

Through my search about AI tools, I found some software related to Interior Design, but I didn't try it because it's not free. I also tried ping search which have AI tool with 24 trials but the results are not similar to mid- jour.

- **Do you think this technology can replace human skills and ideas? How and why?**

No never will replace human however in future it may develop more but there should be always a person behind the scenes.

- **What are the benefits and drawbacks (or limitations) of using this tool?**

This is what we hear about and is easy to use at a lower cost.
A great inspirational tool and give more ideas, it collects different things from available data it gives different results but with the same spirit.
Very good starting in the AI world – it can be used in studios as an extra tool but not depend on it . It is not a real 3D, but it looks as 3D renders as we get from the 3Ds max. It almost gives the same style or vibes.

- **What is the impact of this tool on the future of Architecture?**

In the future, it may include more details as working drawings details to be ready to be used.

Appendix C: Interview 2

General information:

- Age – range (26 – 40)
- Gender (male)
- Major (Interior Design)
- Job (student)
- Interest area: art & architecture

- How did you know about the mid-journey tool and what encourage you to try it?

I saw about it in social media (Instagram) & some YouTube videos. I tried it as it looks like a helpful tool for design field in architecture as well as interior design. Also the experience is so fun according to what I saw in YouTube videos, as it is simple to use and not complicated.

- How far do you use the mid-journey tool and why did you use it? (What is the purpose of using it?)

I used it for about two weeks, but I don't use it anymore. The purpose was for fun for the first time as well as experimenting the quality of the outcomes and testing them whether it is really helpful in design projects or not. Then I used it to produce inspiration images for one of my interior design projects in the university.

- How does this tool used in architecture and interior design work and how does it affect their work?

In my opinion it is an effective tool for inspiration and it may help for creating new ideas for the designers, but it is not a tool for producing a real space visualization, which means that it could be useful only for ideation stage but never for later stages in a design project.

- Give some examples from your experience in using this tool personally and how you used it to benefit from it.

I used it to visualize an Islamic style architecture, then I focused more in Islamic libraries building and the style of the interior. Another topic I searched about is the biophilic buildings in general and how this generator imagines this concept in architecture and interior design. Also I did some experiments about buildings made with none structural materials like fluid, gas, and other imaginary materials which are not suitable for building.

The only experiment that benefited me in design projects was the one about Islamic architecture, as it gave me a good visual that really present the Islamic architecture, not only the patterns but even the natural lighting and the style of architecture and even the mood of the visuals.

- Do you think this technology can replace human skills and ideas? How and why?

I think this will never replaces the human skills as this technology is only for visualizing what inside the designer's mind, it cannot be used as professional visuals for certain project as it is not meant to be. It can enhance the creativity for designers but it will never replace them.

- What are the benefits and drawbacks (or limitations) of using this tool?

Benefits:

1- Very simple to use.
2- Great inspiration source.
3- Visuals within less than a minute (very fast).
4- Endless variations.
5- Open to public.
6- No special devices needed.
7- Updated versions.
8- Can creates different images sizes & ratios.
9- Can optimize the style of image eg (photo realistic, watercolor, oil painting, etc).

Drawbacks:

1- It is not free tool.
2- Can not be controlled partially (every time it creates a whole new picture).
3- Limited image size (not bad sizes but limited).
4- Controlled only and only by words (you cannot use any brush tools or other tools than words).

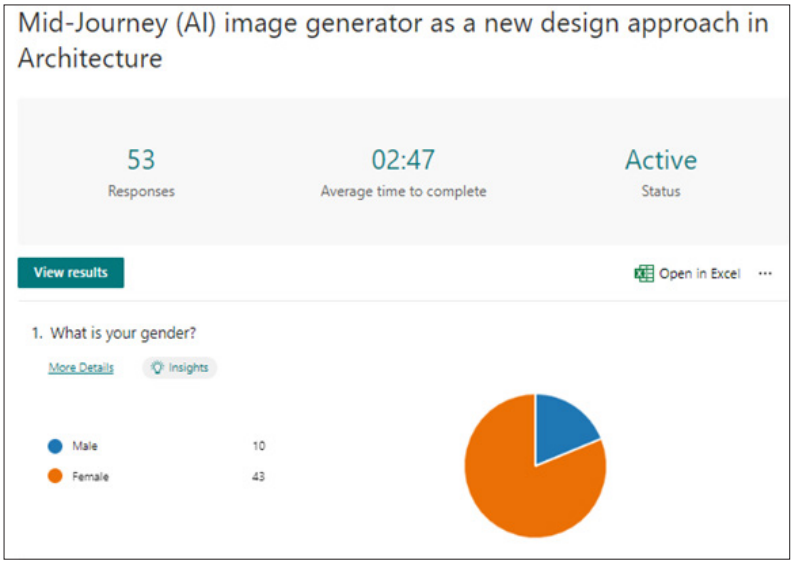
- What is the impact of this tool on the future of Architecture?

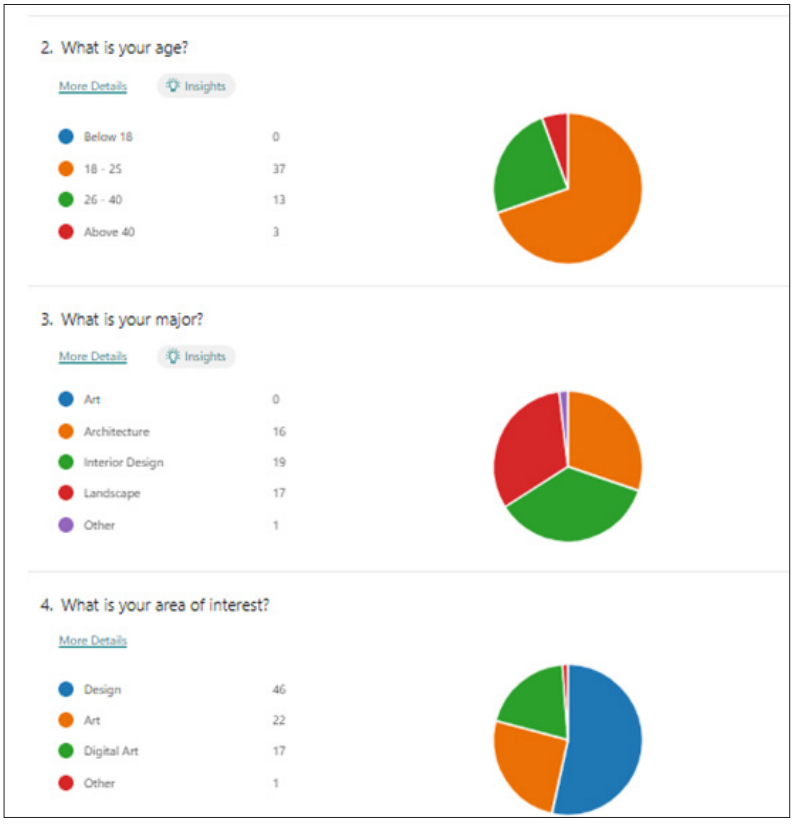
New forms of buildings will be seen.

- Any other comments or additions.

This is my experience in version 4.0, this generator is updated frequently and by the day it reaches 5.1 and the experience improving with these updates as well as the generated image's quality.

Appendix D: Questionnaire Results





5. What is your job?

More Details | Insights

Student	36
Academic Staff	9
Designer	5
Architect	3
Other	0

6. Did you hear about AI (Artificial intelligence) and mid-journey tools (a text-to-image generator)?

More Details

Yes	44
No	9

7. If yes, How did you know about it? (you can select multiple answers)

More Details

Social media	38
Internet search	13
Your friends, teachers and collea...	15
Other	0

8. Did you use mid-journey tools before?

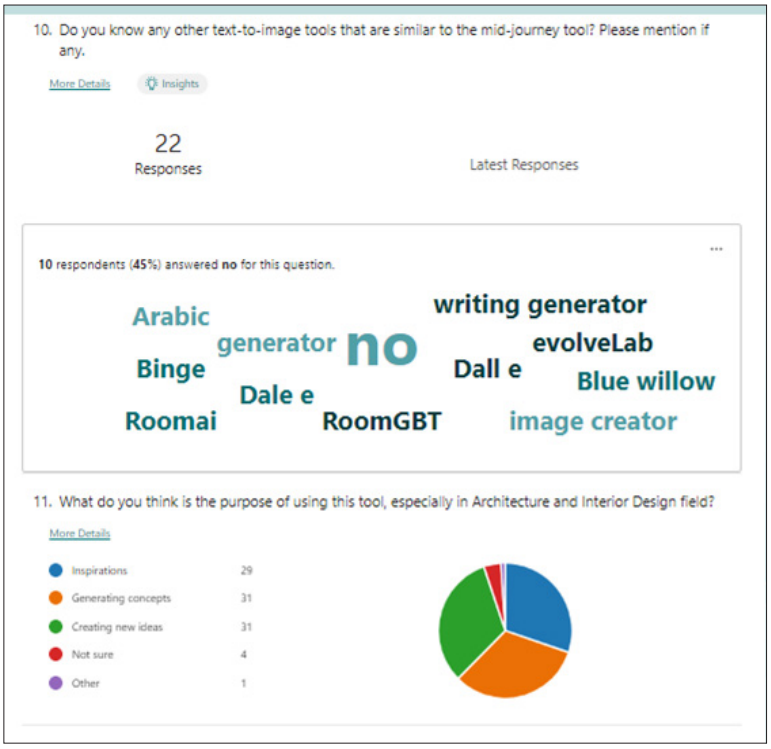
More Details

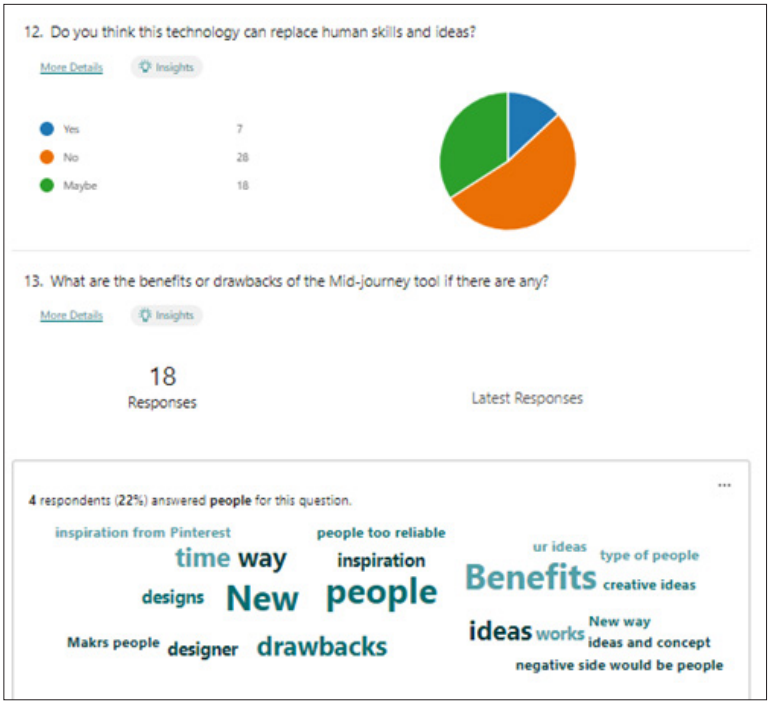
Yes	19
No	34

9. If yes, How far do you use this tool?

More Details

Always	2
Sometimes	8
Rarely	10
Never	14
Other	1


10. Do you know any other text-to-image tools that are similar to the mid-journey tool? Please mention if any.
More Details
Insights
22
Responses
Latest Responses
10 respondents (45%) answered no for this question.
Arabic
generator
no
writing generator
evolveLab
Binge
Dall e
Blue willow
Dale e
Roomai
RoomGBT
image creator
11. What do you think is the purpose of using this tool, especially in Architecture and Interior Design field?
More Details
Inspirations 29
Generating concepts 31
Creating new ideas 31
Not sure 4
Other 1


12. Do you think this technology can replace human skills and ideas?
More Details
Insights
Yes 7
No 28
Maybe 18
13. What are the benefits or drawbacks of the Mid-journey tool if there are any?
More Details
Insights
18
Responses
Latest Responses
4 respondents (22%) answered people for this question.
inspiration from Pinterest
people too reliable
time
way
inspiration
ur ideas
type of people
Benefits
designs
New
people
creative ideas
ideas
works
New way
ideas and concept
Makrs people
designer
drawbacks
negative side would be people

13. What are the benefits or drawbacks of the Mid-journey tool if there are any?

18 Responses

2	anonymous	Benefits: i think it is a great way when u type down ur ideas and concept or color scheme and see how they will match together to have inspiration from, it benefits a designer in a visual way just like having inspiration from Pinterest but its ur own ideas! Which is fascinating.. I personally don't see drawbacks but maybe its a negative point that all these generated designs where kind of collected from online works from designers
3	anonymous	New way for imagination, very usefull for specific type of people. People can use this ai tool to fill many art works or 3D visualization work and to avoid any copyrights in production.
4	anonymous	benefits : generating ideas quickly without having to go through the trouble of using time consuming softwares. drawbacks : not able to generate a space with specific dimensions and details yet
5	anonymous	Benefits: prompt concepts generations Drawback: limit creativity
6	anonymous	Not all concepts applicable
7	anonymous	Benefits: could save time especially when dealing with clients, gives more inspiration and helps in brainstorming. Drawbacks: although it could give inspiration, it can also make people stop thinking and depend heavily on these software.
8	anonymous	For now the best use is generating ideas when you have a block and can't come up with something new, they will help with creative ideas and feeding our eyes. The negative side would be people getting used to it to a point where they kill their own creativity. And I see it replacing some tasks and creating mood boards and similar tasks
9	anonymous	I have no idea
10	anonymous	Using it the right way can create new field of opportunities
11	anonymous	Representation of human figures and anatomy are still not accurate + Not all results are applicable to real life but can be inspirational
12	anonymous	Makrs people too reliable on technology
13	anonymous	It's really help to see the future
14	anonymous	Not doable realistic interior
15	anonymous	-
16	anonymous	-
17	anonymous	Help inspire new and innovative design in a time of ideablock within the designer mind
18	anonymous	-

Appendix E: Mid-journey Prompts for Architecture Design

***Prompt**: A modern house beside the waterfalls, in the forest, by Frank Lloyd Wright, extreme long shot, 8k— ar 16:9*

***Prompt**: An art museum, by Zaha Hadid, concrete and glass facade, natural light with warm tones, super-resolution — ar 16:9*

***Prompt**: A concrete science museum over a serene body of water, by Le Corbusier, minimal, — ar 16:9*

***Prompt**: A hotel in unusual shape, by Frank Owen Gehry, in the urban city — ar 16:9*

***Prompt**: : A modern city hall, over a serene body of water, minimal, inspired by Norman Foster — ar 16:9*

***Prompt**: An aquatics centre beside the waterfront, breathtaking structure, by Santiago Calatrava, natural elements — ar 16:9*

"Beyond Blueprints: Advancements in Architectural Education and Innovations" is a groundbreaking exploration of the dynamic world of architectural education and the remarkable advancements shaping the future of the discipline. In this book, a diverse group of authors from various backgrounds come together to present a comprehensive overview of the latest technologies, methodologies, and approaches revolutionizing the way architecture is taught and practiced.

Spanning seven thought-provoking chapters, this book delves into the cutting-edge developments that are reshaping architectural education. From the integration of artificial intelligence (AI) and virtual reality (VR) into design processes to the innovative use of digital tools, readers will discover how technology is expanding the boundaries of architectural creativity and problem-solving. Through captivating case studies and insightful analyses, the authors shed light on the transformative power of these tools, empowering architects, and educators to explore new horizons. Furthermore, "Beyond Blueprints" explores the evolution of architectural programs and curriculum, highlighting the emergence of interdisciplinary approaches that foster collaboration and integrate diverse perspectives.

With contributions from experts in architecture, technology, and education, this book offers a comprehensive and forward-thinking guide to the future of architectural education. It provides valuable insights for educators, students, and professionals alike, inspiring them to embrace the limitless possibilities that lie beyond traditional blueprints. "Beyond Blueprints: Advancements in Architectural Education and Innovations" is an indispensable resource for those seeking to shape the future of architecture and drive positive change in the built environment.

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