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Editorial

Mehmet Topçu (Editor in-Chief)

As we release Vol. 5 No. 2 (2024) of the Journal of Design for Resilience in Architecture and Planning (DRArch), we continue our exploration into the multifaceted world of architectural design and planning with a focus on resilience and quality. This issue presents a collection of articles that push the boundaries of our understanding of these critical concepts. This issue offers a wide range of perspectives and methodologies, each contributing to our understanding of resilience in architecture and planning. We hope these articles inspire further research and dialogue within the academic community.

In "Methodological framework of the emotional dimension in the built space for architectural quality," Hadjer Zeghichi and Said Mazouz introduce a user-centered approach that integrates environmental psychology and neuroscience to address the emotional impact of architectural spaces. This approach is vital for bridging the gap between subjective experiences and the technical rigor required in architectural design.

Odeta Manahasa, Manjola Logli, and Edmond Manahasa's study, "Capturing the social values of a mix-used university campus outdoor: An assessment of the Agricultural University of Tirana," highlights the significance of outdoor environments in mixed-use university campuses, emphasizing the indicators of well-being these spaces generate, which play a crucial role in enhancing community life.

Özlem Nur Aslantamer and Hüseyin Emre Ilgın, in "Exploring the impact of landscape design on user preferences in shopping centers post the COVID-19 Pandemic," explore the evolving landscape of shopping centers, revealing a shift towards outdoor and semi-outdoor spaces driven by post-pandemic user preferences. Their findings suggest that landscape design will be central to future shopping center developments, reflecting a balance between ecological sustainability and psychological well-being.

In "Navigating priorities: Assessing the challenges of curriculum reform in Turkish Urban and Regional Planning Schools," İpek Şen and Turgay Kerem Koramaz delve into the challenges faced by urban planning education in Turkey, particularly the tension between global curriculum integration and the pressing resource constraints that threaten educational quality.

Ayşegül Kıdık and Burak Asiliskender offer a comprehensive review of the evolution of design studio education in "An insight into architectural design studio education space from a 'time' perspective." Their analysis, particularly focusing on the integration of VR and AR technologies, underscores the necessity for adaptive and flexible educational models in architectural training.

"Digital game-based learning in architecture education: Consolidating visual design principles in freshmen," by Aslı Çekmiş and Mert Karakaya, introduces an innovative game designed to teach visual design principles to architecture students, demonstrating the potential of digital tools to enhance active learning and engagement.

Serdar Aşut's "Computational earthquake management: An educational perspective" presents a forward-looking approach to integrating computational thinking and earthquake management into architectural education, advocating for interdisciplinary learning environments that prepare students for real-world challenges.

Bilge Kalkan and Kağan Günçe's article, "Monastery heritage as a tool for reconciliation pre-post earthquake: The case of Saint Simeon Monastery," highlights the role of religious heritage in fostering post-disaster reconciliation, using the resilience of the Saint Simeon Monastery as a powerful symbol of recovery and unity.

In "Urban parks in developing countries: Challenges and opportunities in Addis Ababa, Ethiopia," Bruktawit Getachew Kebede and Devrim Yücel Besim compare two urban parks, offering critical insights into the challenges and opportunities these vital green spaces face in rapidly urbanizing contexts.

Finally, Mehmet Noraslı's study, "Perceptual effect of color use in patient rooms," explores how color choices in patient rooms can influence the mental and emotional well-being of patients, providing essential guidelines for creating healing environments that support patient recovery.

Together, these articles contribute to a deeper understanding of the complexities and challenges inherent in designing resilient and emotionally resonant spaces. We hope that the insights presented in this issue inspire ongoing dialogue and innovation within the field of architecture and planning.

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We believe in the strong relationship between the concept of resilience, characterized by the swift recovery from challenges through adaptive capacities, is at the heart of our exploration. DRArch goes beyond the traditional boundaries of resilience design, delving into the uncharted territories of future design in our ever-evolving world. DRArch stands at the forefront of innovation and foresight in the realm of design. As we navigate the complexities of the modern world, our commitment to anticipating the future, embracing sustainability, and integrating technological advancements with inspiration and aesthetics remains unwavering. DRArch serves as a catalyst for collaboration, providing a dynamic forum that bridges existing design knowledge with a futuristic approach. In essence, DRArch is not just a journal; it is a testament to our collective vision for a resilient, sustainable, and inspiring future. Join us on this transformative journey as we continue to shape the narrative of design for resilience, pushing boundaries and fostering a community of building a brighter tomorrow. I would like to extend my deepest gratitude to all participants and all our readers for the support they provide to the Journal. And I would like to a special thanks to the referees. We look forward to your comments, contributions, suggestions, and criticisms.

Best regards...

Following names that provided valuable contribution as referees of articles in this issue are:

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DRArch's objectives are:

- to question how future building technologies are revolutionizing architectural design, city planning, urban design, landscape design, industrial design, interior design and education,

- to catalyze the processes that lean on interdisciplinary and collaborative design thinking, creating a resilient thinking culture,

- to improve the quality of built environment through encouraging greater sharing of academicians, analysts and specialists to share their experience and answer for issues in various areas, which distributes top-level work,

- to discover role of the designers and design disciplines -architecture, city planning, urban design, landscape design, industrial design, interior design, education and art in creating building and urban resilience,

- to retrofit the existing urban fabric to produce resilience appears and to support making and using technology within the building arts,

- to discuss academic issue about the digital life and its built-up environments, internet of space, digital in architecture, digital data in design, digital fabrication, software development in architecture, photogrammetry software, information technology in architecture, Archi-Walks, virtual design, cyber space, experiences through simulations, 3D technology in design, robotic construction, digital fabrication, parametric design and architecture, Building Information Management (BIM), extraterrestrial architecture, , artificial intelligence (AI) systems, Energy efficiency in buildings, digitization of human, the digitization of the construction, manufacturing, collaborative design, design integration, the accessibility of mobile devices and sensors, augmented reality apps, and GPS, emerging materials, new constructions techniques,

-to express new technology in architecture and planning for parametric urban design, real estate development and design, parametric smart planning (PSP), more human-centered products, sustainable development, sustainable cities, smart cities, vertical cities, urban morphology, urban aesthetics and townscape, urban structure and form, urban transformation, local and regional identity, design control and guidance, property development, practice and implementation.

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Editorial Team

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Table of Contents

JOURNAL OF DESIGN FOR RESILIENCE IN ARCHITECTURE & PLANNING

Research Article
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Methodological framework of the emotional dimension in the built space for an architectural quality

Hadjer Zeghichi[*]
Said Mazouz[**]

Abstract

Architecture quality is complex due to a number of factors. Some of these factors implicitly engage in deep reflection on architectural space, then they end up having a significant impact on the user's architectural experience. For the purposes of this paper, *experience* is considered as any contact between the user and the built environment through the architectural space, where the impact will be the result of both objective and subjective factors. Among these subjective aspects, we focus on the *emotional dimension* of the user's experience. This theoretical article will address this issue using an inductive approach. The main purpose is to examine the role of each of the following elements: firstly, the architect's perception of architectural space, in particular in relation to the traditional duel between form/space or geometry/architecture; secondly, the impact of emotion which is thought to be most closely related to human nature in promoting architectural quality; and finally, we will attempt to define the methodology that will enable the architect to address this emotional dimension in such a technical practice. The desired and appropriate methodological frame is intended to provide a scientific solution to the potential conflict between subjective and objective factors from the disciplines and participants involved. To do so, it should represent the first level (level-0 methodological framework) where the user-centered approach takes precedence and coordinates between architects, environmental psychologists and neuroscientists to prepare the quantitative and qualitative data needed to support the next level (level-1: architectural design), which is primarily the responsibility of the architect.

Keywords: architectural quality, architectural space, emotional dimension, methodological framework, user-centered approach.

1. Introduction

Despite the differences between the architect's and the user's visions, they tend to be reconciled on a common ground known as *architectural quality*. However, in order to achieve this latter effectively, it is necessary to take a higher interest in architecture because of its utilitarian character which the other arts do not have (Mazouz, cited in Bouchareb, 2020), as well as the interest that the architect must show for the user (Noschis, 1988) as a whole and across all levels (Lehman, 2017). Similarly, Eberhard (2009) is convinced that spaces designed based on extensive research can produce positive scientific outcomes such as the reduction of stress and inherent chronic illnesses. So, the depth of architectural thinking on space and the user simultaneously is another argument for highlighting the consistency of researches to be carried out in this field.

Otherwise, the user is less concerned about these fundamental issues. He is seeking a space that fulfills his needs in various dimensions (Preiser & Vischer, 2005). In this way, architectural quality occupies a natural place in design to meet the needs of users through solutions that are functional,

[*](Corresponding author), Assist. Prof., University of Oum El Bouaghi, Oum El Bouaghi, Algeria, Hadjer.zeghichi@univ-oeb.dz [**]Prof. Dr., University of Oum El Bouaghi, Oum El Bouaghi, Algeria, mazouz.said@univ-oeb.dz
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technical, environmental, social and economic, while being culturally relevant (Government of Quebec: Aide-mémoire sur la qualité architecturale, 2022). Thus, it is important that architectural quality faithfully respects the different levels that make up the human experience, namely: "the physiological, intellectual, emotional, behavioral and spiritual" (Lehaman, 2017, p.26), while the contemporary architecture lacks the sensory dimension (Zineddine & Belakehal, 2021).

Analyzing the current situation makes it is easy to understand a number of factors that impact on architectural quality. These include the need to build more quickly and at a lower cost, construction methods, standardization of programs and building materials, and cost rules that guide the built environment without considering climatic conditions or cultural variables (Laroui, 2017, p.1). According to Boudon (2003), fieldwork also shows that the realized projects focus less on research into materials and massing than on research into concepts. As a result, architectural quality may seem incomplete for the user when the emotional dimension, in particular, is diminished due to various factors such as a reductive vision, limited understanding of the user's needs or even a poor ordering of priority dimensions.

2. Quality and architectural quality

Quality in general is seen positively; However, it can also have negative connotations (Rönn, 2011) and adverse effects on mental well-being (Abbas et al., 2024). This suggests that the concept of quality is open to debate and should be the subject of a well-founded discussion (Rönn, 2011) to manage its effects. Therefore, quality can be defined differently depending on the chosen criteria, although two main approaches can be distinguished. According to Reeves and Bednar (1994, cited in Mjit, 2021, p.594), the first one considers quality objectively, focusing on:

1. The excellence of the service offered.
2. Product compliance with norms and standards.
3. The product production process.

Mjit (2021) also presents the second approach, which involves the user's evaluation. The complexity of dealing with the user's subjective dimension must be considered.

Overall, these two definitions represent architecture that is simultaneously with space and the user's satisfaction on various scales and dimensions, such as technical, architectural, and other factors. This makes the architect's job twice as difficult.

2.1. Evolution of the concept of architectural quality

There are various phases that characterize the development of architectural quality. However, its evolution is mainly marked by replacing the model based on the skills of the person responsible for design with an industrial model based on the production process (Dehan, 2005)[1]. After the latter's failure, a competition policy was introduced where the best project would be selected from other competing projects (Dehan, 2005). Margerand and Gillet-Goinard (2006) believe that the concern is due to the fact that compliance is assessed based on specifications, whereas satisfaction is linked to users. In addition, this observation will be beneficial in architecture in order to preserve the human essence of space which is tending to fade because of the increasing development of intelligent technologies that are gradually moving away from the emotional dimension of architecture. For their part, Zineddine and Belakehal (2021) encourage architects, both researchers and practitioners, to inspect contemporary architectural quality in terms of the senses, alongside the other dimensions.

Recently, articles on architectural quality have been distinguished by two main aspects. The first highlights the opening of this concept to other, non-quantitative aspects, by emphasizing the psychological and sensory dimensions. This is due to the desire to integrate this dimension in order to meet all user's needs. The second and most predominant aspect is more global and specifically

[1] This section particularly discusses how French architecture has evolved. We think that these stages are generally transferable.

concerns the energy dimension, which aims to improve energy quality in order to meet the current global climate challenges.

2.2. Definition of the concept of quality

Le Robert (cited in Dehan, 2016, p.90) cites the twelfth (XIIth) century as the date of appearance of this word, as it also mentions its origin derived from the Latin "qualis (quel)". Among the six (06) meanings mentioned (Dehan, 2016, p.90), we shall cite the meaning that we consider the most relevant to our purpose, as: 1. attribute, character, property; 2. that which makes a thing, a person, good, better (Dehan, 2016, p.90). Once the word *quality* has been attributed to another, it will give an assessment of it, such as the quality of a product or service is its ability to satisfy the customer's needs (Margerand & Gillet-Goinard, 2006, p.XI).

Architectural quality can also refer to total or partial conformity to the code of a style or subculture with a distinctive taste characteristic. Hence, it's frequently used to assess building's aesthetic value (Larochelle, n.d, cited in Hanafi & Alkama, 2019). This aesthetic dimension emphasized in this definition would only be complete with the integration of certain parameters that enable a true assessment of architectural quality, such as ecological qualities, social and functional aspects, perceptual and experiential aspects (Larochelle, 2010, cited in Laroui, 2017, p.10; Hanafi & Alkama, 2019), which makes it possible to arrive at overall architectural quality.

Technically speaking, the International Organization for Standardization has defined quality and, at the same time, cited the conditions for achieving it concretely according to the ISO 9000 (2015)[2]. The standard defines the ability of a set of intrinsic characteristics to satisfy requirements [and that it is tangible] when the nature of the service offered corresponds to the requirements.

Finally, despite all this diversity of definitions of quality and their different aspects, three pillars form a basis for a global and shared definition. Since Vitruvius and even today, the three essential principles of *solidity*, *habitability* and *beauty* (CAUE28, 2014) support the various attempts to define it in different fields. In architecture, these three concepts are frequently mentioned in the designer's mind, either explicitly or implicitly, fully or partially, and even before they become apparent in the project. Besides, implementing architectural quality factors will make the meaning conducted by these definitions more operational. Dehan (1999, cited in Hanafi, 2021) (Figure 1) has categorized these factors into three (03) groups corresponding respectively to *use*, *durability* and *form*. The intended quality should then emerge from their harmonious use with the different dimensions of the user's needs mentioned above.

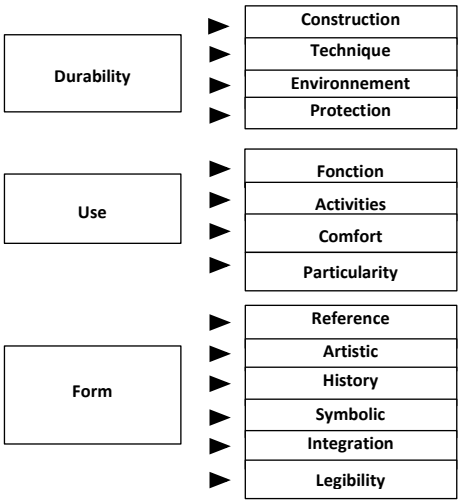

Figure 1 Summary diagram of the architectural quality of an architectural work (Dehan, 1999 in Hanafi, 2021, p.5)

[2]ISO 9000 2015 FR version.

The indicators relating to the three dimensions of architectural quality presented in (Figure 1) include, among them, an artistic indicator that derives from form. This is explained by Özsavaş Uluçay (2017, cited in Müezzinoğlu et al., 2023) who states that architecture and art are a subset of each other and hence have a universal relationship. This artistic component naturally calls for quality to be considered in relation to the effects that art might naturally induce in the user including emotions.

2.3. Characteristics of architectural quality

Listing the characteristics of the quality is another crucial element for comprehending that concept. According to the awareness poster (CAUE28, 2014), these correspond to the following elements:

1. A vision liberated and independent of a dogma or changing fashion in the image of new advanced technologies.
2. The adoption of timeless values that form a hard and permanent core of architecture.
3. The ability to respond to today's demands and challenges.
4. Perfectly in harmony with Mies Van der Rohe's “Less is more” philosophy, these characteristics tend towards minimalism, broadening its scope so that it can respond to a wider range of criteria.

So, as it can be understood, quality in architecture should be viewed in a positive light because, as per Rönn (2011), it represents a high-level goal. From a European perspective, (Rönn, 2011) outlines three tiers for achieving quality. The first tier is seen as a project-related attribute, the second focuses on the talent and skills of the architect, and the third involves assessing how well the project integrates into its surroundings (Rönn, 2011). This suggests that quality is multifaceted and should be considered from different perspectives, with emotions highlighted as a key and critical factor in this article.

3. Emotions as determinants factor in architectural quality

It is common to accuse emotions of being the opposite of reason (Schenk, 2009). However, they play very important roles, such as maintaining social cohesion, determining priorities in relationships, informing individuals about the state of their environment and informing others about their motivational and emotional state (Niedenthal et al., 2009). It is therefore essential to review their real importance for the user experience in architecture.

3.1. Definition of emotions

Debates on emotions require a consensual framework in order to come up with a well-defined definition. Kleinginna and Kleinginna (1981, cited in Proulx, 2001) were able to distinguish the following three components: affective, cognitive and polymorphism to characterize emotions. Similarly, Sander (2008-2009) specifies the following parameters that are part of this definition:

1. The subjective dimension.
2. The categories of trigger stimuli.
3. Physiological mechanisms.
4. The expression of emotional behavior.
5. Adaptive effects.
6. Disruptive effects.

In terms of a consensual and synthesized definition for this multitude of parameters, Scherer (2001, cited in Coppain & Sander, 2010, P.17) proposes to define emotions as a set of episodic variations in several components of the organism in response to events evaluated as important by the organism. The proposal by Kleinginna and Kleinginna (1981, P.355, cited in Proulx, 2001, pp. 54-55) is more generalized, stating that emotion is a complex set of interactions of subjective and objective factors, mediated by neural/hormonal systems.

These attempts to define a general formula for emotions are beneficial for architects so they give them an indication of the elements to use in their design to integrate the emotional dimension in order to enhance the architectural experience.

3.2. The emotional dimension of architecture

Although emotions are accused of lacking objectivity, according to Serero and Terracol (2019) they remain a key component in the user experience. And because good architecture is only exceptional and therefore naturally emotional (Ardenne & Polla, 2011, p.15, cited in Bambridge, 2018, p.9), Cyrille[3] (cited in Monnet & Vos, 2011) argues that architecture has always had a complex and long-standing relationship with emotions.

In fact, the study of the link between architecture and emotions was first approached through environmental psychology in the 1950s, when the collaboration between the doctor Jonas Salk and the architect Louis Khan led to the conclusion that our built environment has an impact on the way we think, feel and behave (Pin, 2016, cited in Meriaux et al., 2021). In this context of direct influence, certain bad conditions relating to noise, insalubrity, narrowness of spaces and light conditions are likely to destabilize people and give rise to bad emotions such as anxiety (Stassi, 2012), whereas the main aim is to procure positive emotions (Stassi, 2012) such as the enchantment that modern architecture, which has transformed the human being into measurable data, lacks (Gilsoul, 2009).

It is important to note that the emotional dimension in architecture is not an abstract value that can be calculated. It is a parameter to be thought of in parallel with space, and more particularly with the internal space that constitutes the genesis of architecture. Zevi Bruno (cited in Boudon, 2003, p.53) describes architecture in terms of internal space and its emotional qualities, saying that a beautiful building is one whose internal space attracts, uplifts and spiritually subjugates us; an ugly building is one whose internal space tires or repels us. So, the architect who wants to address such a topic as quality and emotions in architecture, is supposed to start with space, which is the central focus of design. Hence, the user's emotional connection to the architectural space is primarily established through mobility, spatial perception, and the emotions triggered, rather than solely through ocular stimulation (Ioannou, 2023, p.11).

4. Architectural space as a focus for cultivating the emotional dimension

Quality is inherent in architecture, because it enables it to achieve more than just creating technically feasible spaces. Brigitte Métra[4] (cited in Jourdheuil, 2020, pp.10-11) expressed the same idea saying that standard cells with no quality are often imposed to them and in some cases, they are no longer allowed to do any architecture, and their work is reduced to that on the facades. On another dimension, Sana Layeb (2022, p.54) refers to Bellusso et al. (2017) to show the negative impact of the normative approach that reduces architectural and sensitive quality in special education facilities for children with autism. Here, the normative approach which has shown to be insufficient in delivering holistic quality, is accused of diminishing the architectural and sensitive qualities of the architectural space.

Considering the architectural space as a maturing stage of development for the concepts that are supposed to satisfy the various needs, it is essential for the architect to think more carefully about it (the space) in order to exploit all its characteristics to achieve the necessary qualities, including emotional impact. We shall approach the ensuing elements according to this perspective.

4.1. Architectural space, attempts at a definition

Etymologically, the word space is derived from the Latin word *spatium*, which meant racecourse, expanse, distance (Paquot & Younès, 2012, p.8), while the Larousse online dictionary (n.d.) gives

[3] Cyrille Simonnet, professor of architectural history in the History of Art Unit of the Faculty of Arts and editor of the journal Faces.

[4] Brigitte Métra, born in Besançon on 25 March 1954, is a French architect. A former associate of Jean Nouvel, she runs an architectural practice and has designed a number of buildings in France and China, including the associate architect of the Philharmonie de Paris.

several variants, including: Def.1: A particular property of an object which causes it to occupy a certain extent, a certain volume within an extent, a volume, necessarily larger than it, and which can be measured. Def.2: Surface, area, volume intended for a particular use.

These different definitions tend to designate a surface or expanse with particular properties intended for a specific use and occupying a volume. This is a great fit for the field of architecture, where the goal of the intervention is to create one space or several spaces in accordance to the intended use and attributes of this latter. However, in order to formulate a synthesis of architectural space, we can refer to Amaldi (2007) who defined it in relation to both the designer who deals with abstract notions and the user who lives the subjective experience. This shows that the most exhaustive definition should not take into account a single actor or a single dimension, but rather consider them as two parts of the equation.

4.2. Typology of spaces as a set of scales for integrating the emotional dimension

The aim of this study is about highlighting other factors that influence design, such as the architect's perception of space, that is why the emphasis is on the complementarity between these different types of space rather than on discussing which dimension is better than others.

As seen below in (Figure 2), Boudon (2003)[5] proposed four types of spaces where three of them are explicit and one is implicit.

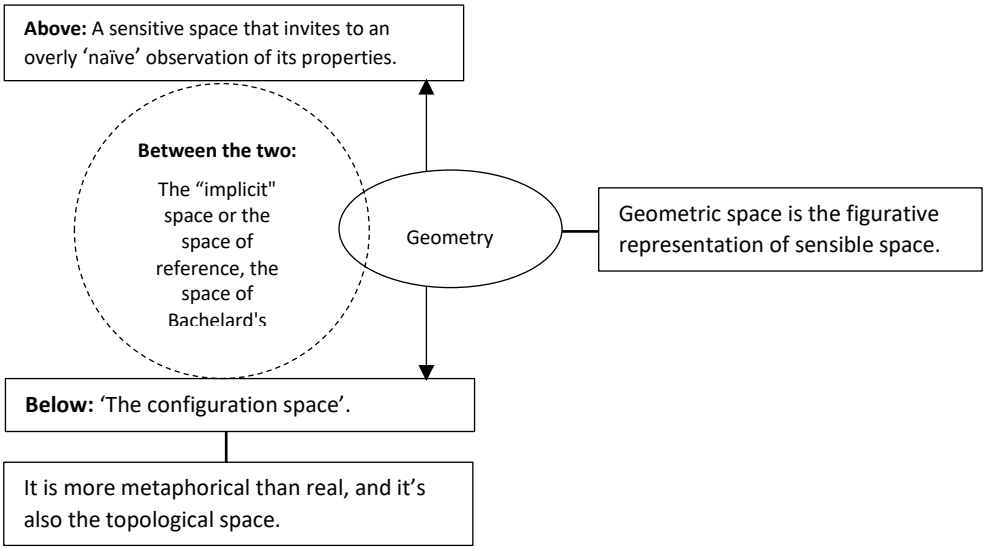

Figure 2 Diagram of types of space according to Boudon's thinking (Prepared by the author on the basis of Boudon, 2007, p.80).

The manipulation of these types of space is a scale play in which the reference space (space of design) is attributed to the architect under the following nominations: *concrete*, *true*, *abstract*, *geometric space*, or even *the space of the building*, becomes for the user the *space of representation*, *sensitive space*, *phenomenological space* (Boudon, 2003). But the problem arises when the term architecture is used interchangeably for these different types (Layeb, 2016-2015), or even when the only definition of architecture is the concept of *concrete space* (Boudon, 2003).

Overall, this typology of spaces represents architectural design on two levels. The first expresses the articulation between its mental side as a global and abstract image of one or more objects (Larousse, 2001, cited in Othmani, 2010) and the second is practical as an act of creating a whole (Othmani, 2010). It is, therefore, essential to focus on the design of space, not in its processual form, but rather as an act of managing space (Pingusson, 2010) in relation to these different types

[5] Bachelardian philosophy has been mentioned in the diagram (Figure 2) in order to respect the description given by the author Philippe Boudon, although we are cautious about his philosophy built in a personal and tormented context.

in order to determine the appropriate level to incorporate the emotional dimension to provide the best possible architectural quality with a strong and distinct architectural character.

4.3. Typology of spaces and the relationship between them

Architecture begins with an idea and ends by giving it concrete form. According to Boudon (2003), this transformation occurs through a fundamental and permanent process of back and forth between reasoning in architectural mode and representation in geometrical mode with the contribution of other specialties like mathematics. The graphic below with the notes that follow show the contribution as well as the crucial role of each of these specialties in this transition from idea to volume:

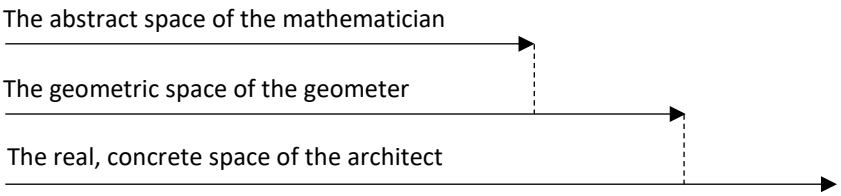

Figure 3 Abstraction of the Boudon's thinking on the difference types of space (Prepared by the author on the basis of Boudon's text, 2003, p.80).

- The mathematician ignores the distinctions between the various types of space, since he doesn't need to consider how to occupy the space he creates. As a result, the soul of the space is absent in this type.
- Despite staying relatively superficial, the geometer is one step ahead of the mathematician and gives the space a form based on a naive realism of spatial properties (Boudon, 2003, p.80).
- The architect goes further and puts the greatest effort into designing the real, concrete space where we walk and where our body's activity takes place (Boudon, 2003, p.59).

This anatomy of the process of transforming the idea into a concrete/real space will facilitate achieving the desired holistic quality. In this instance, the logical sequence of these different stages reveals its characteristics, making it possible to determine exactly the role that each actor must play. Bachelard, as expressed by Boudon (2003), places geometry halfway between the abstract space and the concrete space; as such, for the architect, geometry is nothing more than an abstract mathematical tool that enables him to represent phenomena geometrically and organize them. Thus, according to Boudon (2003), this issue is not limited to the geometric representation of the phenomenon, because architecture focuses on the phenomenon itself to be represented, which gives the architect the ultimate responsibility of enhancing the space for the user by taking into account his experience of it, rather than focusing solely on the design.

This first stage of reflection on space as the genesis of architectural quality should be assisted by a second one dedicated to the reflection on the methodological framework to discuss the best way of coordinating the various actors from different disciplines who can contribute to achieving holistic architectural quality.

5. Methodology for dealing with the emotional dimension

Research on architectural and urban ambiences has traditionally adopted a method based on an intelligibility model made up of quantitative and qualitative parameters, as well as a more interdisciplinary method at the intersection of in situ perception, intersensoriality and social representations (Augoyard, cited in Gilsoul, 2009). Recently, artificial intelligence has emerged as a major player in the emotional aspect of architecture design, proposing to analyze user's sensitive and emotional data[6] (Serero & Terracol, 2019). Overall, rather than relying on descriptive theorizing

[6] The example mentioned by the author (Serero & Terracol, 2019, p.29) is a database that classifies emotions related to the perception of space using artificial intelligence.

studies, the emotional problem can be resolved through collaborative work including architecture, environmental psychology and neurosciences. This work needs to be carried out within a multidisciplinary, interdisciplinary or transdisciplinary framework in order to benefit from the contributions of each of the disciplines involved, depending on the aims assigned (Moser, 2009).

5.1. Methodological framework for integrating the emotional dimension into architectural design

The three primary issues that are likely to impede the study of ambiences are listed by Gilsoul (2009, p. 83) as follows:

1. The complexity of ambience where intersensoriality engages interdisciplinarity.
2. The problem of objectivity which concerns the method used to operationalize and objectify sensitive data.
3. The question of *continuous creation* (Grosjean, Thibaud, dir. 2001, cited in Gilsoul, 2009, p.83), where we need to explain the creation of atmosphere in relation to the built environment and social practices.

In fact, the methodological delicacy becomes more apparent because emotions must be understood simultaneously in relation to the user and the physical attributes of the space. Hence, environmental psychology is the best basic method to study them more effectively.

However, complexity does not seem to be the only issue that the architect has to deal with; the most critical one is the subjectivity of the user. The section that follows gives a sight on acceptable methods and instruments to provide methodological clarity on the topic of the emotional dimension in architecture.

5.2. Environmental psychology

Applying the psychological dimension to a technical field like architecture is challenging for a practicing architect. In this case, environmental psychology allows us to deal with the reciprocal interaction between the surroundings and the user's perceptions, emotions, attitudes, and behavior (Lecomte, 2017, p.97). These themes are the three main axes of environmental psychology mentioned by Bonnefoy (2017, p.12) in the following order:

1. The effects of the physical and social environment on cognition and behavior.
2. Perception, evaluation and representation of the environment.
3. The relationship with the living environment.

On the other hand, the characteristics of environmental psychology, such as uncertainty, the holistic aspect and flexibility provide support for dealing with these themes of perception and representation of the environment (Moser, 2009, pp.58-60). This process simultaneously involves perceptual, cognitive, affective and conative processes, all combined with past personal experiences (Moser, 2009, p.65).

5.3. Emotions through the prism of environmental psychology

Environmental psychology is an inductive approach that gives architects a comprehensive or systematic understanding of the subject of their research (Moser, 2009). As seen in (Figure 4), Nasar (1998, p.5, cited in Moser & Weiss, 2003, p.56) deconstructs the evaluative response to the environment and visualizes the emotional reactions to various individual and environmental factors with the aim of explaining the mechanism by which emotions emerge.

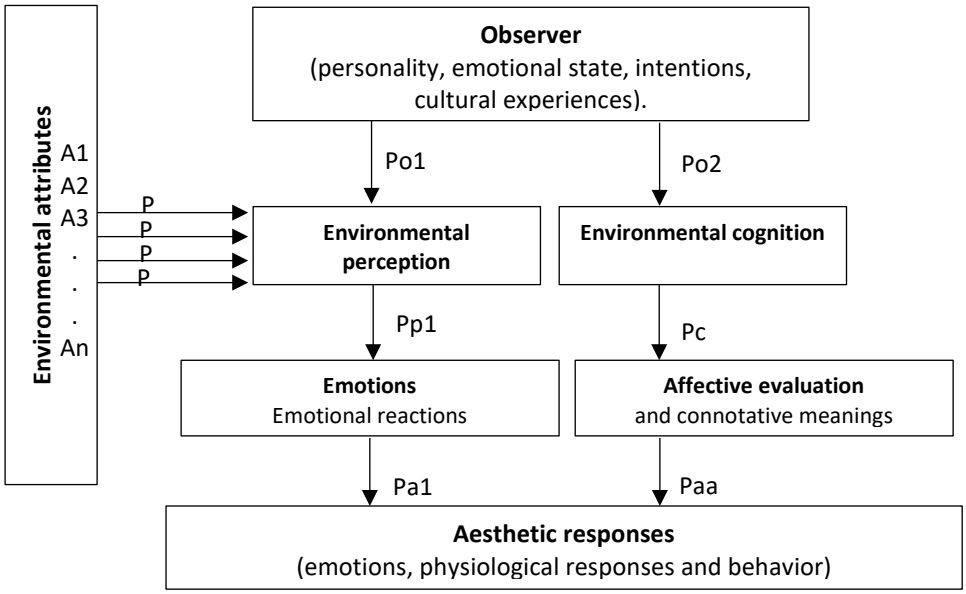

Figure 4 David Miller's model of the evaluative response to graphic environment (Nasar, 1998, p.5, cited in Moser & Weiss, 2003, p.56).

According to Lehman (2017), a balanced approach to researching emotions in this setting is favored by developing a system that learns from every contact between the user and his architectural surroundings (Figure 5). This will allow architecture to engage more actively with the social sciences which have a significant influence on the field of emotional dimension research.

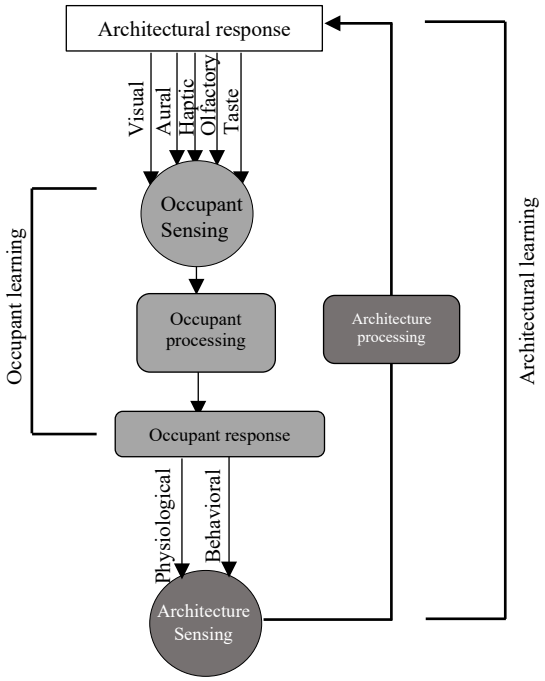

Figure 5 The role of adaptive architecture (Lehman, 2017, p.73)

5.4. The methods most commonly used in environmental psychology

Architects have to investigate and assess user's emotional responses to their designs. To do so, they can adopt two global approaches, either the approach called the *place-centered method* which uses the environment and its characteristics as its focal point (Moser, 2009, p.63) or the other one called *person-centered method* (Moser, 2009) also known as *occupant-centered design* (Lehma, 2017, p.3) which focuses on the user's subjective appreciation of the environment. However, the

success of this type of issues depends on the right selection of data collection techniques as well as the quality and applicability of the information provided to architects by environmental psychologists (Moser & Weiss, 2003).

Among the many approaches to assessing spatial experience in relation to emotional state, it is worthwhile to list the most popular techniques available, going from the most theoretical to the most experimental in terms of how they have evolved over time.

a. Basically, the theoretical methods mentioned by Moser and Weiss (2003, pp.60-77) such as:

1. Sensory pathways.
2. Simulation.
3. Questionnaires.
4. The theory of personal constructs.
5. Semantic differentiator.

b. The intermediate phase is one step ahead of the classic tools, using physiological reactions to measure the somato vegetative reactions generated by the evaluation (Proulx, 2001).

c. The most recent stage provides highly sophisticated data from the neurosciences to explain this mechanism of influence. This approach has shown in an unexpected way that there is a possibility that the brain can reorganize itself and that this reorganization can improve human emotions, thoughts and actions (Verdonk et al., 2021). These results were confirmed by neuroimaging, observing the activation of certain areas in response to specific categories of primary emotions (Verdonk et al., 2021).

6. Toward the right methodology for good architectural quality through emotions

Emotions are problematic since they are subjective and are not static (Moser, 2009, p.59), as a result, it's challenging to handle them (Gilsoul, 2009). However, in order to deal with them, designers have traditionally had recourse to the theories and findings of a few related disciplines (Pallasmaa, 2013, cited in Gepshteina & Snider, 2019), such as psychology and environmental psychology which have enabled the study of sensitive experience. Subsequently, the results from environmental psychology were much scientifically improved by the neurosciences thanks to their extremely advanced and modern instruments. The experimentalist paradigm of neurosciences has also allowed to understand the human cognition (Shamay-Tsoory & Mendelsohn, 2019). As a beneficial result, the alliance between architecture and neuroscience has given rise to the new field of neuroarchitecture, which serves as a window into exactly what happens in humans after they encounter certain buildings or locations as shown in (Figure 6) through the implication of its main elements (George & Prakash, 2024, p.6).

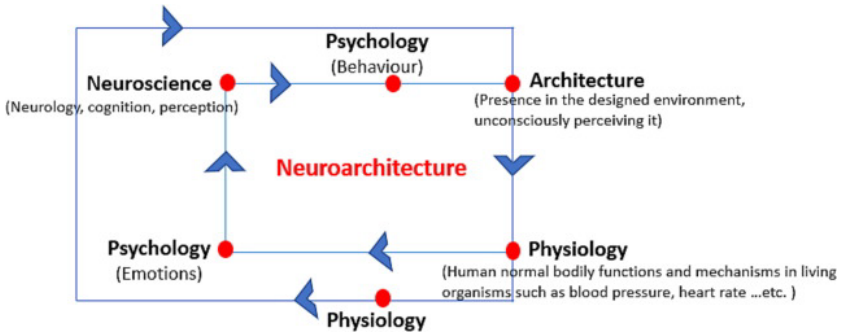

Figure 6 The cyclic relationship between the pillars of Neuroarchitecture (Assem, Khodeir, and Fathy 2023, p.5, cited in George & Prakash, 2024, p.6).

Though, despite the accuracy of neuroscience in relation to other theoretical fields, Levine (1983, cited in Dalton, 2023) points to an “explanatory gap” in terms of the mechanism that could be at the origin of the emergence of this emotional impact during the interaction between the user

and the architectural space. This can be explained by the fact that this mechanism of influence cannot be comprehended by merely imaging neuronal activity in connection to the mental process (Dalton, 2003) since there is a complete field of cooperative research between classical techniques and neuroscience that has to be established. This work which unites architects and scientists will be able to answer the fundamental question of what we are going to design and how this design is going to provide a positive experience for the user (Eberhard, 2009). Effectively, some recent researches were able to explain how surroundings can impact the user's emotions and behaviors through the neurosciences field. Abbas et al. (2024) have confirmed that emotional response to architecture is innate and that's why there is a close relationship between humans and architectural through emotions. So far, this emotional response is affected by architectural forms (Banaei et al., 2017, cited in Abbas et al., 2024).

Based on these observations, our research suggests that this collaboration should bring together architects, environmental psychologists and neuroscientists. The latter's intervention should take place at the base of the pyramid (Level-0) designated for the establishment of a methodological framework that can organize collaboration between the *classical approaches* of environmental psychology and the experimental approaches of neuroscience (Figure 7). The reason for placing them at this initial level is that they are complementary and will enable the designer to begin the design process with a thorough understanding of how the environment interacts with it, thanks to the tools employed by each of them.

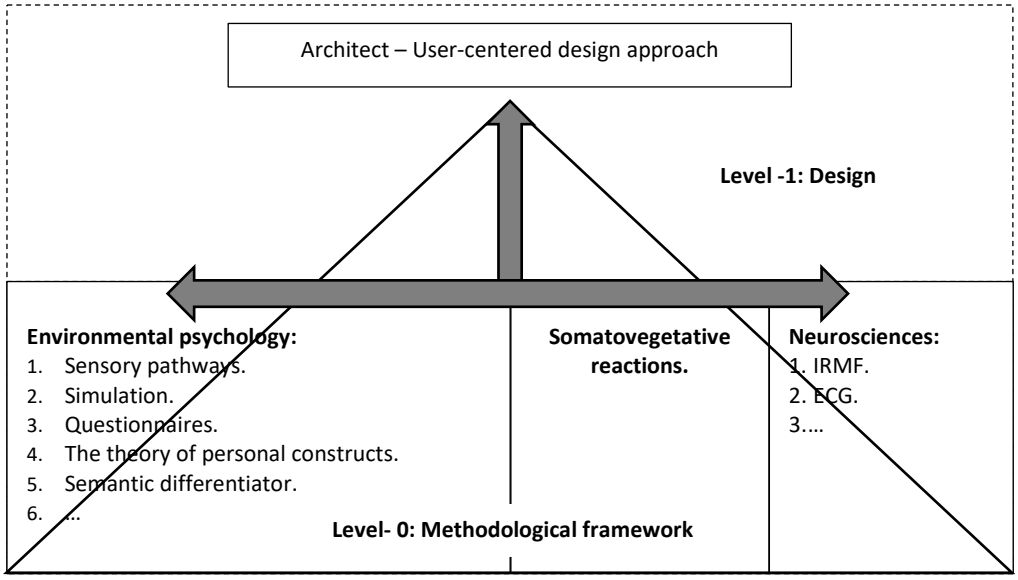

Figure 7 Constituents of the framework Methodologies for studying the emotional dimension in the built environment (The author)

This beneficial combination is particularly relevant for those who are interested in the emotional dimension of architecture. According to this scheme (Figure 7), they will take as their starting point the theories of environmental psychology in order to support the scientistic approach where the computer model that is very widespread in current architectural practice does not take affect into account and merely simulates emotions (Gilsoul, 2009), even though we are always confident that the variables chosen are the right ones, thanks to the rigorous scientific filter of neuroscience.

Dehan (1999, cited in Laroui, 2017, p.9) states that the majority of the factors that make up architectural quality are not technical, many of them cannot be measured objectively, and some require the mediation of a survey and sociological analysis. Based on this, we think that this methodological framework is considered complete to help us comprehend emotions in the built environment. In fact, it is considered as such because it offers a wide range of data which covers a quantitative physiological and cognitive data for the functioning of the body and brain besides qualitative data collected using the traditional instruments of environmental psychology.

In this case, we would say that this methodological framework addressed to the emotional issue must be able to identify the following components:

1. **The appropriate approach** would be a user-centered approach which values the user's needs in the design and attempts to meet them.
2. **The appropriate tools** that can provide more precise qualitative and quantitative variables which are easy to measure and quantify.
3. **The exact variables** dictated by the nature of the project to be designed in the next design level (Figure 7. Level-1: User-centered design).

7. Conclusion:

In response to the quest for quality in architecture and its associated parameters, it was essential to analyze the existing postulates using an inductive approach in order to identify any potential gaps. The final objective is to reconcile the fundamental concepts involved, namely the *architect*, the *user* and the *architectural space*, in order to arrive at a methodological framework that facilitates the harmonious fusion of the emotional dimension of the user and the technical practice of architecture to achieve an architectural project of satisfactory emotional quality for the user. To achieve this, architects must adopt a new culture that incorporates teamwork with scientists into their design practice which is already based on their creative and intuitive approaches (Eberhard, 2009).

So, given that architecture aims to achieve quality at a higher level by using the central and determining component, namely architectural space, it is essential that the architect begins to verify this desired quality at the start of the design process, as soon as he begins to develop the architectural space. In other words, it is necessary for the architect to manage his vision of the architectural space in such a way as to project the impact on quality by considering, on the one hand, the needs of the user and, on the other, the spatial variables.

Fundamentally, it is impossible to ensure high-quality architecture based only on quantitative requirements. Respect for the user and all of his needs, which inevitably includes the emotional dimension, is necessary to achieve this satisfaction. However, to be able to speak about optimal architectural quality, only positive emotions procured through architecture should be taken into account. Hence, the term *emotional* should not be considered in the broadest sense of the word. In order to achieve this objective, it is essential to take several parameters into account in a person-centered-design approach that focuses primarily on the user.

Even though it's widely accepted that emotions play a crucial role in architectural space, architects find it so challenging to include them that they have reduced this issue to the aesthetics and/or external form. Indeed, emotions are fragile so that they require adequate data from an appropriate methodology to reconcile the quantitative and qualitative dimensions.

In conclusion, we can state that architectural design can go further in terms of technology and intelligence, but it also needs to be qualitative, taking into account the emotional experience that distinguishes human beings.

References

Abbas, S., Okdeh, N., Roufayel, R., Kovacic, H., Sabatier, J., Fajloun, Z., & Khattar, Z. A. (2024). Neuroarchitecture: How the Perception of Our Surroundings Impacts the Brain. *Biology*, 13(4), 220. https://doi.org/10.3390/biology13040220

Amaldi, P. (2007). *Espaces*. La Villette.

Bambridge, A. (2018). *Le contenu émotionnel en architecture à travers le travail de Peter Zumthor* [Emotional content in architecture through the work of Peter Zumthor]. Architecture, aménagement de l'espace. https://dumas.ccsd.cnrs.fr/dumas-02352224v1

Bonnefoy, B. (2017). Psychologie environnementale. *Espaces Naturels*, (n° 58), 12. http://www.espaces-naturels.info/file/7449/download?token=A3rGgEe2

Bouchareb, A. (14 décembre 2020). SAID MAZOUZ (Architecte/urbaniste/universitaire): "Il est temps pour l'état d'aller plus vers la régulation et d'abandonner son statut sacro-saint". (Interview Part 2 suite et fin.). *VILLES ET PROJETS, SAVOIRS ET ACTIONS*. https://doi.org/10.58079/v9am

Boudon, P. (2003). *Sur l'espace architectural* [On architectural space]. Parenthèses.

CAUE28, C. d.-E.-L. (2014). *La Qualité Architecturale, Affiche de sensibilisation*. Chartres. http://caue28.org/sites/default/files/pages-fichiers/14_qualite-archi_oct2014_web.pdf

Coppin, G., & Sander, D. (2010). *Chapitre 1 : Théories et concepts contemporains en psychologie de l'émotion* [Contemporary theories and concepts in the psychology of emotion] [Lesson]. www.unige.ch. https://www.unige.ch/fapse/e3lab/static/pdf/Coppin%20&%20Sander%20(2010).pdf

Dehan, P. (2005). La construction collective de la qualité. *POSITIONS. La qualité architecturale entre art et usages*. Intervention au colloque Ramau (PUCA-DAPA) (pp. 88-93). https://cahiers-ramau.edinum.org/423?file=1

Dehan, P. (2016). *Pertinence d'une approche globale de la qualité architecturale dans l'optique de la construction d'un jugement critique raisonné* [Relevance of a global approach to architectural quality with a view to developing a reasoned critical judgement] [PhD thesis]. Université de Paris-Est & Ecole Nationale Supérieure d'Architecture Paris-Malaquais. http://www.theses.fr/2016PESC1176/document.

Dalton, R. (2023). The Science behind our Emotional Connection to Architecture. *a+u magazine.* https://www.heatherwick.com/wp-content/uploads/Ruth-Dalton-The-Science-behind-our-Emotional-Connection-to-Architecture.pdf

Eberhard, J.P. (2009). *Brain landscape, The Coexistence of Neuroscience and Architecture.* Oxford University Press.

George, J., & Prakash, V. P. (2024). Exploring the Influence of Neuroarchitecture on Human Behavior and Well-being. *Indian Scientific Journal of Research in Engineering And Management*, 08(03), 1-9. https://doi.org/10.55041/ijsrem28978

Gepshtein, S., & Snider, J. (2019). Neuroscience for architecture: The evolving science of perceptual meaning. *Proceedings of the National Academy of Sciences of the United States of America, 116*(29), pp. 14404-14406. https://doi.org/10.1073/pnas.1908868

Gilsoul, N. (2009). *L'architecture émotionnelle au service du projet, Etude du Fonctionnement des mécanismes scénographiques dans l'œuvre de Barragan (1940-1980)* [Emotional architecture at the service of the project, Study of the functioning of scenographic mechanisms in Barragan's work (1940-1980)] [PhD thesis]. AgroParisTech - Ecole Doctorale ABIES. https://pastel.hal.science/pastel-00005540

Gouvernement du Québec. (2022). *Pour une architecture humaine, durable et créative, Aide-mémoire sur la qualité architecturale*. Canada.

Hanafi, A., & Alkama, D. (2019). L'architecture en Algérie entre repère et ambigüité. *International Journal of Innovative Research in Human Sciences, 3*(3), 001 014. https://www.researchgate.net/publication/348488450_Article_hanafi_L'architecture_en_Algerie_entre_repere_et_ambiguite

Ioannou, A. (2023). The power of daylight. Daylight influencing emotions and spatial perception of indoor space. [Dissertation, KTH Royal Institute of Technology | School of Architecture and the Built Environment]. https://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-342964

ISO. (2015). ISO 9000:2015(fr) *Systèmes de management de la qualité — Principes essentiels et vocabulaire* [Quality management systems - Essential principles and vocabulary]. International Organization for Standardization. https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-4:v2:fr

Jourdheuil, A. L. (2020). Qualité(s) architecturale(s) des logements sociaux produits par les promoteurs immobiliers : une question qui fait débat [Architectural quality(s) of social housing produced by property developers: a matter of debate]. *Les Cahiers de la recherche architecturale urbaine, 8.* http://journals.openedition.org/craup/4842

Laroui, A. (2017). *La qualité architecturale des bâtiments publics à Ghardaïa, Cas d'étude bâtiment du siège de l'office de promotion et de gestion immobilière -OPGI-* [The architectural quality of public buildings in Ghardaïa, case study of the headquarters building of the Office de Promotion et de Gestion Immobilière -OPGI-] [Magister dissertation]. Université Mohamed Khider – Biskra. http://thesis.univ-biskra.dz/2995/1/M%C3%A9moire_28_2017.pdf

Larousse. (s.d.). Dictionnaire de français Larousse. https://www.larousse.fr/dictionnaires/francais

Layeb, S. (2015-2016). *Essai d'épistémologie de l'architecture. Cours de 1ère année : Théorie de l'art et de l'architecture* [Lesson]. Ecole Nationale d'Architecture et d'Urbanisme, Carthage, Tunisie. https://www.academia.edu/19589912/Cours_1_epistemologie?auto=download

Layeb, S. (2022). La perception de la transition architecturale chez l'enfant avec autisme [The perception of architectural transition in children with autism]. *Revue française de pédagogie*, 214, pp. 53-69. https://doi.org/10.4000/rfp.11302

Lecomte, J. (2017). La psychologie environnementale [Environmental psychology]. Dans J. Lecomte, *30 grandes notions de la psychologie* (pp. 97-99). Dunod. https://doi.org/10.3917/dunod.lecom.2017.01

Lehman, M. L. (2017). *Adaptive Sensory Environments an introduction*. Routledge.

Margerand, J., & Gillet-Goinard, F. (2006). *Manager la qualité pour la première fois* [Managing quality for the first time]. Edition d'Organisation. https://socialmediacameroun.files.wordpress.com/2016/11/jean_margerand__florence_gillet-goinard-manager_la_qualitecc81_pour_la_premiecc80re_fois__conseils_pratiques__diagnostic__plan_d_action__certification_iso_9001__-editions_d_organisation2.pdf

Meriaux, M., Ngambi, L., & Denis, J. (2021). « Quand je suis arrivé en salle d'attente, j'avais déjà envie de faire demi-tour ». *L'architecture au service de l'accueil des urgences psychiatriques. Journal Européen des Urgences et de Réanimation, 33*(3), 162 169. https://doi.org/10.1016/j.jeurea.2021.10.001

Mjit, A. (2021). La qualité : définition consensuelle ou polémique ? [Quality: a consensual or controversial definition?] *International Journal of Accounting, Finance, Auditing, Management and Economics-IJAFAME, 2*(5), pp. 592-607. https://www.ijafame.org/index.php/ijafame/article/view/384/299

Monnet, V., & Vos, A. (2011). Construire et émouvoir. *Campus* (103), pp. 12-27. www.unige.ch/campus/index.php/download_file/view/1584/170/

Moser, G. (2009). *Psychologie environnementale, Les relations homme-environnement* [Environmental psychology, Human-environment relations]. De Boeck.

Moser, G., & Weiss, K. (2003). *Espaces de vie, Aspects de la relation homme-environnement*. Armand Colin.

Müezzinoğlu, M., Akan, S., Dilek, H., & Güçlü, Y. (2023). An analysis of spatial designs produced through mid-journey in relation to creativity standards. *Journal of Design for Resilience in Architecture & Planning, 4*(3), pp. 286-299. https://www.researchgate.net/publication/376605418_An_analysis_of_spatial_designs_produced_through_mid-journey_in_relation_to_creativity_standards

Niedenthal, P., Silvia Krauth-Gruber, & Ric, F. (2009). Chapitre 1. Que sont les émotions et comment sont-elles étudiées ? Perspectives cognitives et psycho-sociales. Dans S. Krauth-Gruber, P. Niedenthal, & F. Ric, *Comprendre les émotions* (pp. 9-45). Mardaga.

Noschis, K. (1988). Intéresser l'architecte à l'usager. *Habitation : revue trimestrielle de la section romande de l'Association Suisse pour l'Habitat, 61*(7-8), 16-19. http://doi.org/10.5169/seals-128900

Othmani Marabout, N. (2010). *Etude des interactions maîtresses d'œuvre-maître d'ouvrage dans un processus de conception architecturale, Etude de cas : Projets de logement* [Magister dissertation]. Université Mohamed Khider – Biskra. http://thesis.univ-biskra.dz/2416/1/M%C3%A9moire_2010.pdf

Paquot, T., & Younès, C. (2012). Introduction. Dans T. Paquot, *Espace et lieu dans la pensée occidentale : De Platon à Nietzsche* [Space and place in Western thought: From Plato to Nietzsche] (pp. 7-11). La Découverte. https://doi.org/10.3917/dec.paquo.2012.02.0007

Pingusson, G.H. (2010). *L'Espace et l'architecture, Cours de gestion de l'espace 1973-1974*. Linteau.

Preiser, W. F. E., & Vischer, J. C. (2005). *Assessing Building Performance*. Routledge.

Proulx, J. (2001). *De la rationalité des émotions* [On the rationality of emotions] [PhD thesis]. Université du Québec. https://depot-e.uqtr.ca/id/eprint/6661/1/000685874.pdf

Rönn, M. (2011, January). *Quality in Architecture : A Disputed Concept* [Conference paper]. Royal Institute of Technology, Stockholm, Sweden. https://www.researchgate.net/publication/277744433

Sander, D. (2008-2009). *Psychologie de l'Emotion* [Lesson]. Université de Genève. https://www.unige.ch/fapse/motivation/courssander.pdf

Schenk, F. (2009). Les émotions de la raison. *Revue européenne des sciences sociales, XLVII*(144), 151-162. https://doi.org/10.4000/ress.75

Serero, D., & Terracol, P. (2019). *Systèmes de conception intelligents pour l'architecture, Recherche sur les impacts de l'intelligence artificielle sur l'acte de construire*. Architecture Intelligence International conference. Paris, France. https://hal.science/hal-02915617

Shamay-Tsoory, S. G., & Mendelsohn, A. (2019). Real-Life Neuroscience : An Ecological Approach to Brain and Behavior Research. *Perspectives On Psychological Science*, 14(5), 841-859. https://doi.org/10.1177/1745691619856350

Stassi, V. (2014). *Architecture & émotion* [Degree ESA-Grade 2]. Ecole spéciale d'architecture. http://doc.cresson.grenoble.archi.fr/doc_num.php?explnum_id=1305

Verdonk, C., Claverie, D. & Trousselard, M. (2021). Chapitre 2. Contribution des neurosciences à la psychologie positive. Dans : Charles Martin-Krumm éd., *Grand manuel de psychologie positive : Fondements, théories et champs d'intervention* (51-63). Dunod. https://doi.org/10.3917/dunod.marti.2021.02.0049

Zineddine, S., & Belakehal, A. (2021). La Sensorialite comme Thematique de L'architecture du Xxème Siecle en Algerie. *مجلة العمارة وبيئة الطفل, 6*(3), pp. 175-192. https://www.asjp.cerist.dz/en/article/177556

Resume

Hadjer Zeghichi is an assistant professor at the Institute of Urban Technology Management and a member of the LEQAREB lab at the University of Om El Bouaghi in Algeria. In 2014, she earned a master's degree in architecture specializing in the option of Architecture, Shapes, Ambiences, and Sustainable Development. This multidisciplinary program has provided her with a broad view of various themes related to both human beings and the environment across different levels. Currently, she focuses her research in the field of psychology, investigating the interaction between the built environment and the behavioral and emotional dimensions of users in order to improve the architectural experience.

Said Mazouz is a university professor in the Department of Architecture at the University of Oum El Bouaghi, Algeria, where he also occupies the position of LEQUAREB Research Laboratory Director. Furthermore, he is the author of several books, including "Éléments de conception architecturale" and the latest one, "Formes Urbaines et Espace Public dans la Ville Algérienne Contemporaine: Des mots sur les maux" in 2024. He is also the co-author of the book "La ville et le desert," edited by Marc Cote. His fields of interest are as diverse as his teaching experiences at various universities, including the University of Biskra (1983–2013, Algeria), ENAU, Tunisia (visiting professor, 2003–2023), and finally the University of Oum El Bouaghi, Algeria (2013–present). These domains encompass architectural design, architecture, sustainable urban planning, space syntax, and urban architecture, all of which he has explored through numerous scientific papers published in prestigious journals.

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Capturing the social values of a mix-used university campus outdoor: An assessment of the Agricultural University of Tirana

Odeta Manahasa[*]
Manjola Logli[**]
Edmond Manahasa[***]

Abstract

Although mixed-use campuses are recognized by designers, little attention is paid to the social values that their outdoor environment generates for the wider community. Aiming to identify social values, the methodology used in this study includes a survey that is applied via an online questionnaire (N=156) to explore users' perceptions about the values the campus produces to translate into indicators of wellbeing. This study's aim is to identify indicators of wellbeing that can capture campus social value, referring to a continuously changing campus (Agricultural University of Tirana). The results indicate that the social and cultural benefits that come from a mixed-use campus are related to the adequacy of physical outdoor environments and social activities. However, compared to mixed-use spaces, outdoor spaces that preserve the functions of agricultural backgrounds (as originally designed) have higher social values. We suggest that both physical and non-physical determinants play a basic role in enhancing social interaction (this is a strong indicator), so they must be included in the policies and strategies of the higher education systems.

Keywords: mix-used, university campus, outdoor environment, satisfaction, social sustainability

1. Introduction

It is well accepted that universities in general and university campuses, together with their outdoor environments, are promoters of socio-cultural sustainability in the society for the society (Fuchs et al., 2022). There is much research that is focused on the research of the university campus and the effect that its outdoors has on the students' wellbeing and learning outcomes (Van de Bogert et al., 2020; Puhakka, 2021). Being aware of these facts, universities are spending enormous amounts of money on the construction of new buildings and new spaces about the universities that foster the relationship between the users. Especially their outdoor spaces are social and cultural activity places that enhance sustainability in a society, contributing to better urban living (Göçer, et al., 2018).

Even though university campuses are generally designed to foster social interaction and therefore sustainability, when it comes to the relationship between students and the built environment, sustainability remains a challenge. It is important for designers, researchers, policymakers, and stakeholders to understand how users, especially students, perceive the outdoors' influence on social sustainability. Students play an influential role in shaping the social sustainability of the campus outdoors; however, since their presence on campus is limited to their

*(Corresponding author) Assoc. Prof. Dr., Epoka University, Albania, odurmishi@epoka.edu.al
**Assist. Lecturer, Epoka University, Albania mlogli@epoka.edu.al
***Assoc. Prof. Dr., Epoka University, Albania, emanahasa@epoka.edu.al
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studying period, there is a need to depict and capture the social values provided by the interaction that they have with the built environment.

Thinking of the triple bottom line of sustainability, the architecture defines in a way the constituents of "Design Value". Social value, as one of these components, is produced by architecture and the built environment, however it is poorly understood (Samuel & Hatleskog, 2020). Social value in the built environment refers to the social impact that any institution makes on the lives of people and communities that are affected by its activities (Raiden & King, 2021). Thus, a contextual and operational interpretation would help in the ambiguity of the social values that the outdoor campuses produce.

Outdoor spaces on campuses that are already used by the community might offer social values for both students and the wider community. These settings, which are meant to support students' quality of life, often end up promoting social segregation. In this situation, there is a need to utilize a communication tool that can bring into surface the aspects of this segregation to understand what changes may take place and to conserve or recover the functions of outdoor campus spaces. However, there is little information on how to evaluate without creating subjective uncertainty. An established culture on university campuses encounters challenges when opened to nearby citizens, and there is a need to implement some sustainable solutions in the built environment for sustainable development. Researchers (Qtaishat et al., 2020) acknowledge that there is not a definite list of indicators that assist in measuring sustainability.

To analyze this, our research applies the concepts of social sustainability and social value of the built environment to study a complex, mixed use campus. Social sustainability is defined as a condition that is life enhancing, but at the same time the process that brings to this condition (McKenzie, 2004). It aligns very well with the rapid changes in the outdoor environment of the campuses and the continuous movement of the students, and therefore it might be "counterproductive to delimit social sustainability in space and time" (Stender & Walter, 2020).

Second, a built environment generates social values, one aspect of which is wellbeing (Samuel & Hatleskog, 2020). There are two reasons for applying these two concepts; first social sustainability brings social and physical aspects together, and second, depicting the social values of the campus would help in the discourse of understanding the dilemmas and the gaps resulting from the mix-used campus and social sustainability.

In this respect, through this study, we aim to answer the following research questions:

i. How do university users establish and maintain their social sustainability?

ii. What social values are encouraged by the physical setting of a continuously changing campus, and how may they be preserved?

Through the only designed campus in Albania as a case study, this research reveals whether social interaction is sufficient to attain social sustainability and, at the same time, tries to capture the social value of the outdoors of this campus. We focused on satisfaction as one of the indicators of wellbeing on the campus. Wellbeing is a social value that architecture generates together with job creation, learning that takes place during construction, user input in the design process, and using local materials (Samuel & Hatleskog, 2020).

Spatially speaking, this campus does have a unique layout transformation, due to the special context of post-socialist Tirana, which underwent turbulent, uncontrolled urban development resulting in informal settlements. As such, this campus is being used by citizens, who are benefiting from it, yet their contribution to the institution is not what it ought to be.

For a better comprehension of the concept in the below section, we explain the determinants of social dimensions of sustainability and their relationship to campus culture so that we can identify the role that social interaction plays in the user's satisfaction and consequently look for social value conservation.

1.1. Social Interaction and Built Environment

Social contacts are considered the most important part of an experience (Bechtel & Churchman, 2002). They have a great impact on communities, contributing to a range of beneficial economic and social networks (Williams, 2005). The social network brings a good understanding of the users, but at the same time, it brings positive actions due to the encouragement of sharing ideas and activities (Bechtel & Churchman, 2002; Gehl & Svarre, 2013). Thus, the physical environment is indeed a good supporter of social interaction. Yet, the users and the social factors are the other components of this interaction (Williams, 2005) (Figure 1). What researchers stress (Karuppannan & Sivam, 2011; Bertlin, 2014; Williams, 2005) is that interaction happens in communal spaces of good quality that are accessed easily and aesthetic spaces with a safe and comfortable environment. On the other hand, there is reduced social interaction when there is poor quality, safety, and maintenance of communal spaces (Jabareen, 2006) and when segregation of users is present. The users should be willing to socialize, the environment should offer different social dynamics, and the users should share not only the space but also time and more (Williams, 2005).

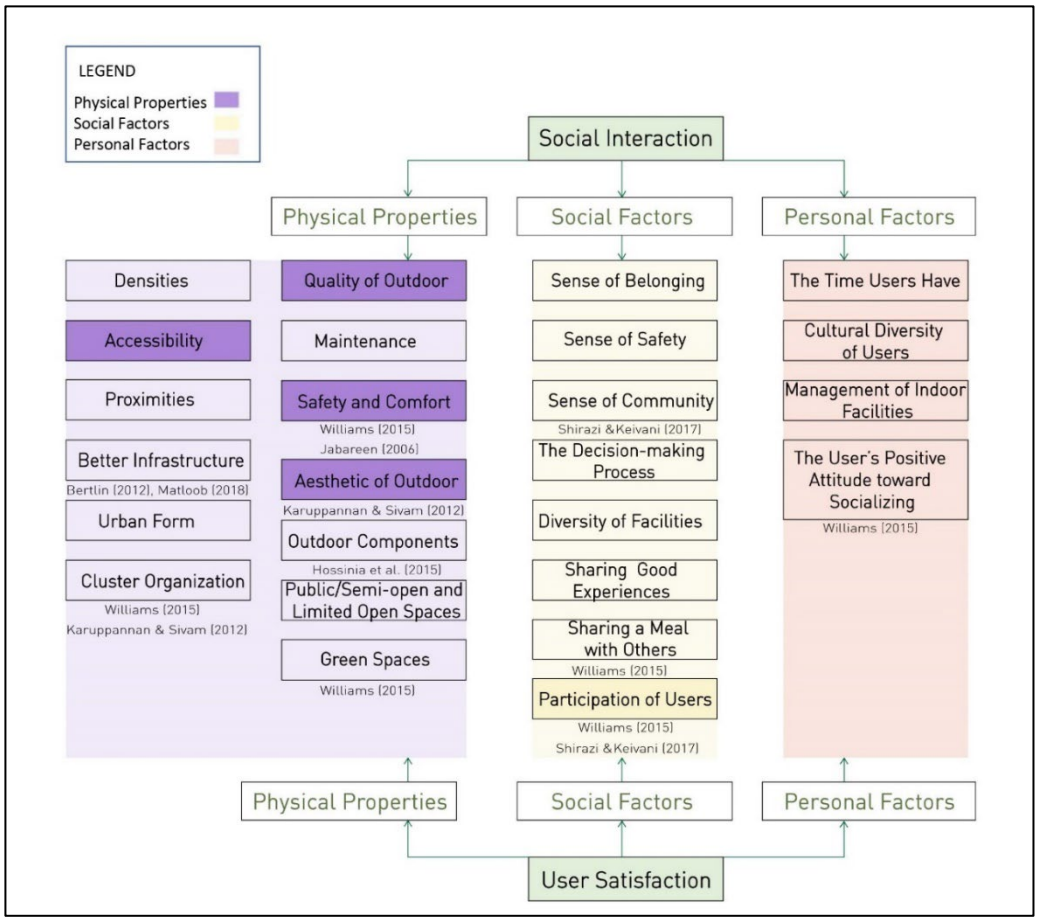


Figure 1 Variables of social interactions (Based on literature reviewed by authors)

The quality of the outdoor space with all its components is the main reason that invites users. When this quality is combined with aesthetics and the feeling of being comfortable and safe, physical qualities that considerably promote social interaction are created. The social interaction on the campuses depends deeply on access to open and recreational areas. The creation of a walkable environment on the campus relates to its layout (Benneworth, 2010). Thus, special attention should be given to the spatial developments of the university campuses. They are the medium where cities and universities meet (Matloob et al., 2014). Thus, there is a vital need to integrate all its physical, cultural, and social aspects to create a pleasing and friendly environment

for all campus users, leading to a socially and culturally sustainable environment (Karuppannan & Sivam, 2011).

In this respect, satisfaction is considered one of the significant factors that form the basis for evaluating social sustainability (Chan & Lee, 2007). Figure 1 presents a collection of the variables that push toward social interaction. Coming to some conclusions, it is seen that user satisfaction is what lays the basis for the evaluation of the campus outdoor space. User satisfaction consists of physical, cultural, and social determinants that have a direct effect on overall satisfaction among users (Karna et al.,2013; Guite et al., 2006; Hashim et al.,2016; Petruzzellis et al., 2006; Permentier et al., 2011; Esfahani, 2012).

1.1.1. Physical Environment as a Determinant of Satisfaction

Regarding physical aspects of the outdoor environment, outdoor quality, similar to the other determinants, is tested by measuring student satisfaction (Petruzzellis et al., 2006). Certainly, the quality of a built environment is viewed as basic for health and safety (Guite et al., 2006). Also, the higher the quality and maintenance, the more satisfied the user is (Petruzzellis et al., 2006).

According to Gehl (2011), visual and aesthetic aspects create the basis for architecture. Further, a poorly maintained area contributes to user dissatisfaction (Bechtel & Churchman, 2002). Also, the quality of outdoor spaces is important since it motivates the users to use that space again (Akhir et al., 2018). Additionally, the aesthetic visuality of outdoor spaces increases the pleasure of users and makes them enjoy their experiences (Abu-Ghazzeh, 1999). In consequence, a satisfied user creates special bonds with different outdoor spaces or services, encouraging a sense of belonging to that space (Akhir et al., 2018). Eventually, quality is dependent on ambient properties and architectural features. Ambient properties consist of factors, such as: 'thermal comfort, appropriate lighting, pleasant sounds, and comfortable air quality. On the other hand, architectural details are considered to give a feeling of aesthetic control and lessen the potential for dissatisfaction (Bechtel & Churchman, 2002).

Furthermore, with this configuration, satisfaction is related to other determinants as well. Good access between various services or public spaces is one of them. (Abd-Razak et al., 2012). "Accessibility is an essential sustainability indicator for university campuses, that leads to innovation and the concern about campus spaces used by pedestrians" (Eckert, 2012). Also, locations and proximity to cultural and entertainment activities or facilities influence satisfaction (Permentier et al., 2011; Lu, 1999; Harris, 2001). Thus, infrastructure places a high value on accessibility, designers should pay attention not only to walkways to provide good access, safety, and comfort for their users (Matloob et al., 2014), but to all campus outdoor environments (Abu-Ghazzeh, 1999).

1.1.2. Social and Personal Factors as Determinants of Satisfaction

It was mentioned earlier that the physical layout of the campus and its design are crucial for the social aspects of the universities and the influence they have on a sustainable environment. The existing physical environment, its improvement, and maintenance are promoters of well-being and quality of life for the present and for the future (Chan & Lee, 2007). Additionally, the spatial organization of outdoor spaces encourages interaction and influences satisfaction and performance (Bechtel & Churchman, 2002). According to Gehl (1987), if the quality of the outdoor environment is good, the frequency of social interaction increases. Furthermore, the maintenance of the outdoor environment's biodiversity and its restoration have a positive effect on improving the quality of social indicators and human wellbeing (Alba-Patino et al., 2021).

Social inclusion ensures better understanding between humans, considered a source of inspiration, attracted by seeing others in action (Gehl & Svarre, 2013). User participation in decision making helps create a sense of community.

However, there is another issue to be considered in terms of satisfaction, and that is linked with the geodemographic and cultural background of the students. These "strategic assets" are

influenced by their background in the way they behave (Karna et al., 2013). A student's gender, origin, and year that they are attending can vibrate their sense of satisfaction (Petruzzellis et al., 2006). In universities, demographic factors are seen in the composition of the campus population, in the age structure, and in the composition of the academic staff (Karna et al., 2013). On the other hand, a multicultural university campus experiences more satisfaction outcomes among its students, such as: "positive learning, democratic expositions and equality, self-confidence, campus satisfaction, pluralistic orientation, openness to diversity and cognitive development" (Clarke & Antonio, 2012). In other words, the institutions of higher education are considered "transformational agent". They do have a great impact on creating some positive habits for the students and therefore for society (Žalėnienė & Pereira, 2021). Satisfaction among campus users is related to an individual's socio-demographic composition, which is essential since it encourages social interaction.

2. Methodology and Data Collection

The methodology used in this research includes a survey, observation, and visual documentation. The survey aims to investigate the extent to which social sustainability is present within the physical setting of the Agricultural University of Tirana campus using an online questionnaire that is conducted with the students, users, and visitors of this campus. Observations and drone photo shooting were used to document the situation.

The survey's focus was on the social interactions in the outdoor spaces of the campus, based on the user's satisfaction as a crucial determinant of social sustainability. The application of the questionnaire online was due to the COVID-19 period, where a total of 156 responses from campus users were collected. It is worth remembering the need for social interaction and the social and cultural sustainability everyone had about the outdoor spaces, which pushed participants to think more about the importance of those areas.

The questionnaire was designed into two parts, to gather comprehensive data regarding personal and social factors related to the physical environment, ensuring participants' privacy and confidentiality. The first part about personal data included questions about participants' geo-demographic background, the faculty where they study or work, the time they spend on campus, and satisfaction with social diversity. The second one, involved asking questions about the variety of activities in outdoor campus environments, satisfaction with activities and their types, facilities, intensity of use of outdoor spaces, user interaction, and satisfaction with the physical changes of the Agricultural University of Tirana (AUT) campus after 90.

2.1. AUT as Study Area

The literature review showed that studying this contemporary development in the context of the university campus is a challenge. Likewise, every campus is composed of a range of physical and non-physical aspects that have a distinctive character; the Agricultural University campus of Tirana has its own distinguishing setting too.

Although this campus is characterized by typical components that a university campus should have, such as being open and flexible to its community, it underwent certain changes. This is related to the specific context of urban development in post-socialist Tirana when peripheral zones of city were especially subject of informal settlements. The informalities also impacted the AUT campus, parts of which were invaded by settlers, who, according to local press (AUT, 2001) were considered "enemies". These "occupations" apart from bringing the sprawling of a newcomer community to the university lands, have changed the campus layout after the transitional period. Being tolerated by the governing local bodies, the community expansion on campus land has caused the historic site to shrink (Figure 2), thus limiting campus growth, and freezing inside its historic site. Even though it is surrounded by a border across its perimeter, this campus is also accessible to all visitors, including local inhabitants, who use it for relaxing and enjoying its landscape.

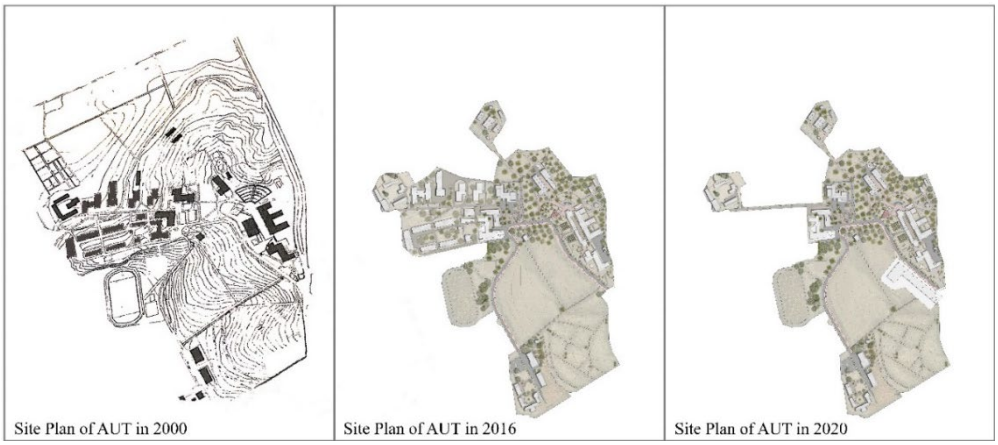


Figure 2 Site plan of AUT showing the campus size reduction from 2000 (Left-AUT, 2001), to 2016 and actual situation in 2020 (Middle and right-authors)

However, this campus has a dynamic layout and organizational structure. According to the categorization of campus layouts by Xu et al. (2012), it can be classified as a medium-sized campus (6000 students) with a band shaped space layout. It consists of two main entrances (vehicular and pedestrian entrances), circulation systems (vehicular, pedestrian, and bike paths), and a total of 25 academic and administrative buildings, including 2 recreational buildings (library and cafeteria) and 3 administrative buildings (police station, rectorate building, and parking office). The main road, which is associated with pedestrian, bike and automobile lanes, is extended along the entire territory of the campus and leads to the main faculty entrances through a branch shaped road system (Figure 3).

Figure 3 Interpretation of AUT campus layout based on Xu et al. (2012) categorization (Authors)

Based on Akhir's (2018) classification of outdoor spaces, on the AUT campus outdoor spaces are categorized as open space (plazas, faculty entrances, courtyards, a botanical garden, orchard areas, an amphitheater), semi-open spaces, natural spaces, and viewing spaces (lawns). Each of these spaces has its own character and size, and provides enhanced experiences through different activities, inviting users to interact with each other. Because of the hilly terrain, a series of open spaces are linked with stairs, generating a flow of open spaces (Figure 4).

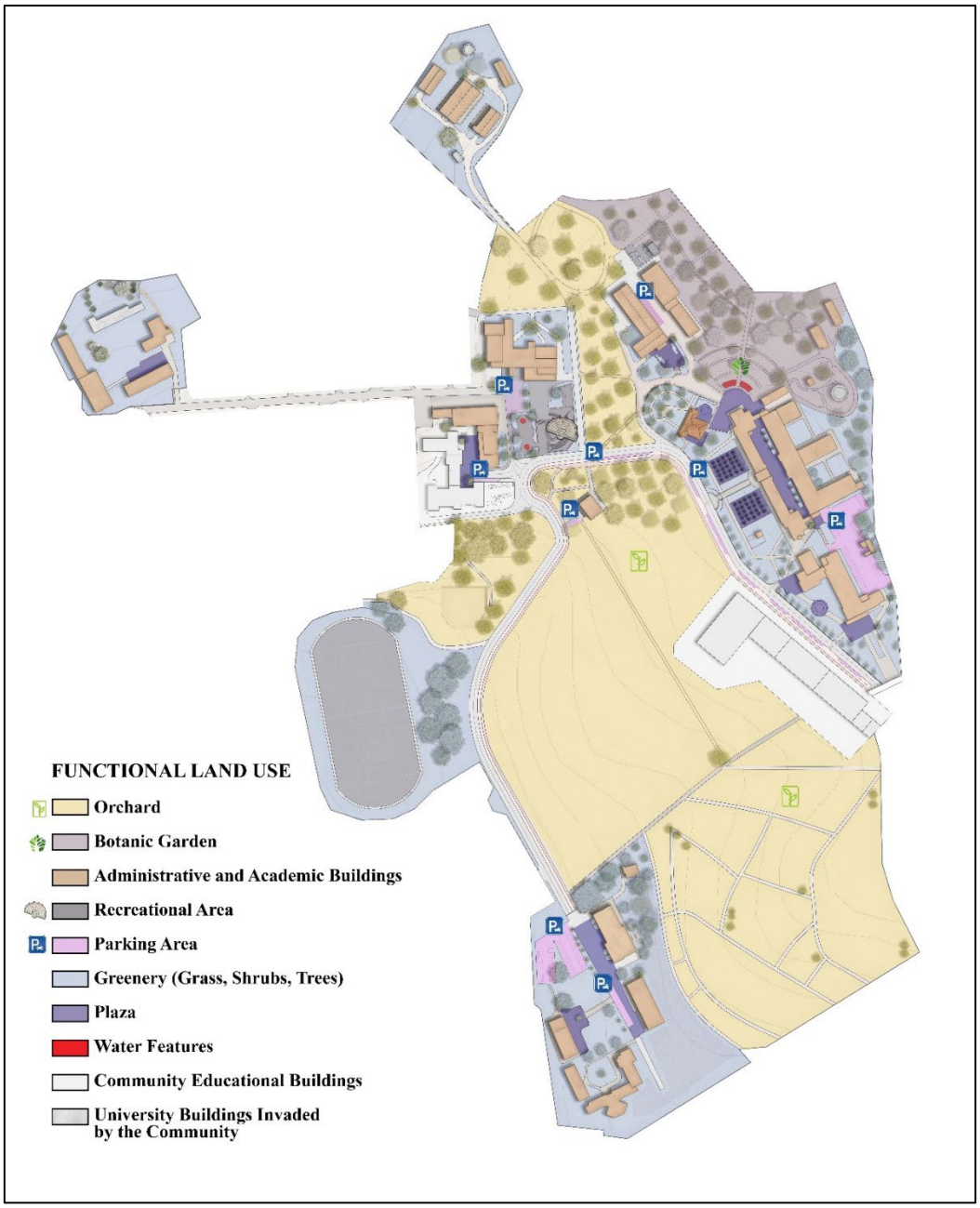


Figure 4 Functional land use (Authors)

Next, the sports field and amphitheater spaces used to be one of the main recreational spaces (Figure 5) for AUT users till the 1990s. A high number of socio-cultural activities were undertaken during that time, especially in the areas of amphitheater. Since all campus roads lead to this space, it was a common intersecting space for all students at the university, where they were gathered to discuss personal, or issues related to their university. The paintings on the building walls, the greenery that surrounds this space, and the fountain (though not functional) and relaxing benches generate an unprecedented aura within this outdoor space.

Figure 5 Amphitheater (left) and (right) sport field (Authors)

Furthermore, the botanic garden is one of the key areas that represents university identity. It provides a variety of experiences and interaction with different kinds of plants of the flora world, where students do different scientific studies. Botanical garden adds aesthetic values to the university campus and entails sensory experience such as feelings, smelling etc.

Figure 6 Spaces that are frequented by the public (Authors)

Also, the orchard areas are placed axially across the length of the campus layout, separating it into two non-symmetrical parts. Before the 1990s, the orchard area used to be grown 120 types of grapes, pineapples, etc.; and it was considered a horticulture laboratory (Hako & Thanasi, 2001). In recent times, horticulture practice has been reduced and consequently most of its space is transformed into lawns. These spaces attract the citizens, who go for a run or sit and relax under the tree crows that serve as shelter during the sunny days.

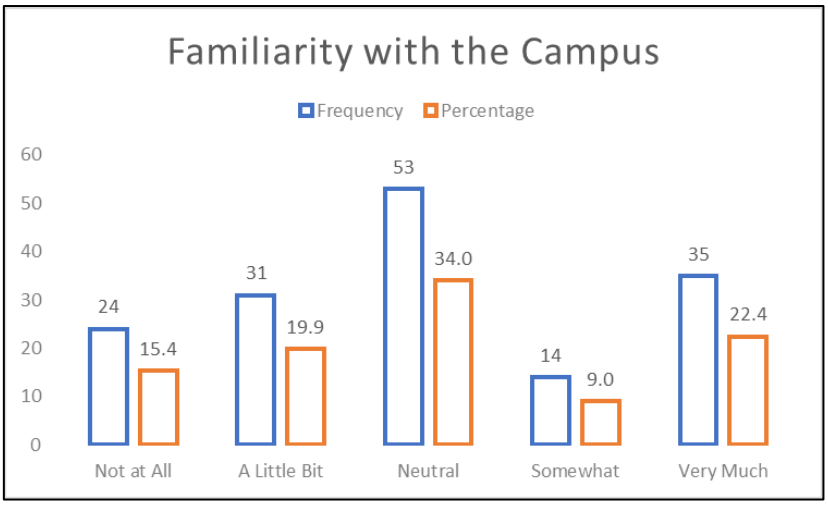
3. Results

3.1. Outdoor Perception and Preferences for the Physical Properties

The analysis and perception about the physical properties of the AUT environments identified three spaces as the most frequented ones including the Faculty of Medicine Veterinary (Figure 6a), the Economy and Agrobusiness (Figure 6b) and botanical garden (Figure 6c). On the other side, the sport field is the least used area in campus territory.

The environment that the respondents considered to have the sense of belonging, are the outdoor spaces of Faculty of Medicine Veterinary, because of the greenery (35.7 %), the maintenance and the shaded areas. In addition, the qualities of campus environments that the participants in this survey found more satisfying were greenery spaces and campus size. Furthermore, they expressed their satisfaction with the maintenance of the campus and the quality of pedestrian roads.

The participant's perception might change because of the time spent in the campus spaces, thus, the frequency of attending outdoor areas is valuable. The majority of the respondents (48.1%) have been attending AUT for 1-2 years, 64.1 % of whom frequent about 5-7 days a week. Also, of all the respondents only 14.1 % had the opportunity to live on the campus of AUT for about 3-9 months. In this context, when asked about the familiarity they have with the campus, results show that 33.3% of users are neutral, while only 22.4% of them know this university campus very well (Graph 1).



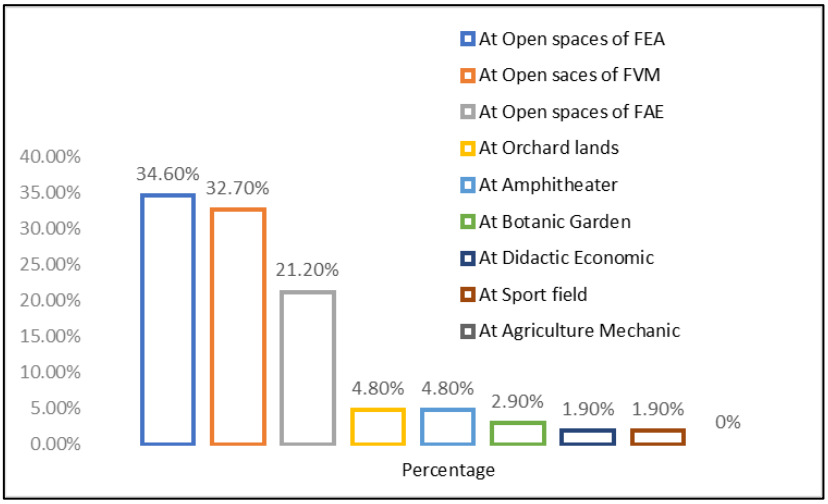
Graph 1 Familiarity of users are with AUT campus

3.2. Social Perception, Preferences and Perceived Activities for Social Values

Based on the data collected in the second part of this questionnaire, the level of social interaction appears to be high. The majority of respondents (76.6 %) have networked with students and academic staff from other departments and faculties, and 70.8 % of the participants interact with their colleagues in other areas of the campus than their faculty. Only 29.2% of the participants interacted with the professors and teaching assistants. On average, 50.6 % of the respondents associate with 4-6 users in outdoor spaces. Most respondents (81.8%) spend a considerable amount of time in the outdoor spaces of the campus (1-3 h).

AUT organizes a variety of extracurricular activities, and 55.2 % of the replies were positive about them, but only 61% participated. The most frequented activities are academic activities (46.3 %) followed by agricultural ones (28.4 %). These activities are the most undertaken during the morning (54.9 %) and others during midday (31.9%).

Despite the activities that the university offers, there are other activities created by students, but 44.8% of the respondents were not even informed, so as a result, either their interest in participating is low or the information system is poor. Despite that, only 24.7% answered that there are activities created by students and that most of those activities are undertaken in the Faculty of Economy and Agribusiness, while a 23.9% percentage of students responded that these activities are developed outside campus territory. Additionally, 18.5% of the participants added that they were not conscious of where these activities were undertaken.



Graph 2 Activities' intensity in outdoor spaces of each faculty of AUT

Regarding all types of activities, most of them are undertaken in the open spaces of the Faculty of Economy and Agribusiness (34%).

3.3. Socio-demographic Factors Influencing Perception

The questionnaire collected socio-demographic data of the campus users, of whom 96.8 % were students. Their position in the university, their background (origin), gender, age, faculty they belong to, and any possible disability are the data that help to monitor the participants sampling (Table 1).

Table 1 Participants Socio-demographic Data

Participants No	Gender	Origin	Position	Age	Faculty
156	61.5% females	44.9% from metropolitan areas	96.8% students	39.1% 20-22 years old	56.9% FMV
	38.5% males	29.5% from peripheric area	1.3% academic staff	28.2% 18-20 years old	20.3 % FAE
		25.6% from rural areas	0.6% administrative staff	27.6% 22-24 years old	17.6% FEA
			0.6% personnel staff	5.1% +25 years old	3.9 % FFS
			0.6% visitor		1.3% FBF

FMV: Faculty of Medicine and Veterinary; FAE: Faculty of Agriculture and Environment; FEA: Faculty of Economy and Agribusiness; FFS: Faculty of Forest Sciences; FBF: Faculty of Biotechnology and Food

The participant's perception might change because of the length of time spent in the campus spaces, thus, the frequency of attending outdoor areas is meaningful. Most of the respondents (48.1%) have been attending AUT for 1-2 years, 64.1% of whom frequented about 5-7 days a week. Also, only 14.1% of them had the opportunity to live on the campus of AUT for about 3-9 months. In this context, when asked about the familiarity they have with the campus, results show that 33.3% of users are neutral, while only 22.4% of them know this university campus very well (Graph 1).

From the results, we noted that the ones who are very well acquainted with the campus are not from the students' group but from the staff, either administrative or academic. Students recognize more the activities organized among themselves, than the academic ones; in return, they identify the need for social interaction among themselves more than with the other users of the campus. Although there is always a continuous physical change on the campus, all the respondents show no significant change in their perception of satisfaction with the outdoor built environment.

3.4. The Relationship that Physical, Social and Personal Factors Have with Social Interaction

Out of 156 respondents, we see a unanimous evaluation of the social factors that influence their satisfaction and, consequently, well-being. The perception of the activities as crucial elements of social interaction was almost neutral. Participants reported that it is a great challenge to translate their thoughts about the activities into social values since they are almost never co-creating the activities. Thus, they evaluate their adequacy as not valid at all (Table 2).

Table 2 Evaluation of Social Factors of User Satisfaction

Levels of satisfaction	Very dissatisfied	Dissatisfies	Neutral	Satisfied	Very satisfied
Adequacy of activities	X				
Diversity of activities			X		
Quality of activities			X		
Diversity between users			X		
Social Security			X		
Social Life			X		

We found that social interaction among the users on the campus is associated with the maintenance of the open spaces and the greenery in those spaces, with the number of activities that the campus provides, and with the time the people spend there. The social values of the campus are mainly linked to the physical (maintenance and greenery) and activity (number of activities) components. We found that satisfaction in each category (physical, social, and personal) is related to good social interaction. Student satisfaction is unaffected by whether or not they attend a mixed-use campus.

4. Discussion

4.1. Social Values Exploration Due to the Physical Properties of the Campus

The evaluation of the physical properties of the campus helps to find out the physical indicators of satisfaction that can enhance students' lives on the campus. We specifically identified that the physical changes on the campus whether good or bad have neutral impact on spatial perception. Firstly, the diversity of the spaces on the campus has changed. This is due to the drastic transformations that emerged in the 1990s, which included the invasion of the dormitories by immigrants and the invasion of the campus land by nearby dwellers. However, there were preserved many physical spaces that express the campus culture and mission. such as the botanical garden, parks, the campus entrance, the "mechanics` environment", and the stables of the didactic economy.

The results show that physical spaces are perceived for the function and the culture they cultivate. If the changes in the physical settings are not serving the people's needs, it leaves the opportunity to enhance social satisfaction. (Lees & Phillips, 2018). On the other hand, we found that the preferences for spatial usage are related to the sociodemographic characteristics such as the faculty the students are studying. The result is consistent with other research (Lu, 1999; Harris, 2001; Permentier et al., 2011), where the location and proximity to the activities and facilities influence satisfaction. At the same time, it shows immediate access with the nearby spaces (the open space of the faculty of Economy and Agribusiness), which agrees with the importance that accessibility does have in the sustainability of campus outdoor environments (Abu Ghazzeh, 1999; Matloob et al., 2014).

4.2. Social Interaction as Indicator of Social Values

Researchers highlight the importance of social networks (Bechtel & Churchman, 2002; Gehl & Svarre, 2013) and sense of community (Fujiwara et al. 2021) as indicators of social value measurement. In this sense, identifying the social values that students and users perceive is crucial, since it can measure the changes and define ways to capture their intangible impacts, so that they can be preserved in the future (Samuel & Hatleskog, 2020). In this context, monitoring and evaluating social interaction gives feedback about the usage of the campus and identifies the role of social activities as tools that promote actions for successful sustainability.

According to our findings, 70,8% of participants interact with colleagues from different faculties and use the outdoor campus environments in groups. Most of them use the outdoor facilities for 1 to 3 hours per day (Table 3).

Table 3 Campus Usage Time Intervals

Campus Usage Variables	Division	Division Percentage
Length of Stay in the Campus	1-2 years	47.4%
	3-5 years	48.1%
	+6 years	48.1%
Weekly Attendance Frequency	5-7 days a week	64.1%
	3-5 days a week	20.5 %
	0-2 days a week	15.4 %

Daily Duration of Indoor Spaces` Usage	1-3 h	82.1%
	4-7h	14.1%
	+8h	6%

These results show that there exists a great interest and positive attitude among university users toward socialization, which identifies personal and social factors as variables of social interaction (Williams, 2005). The latter is the most enjoyable part of an experience. (Bechtel & Churchman, 2002). The high level of social interaction contributes to creating a harmonious and dynamic environment (Cowan, 1997), and in turn it is associated with enhancing satisfaction and, therefore, wellbeing, establishing so an indicator of social value. According to the high percentage of interaction attracted by seeing each other in action (Gehl, 2011), students are socializing in large groups of 4-6 persons.

4.3. What Are the Social Values AUT Campus Produces?

If we analyze the social values of a mixed used campus, we find that AUT has a layout with the largest possible values in the country. However, its value is not acknowledged, because most of the outdoor spaces are invaded, because of the lack of maintenance and because some of the functions are not preserved. In the foundation time, the campus design was in support to the educational and residential aspects of students' lives. However, in the transitional era, the campus was massively changed and transformed to move toward a mixed-used environment. Different studies have tried to determine what the future of the campuses should be like, with a focus on mix-used environments (Penn, 2003) and the transformation of these changing logouts into "living labs" (Den Heijer & Curvelo Magdaniel, 2018) to test and understand different issues related to social values.

The results suggest that this intensively changing context is still productive in terms of social values. There exists good student-professor interaction in outdoor campus spaces except in classroom environments, which can be explained by the fact that most professors have experienced this university first as students than as professors. So, this university appreciates its students' values, giving them job opportunities in its environments, encouraging a sense of belonging toward this university, and promoting positive work performance (Bechtel & Churchman, 2002; Eizenberg & Jabareen, 2017). Being appreciated and recognized refers to one of the other determinants that enhance users' satisfaction and compounds an indicator of the social values in the built environment (Samuel & Hatleskog, 2020).

Following the distribution of the activities, the university organizes different extracurricular activities in outdoor spaces, mostly academic and agricultural. The data shows that there are activities that each faculty organizes in its own outdoor environments. These findings fit with factors that generate a lively atmosphere on campus. They are equally distributed, which encourages all users to be part of them, and consequently, the state of being isolated is reduced. (Eizenberg & Jabareen, 2017).

As aforementioned, the degree of participation in activities, strategies for socializing, traditional activities, the existence of certain physical objects, and notable stories that illuminate the founder determine the cultural character of a campus environment (The New York Times Company, 2004; Axelsson et al., 2013).

Likewise, every university that has its own characteristic traditions, every year AUT campus celebrates its opening day, which is a big celebration not only for this university, but for the higher education system in Albania. Referring to the collected data, more than 72 % of the participants seem to be unaware of the traditional activities on AUT campus, while only 9.7% have reacted positively to that.

Also, the Agricultural University of Tirana organizes fairs and conferences in outdoor environments that help students guarantee a future job, while recreational and student activities seem to be quite low. Non-diversity of activities has a negative impact on sustainability development since it can prevent the university from providing an enriched environment. On the

other hand, through different activities, the environments of university campuses enhance levels of satisfaction, giving users a sense of belonging and a feeling of being welcomed (Purdy, 2012).

Consequently, most users are not satisfied with the diversity and adequacy of the activities that are undertaken in campus environments, but they feel neutral about the quality of these activities, social security, and social life. Despite that, these results also show that there is great integration and a strong social network and support, not only between students, but with professors as well. These aspects represent some of the main objectives of socio-cultural sustainability. (Ali & Faruquie, 2015) and are bases for generating some social values that lead to the user's wellbeing (Samuel & Hatleskog, 2020).

5. Conclusion

Maintaining a socially sustainable university campus, while being spatially connected to the community, is a challenge. This paper appraises the case of the AUT campus, with the aim of identifying and exploring the social perceptions and preferences for the outdoor areas of the campus to depict the social values of the campus and find their impact on wellbeing.

We present a case of a continuously changing campus as a result of many social influences. Social value is what we wanted to explore on a mixed-used and spatially shrinking campus. We employed a questionnaire in the Covid-era, when the need to depict the social values of outdoor environments reached a new level. We illustrated that user satisfaction drives the users' interaction and, thus, their wellbeing. The study found that the user`s interaction is a crucial determinant of social value and pertains to the built environment and the activities it offers.

The main contribution of this research is that universities maintain their social sustainability if the built environment generates actions and promotes activities. Social value here lies more in the built environment, which should be preserved alongside the functions of the agricultural background, than in the mix used. Specific recommendations that our study reveals include raising awareness about the conservation of outdoor spaces and cultural activities, depicting elements of social value, and incorporating them in support of university campus welfare.

Future research can be conducted on this specific campus typology that addresses social issues not only related to students but also to the wider community.

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References

Abu-Ghazzeh, T. M. (1999, 11). Communicating Behavioral Research to Campus Design Factors Affecting the Perception and Use of Outdoor Spaces at the University of Jordan. *Environment and Behavior, 31*(6), 764-804.

Akhir, N. M., Sakip, S. R., Abbas, M. Y., & Othman, N. (2018, 08 26). Landscape Spatial Character: Students' preferences on outdoor campus spaces, *Asian Journal of Quality of Life*, *3*(13), 89-97.

Alba-Patino, D., Carabassa, V., Castro, H., Gutiérrez-Briceño, I., García-Llorente, M., Giagnocavo, C., & Castro, A. J. (2021). Social indicators of ecosystem restoration for enhancing human wellbeing. *Resources, Conservation and Recycling*, *174*, 105782.

Ali, A., & Faruquie, D. S. (2015). *Effectiveness of Social and Cultural Sustainability Practices in Built Environment: A Quasi-Systematic Review*. Academia.

AUT. (2001). Agricultural University of Tirana. Bari, Italy: Tecnomack.

Axelsson, R., Angelstam, P., Degerman, E., Teitelbaum, S., Andersson, K., Elbakidze, M., & Drotz, M. K. (2013, 03). Social and Cultural Sustainability: Criteria, Indicators, Verifier Variables for Measurement and Maps for Visualization to Support Planning. *Ambio, 42*(2), 215-228.

Bechtel, R. B., & Churchman, A. (2002). *Handbook of Environmental Psychology*. John Wiley & Sons Incorporated.

Benneworth, P. C. (2010). Building localized interactions between universities and cities through university spatial development. *European planning studies*, *18*(10), 1611-1629.

Bertlin, J. (2014). *Social Sustainability from the perspective of three concepts: human scale, the city at eye level and public life*. Degree Project in Urban and Regional Planning, Advanced Cycle, Kth Royal Institute of Technology School of Architectture and the Built Environment, Department of Urban Planning and Environment, Stockholm.

Chan, E., & Lee, G. K. (2007, 02 27). Critical factors for improving social sustainability of urban renewal projects. *Social Indicators Research*, *85*(2), 243-256.

Cowan, R. (1997). The Connected City: a new approach to making cities work. Urban Iniciatives.

Den Heijer, A. C., & Curvelo Magdaniel, F. T. (2018). Campus–city relations: Past, present, and future. *Geographies of the University*, *12*(3), 439.

Dober, R. P. (1996). Campus architecture: building in the groves of academe. New York: McGraw-Hill.

Dober, R. P. (2000). Campus landscape: functions, forms, features. New York: Wiley.

Dober, R. P. (2008). Heritage, Identity and Campus Design. (C. o. Education, Interviewer) Retrieved from https://epublications.marquette.edu/cgi/viewcontent.cgi?article=1117&context=conversations

Eckert, E. (2012, 05). Examining the Environment: The Development of A Survey Instrument to Assess Student Perceptions of the University Outdoor Physical Campus. Dissertation, Kent State University College, Health and Human Services.

Eizenberg, E., & Jabareen, Y. (2017). Social Sustainability: A New Conceptual Framework. *Sustainability, 9*(1), 68.

Fuchs, K., Promsivapallop, P., & Jing, F. (2022). Socio-cultural Influences and Intentions toward Environmental Sustainability amongst Undergraduate Students: Evidence from China and Thailand. *Journal of Hospitality & Tourism Education,* 1-12.

Fujiwara, D., Dass, D., King, E., Vriend, M., Houston, R., & Keohane, K. (2021, October). *A framework for measuring social value in infrastructure and built environment projects: an industry perspective*. In Proceedings of the Institution of Civil Engineers-Engineering Sustainability (Vol. *175*, No. 4, pp. 175-185). Thomas Telford Ltd.

Gehl, J. (1987). *Life Between Buildings: Using Public Space*. Van Nostrand Reinhold.

Gehl, J. (2011). *Life between buildings using public space*. Washington, D.C.: Island Press.

Gehl, J., & Svarre, B. (2013). *How to study public life*. Washington, DC: Island Press.

Göçer, Ö., Göçer, K., Başol, A. M., Kıraç, M. F., Özbil, A., Bakovic, M., & Barış, Ö. (2018, 11). Introduction of a spatio-temporal mapping-based POE method for outdoor spaces: Suburban university campus as a case study. *Building and Environment*, *145*, 125-139.

Guite, H., Clark, C., & Ackrill, G. (2006, 12). The impact of physical and urban environment on mental well-being. *Public Health*, *120*(12), 1117-1126.

Hako, H., & Thanasi, S. (2001). *Universiteti i Blerte 1952-2001*. Tirana: Albdesign.

Hossini, S. B., Azemati, S., Elyasi, N., & Mozaffar, F. (2015, 01). The Effect of the Vitality Level of University Campuses on Increasing Social Interactions and Makin. *Procedia - Social and Behavioral Sciences*, *170*, 225-233.

Jabareen, Y. R. (2006, 09). Sustainable Urban Forms. *Journal of Planning Education and Research*, *26*(1), 38-52.

Karuppannan, S., & Sivam, A. (2011). Social sustainability and neighbourhood design: an investigation of residents' satisfaction in Delhi. *Local Environment*, *16*(9), 849-870.

Lees, L., & Phillips, M. (Eds.). (2018). *Handbook of gentrification studies*. Edward Elgar Publishing.

Marie S., & Annette W. (2018): The role of social sustainability in building assessment, *Building Research & Information*, DOI: 10.1080/09613218.2018.1468057.

Matloob, F. A. (2018). Structural Layout as a Crucial Factor Towards Campus Sustainability. *Sustainable Resources Management Journal*, *3*(4), 01 -16.

Matloob, F. A., Sulaiman, A. B., Ali, T. H., Shamsuddin, S., & Mardyya, W. N. (2014). Sustaining Campuses through Physical Character–The Role of Landscape. *Procedia - Social and Behavioral Sciences*, *140*, 282-290.

Penn, A. (2003). Space syntax and spatial cognition: or why the axial line? *Environment and behavior*, *35*(1), 30-65.

Petruzzellis, L., D'Uggento, A. M., & Romanazzi, S. (2006, 07). Student satisfaction and quality of service in Italian universities. *Journal of Service Theory and Practice*, *16*(4), 349-364.

Puhakka, R. (2021). University students' participation in outdoor recreation and the perceived well-being effects of nature. Journal of outdoor recreation and tourism, *36*, 100425.

Purdy, M. K. (2012). Faculty Perceptions of Campus Diversity. Master of Arts, Department of Psychology, Western Kentucky University.

Qtaishat, Y., Emmitt, S., Adeyeye, K., Exploring the socio-cultural sustainability of old and new housing: two cases from Jordan, Sustainable Cities and Society (2020), https://doi.org/10.1016/j.scs.2020.102250.

Raiden, A., & King, A. (2021). Social value, organisational learning, and the sustainable development goals in the built environment. *Resources, Conservation and Recycling*, *172*, 105663.

Samuel, F., & Hatleskog, E. (2020). Why Social Value?. *Architectural Design*, *90*(4), 6-13.

Shirazi, M. R., & Keivani, R. (2017, 09 18). Critical reflections on the theory and practice of social sustainability in the built environment – a meta-analysis. *Local Environment*, *22*(12), 1526-1545.

The New York Times Company. (2004). Campus Culture or Climate. Retrieved May 10, 2020, from Archive.nytimes:https://archive.nytimes.com/www.nytimes.com/ref/college/collegespecial2/coll_aascu_ecculture.html?8bl.

Today, T. (2019, 12 20). VIDEO/ Shembja me tritol e dy godinave tek Universiteti Bujqësor. Retrieved from tiranatoday: https://tiranatoday.al/video-shembja-me-tritol-e-dy-godinave-tek-universiteti-bujqesor/.

Williams, J. (2005). Designing Neighbourhoods for Social Interaction: The Case of Cohousing. *Journal of Urban Design*, *10*(2), 195-227.

Xu, J., Zhang, Z., & Rong, J. (2012). The Campus Road Planning and Design Research. *Procedia - Social and Behavioral Sciences, 43*, 579-586.

Žalėnienė, I., & Pereira, P. (2021). Higher Education for Sustainability: A Global Perspective. *Geogr. Sustain*. *2*, 99–106.

Resume

Assoc. Prof. Dr. Odeta Manahasa is a lecturer of architecture at Epoka University, Tirana, Albania. She has a long-standing interest in understanding environmental psychology in its larger context, particularly in relation to children and child space perception. She is developing this interest as two lines of inquiry: (i) child space perception knowledge, with a focus on a systematic structure for thinking on environmental behavior phenomena from different methodological perspectives, and (ii) improving the quality of learning environments. Thus, her areas of expertise and research interest include architectural education, children and architecture (e.g. children's participation in architectural design), participatory design, school design, environmental psychology, post occupancy evaluation, and environmental behavior and design.

Manjola Logli is an architect and assistant lecturer based in Tirana, Albania. With a background in both professional practice and academia, Logli's areas of interest extend to the environment and user behaviors, user well-being and the interaction between sustainability and design regarding socio-cultural dimension, spanning the latter one on a larger scale, in that of livable communities. Recently, she has participated in a research on the well-being and cognitive functions of senior residents focused on retirement homes in Tirana, Albania.

Assoc. Prof. Dr. Edmond Manahasa has been working since 2008 at Epoka University in Albania as a lecturer in the department of architecture. He is focused on two main research areas: i. environment-behavior psychology, and ii. history of architecture. Within the first research area, he has conducted research on the themes of place identity and place attachment, urban identity, neighborhood identity, housing typologies, gated communities, city image and post-socialist housing developments. In relation to the second area, he has conducted studies on Ottoman period architecture in Albania and Kosovo.

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Exploring the impact of landscape design on user preferences in shopping centers post the COVID-19 Pandemic

Özlem Nur Aslantamer*
Hüseyin Emre Ilgın**

Abstract

This study explores the impact of landscape design, which has gained importance alongside architectural changes in shopping centers, and investigates preferences in the post-COVID-19 pandemic era. Although e-commerce has increased during the pandemic, research and societal behaviors suggest that shopping centers will continue to serve as contemporary agoras due to their socialization and leisure functions. However, in response to the pandemic, it is anticipated that newly designed shopping centers will be architecturally conceived as semi-outdoor or outdoor spaces, regardless of climate conditions. This transformation will involve the softening of rigid appearances through landscape elements, making them both ecologically and psychologically sustainable. The number of studies on this subject is limited. To address this knowledge gap, an online survey was conducted with 586 randomly selected users across nine shopping centers located in three major cities of Turkey: Istanbul, Ankara, and Izmir, with three shopping centers in each city. The survey investigated users' preferences for architectural styles (indoor, semi-outdoor, or outdoor) and landscape design in shopping centers. The findings of the study indicate that post-pandemic, outdoor and semi-outdoor shopping centers are likely to be preferred more frequently. An emphasis is likely to be placed on natural landscape elements such as plants and water features in landscape design. Furthermore, shopping center designs are likely to become simpler, offering comfortable and spacious navigation areas while optimizing parking and transportation conditions. This study is expected to shed light on decision-making processes for future shopping centers. By incorporating consumer preferences, architects can enhance the sustainability of shopping center investments through next-generation design.

Keywords: indoor, semi-outdoor, outdoor shopping centers, landscape design

1. Introduction

Shopping is one of the most significant means of interaction among individuals. The act of shopping has evolved from the past to the present and has remained a continuously developing activity. Especially in urban settings, shopping holds a central position among various activities. Urban centers not only serve as focal points for commercial activities but also host numerous social events. These events are perceived as a means of socialization for individuals.

Public spaces play a crucial role in enabling people to interact with each other, engage in social activities, and establish a sense of shared community life. From this perspective, it can be argued that the development and transformation of the shopping phenomenon are inseparable elements of public spaces. The rapid population growth in cities has led to spatial transformations aimed at meeting the needs of society. This transformation has given rise to shopping centers, which have become the focal point for commercial and social activities, leading to a significant shift in consumption patterns.

*(Corresponding author) Lecturer, Atilim University, Türkiye, ozlem.aslantamer@atilim.edu.tr
**Dr., Tampere University, Finland emre.ilgin@tuni.fi
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Shopping centers have evolved into spaces where people can not only fulfill their shopping needs but also engage in cultural, artistic, and entertainment activities. They have become new venues where various aspects of life converge. In today's society, shopping centers have assumed a prominent role as modern public spaces. These centers have expanded into large spaces that encompass not only stores catering to shopping needs but also units designed for leisure and entertainment (Birol, 2005; Toksözlü, 2011). In this context, landscape design in shopping centers has gained importance. It has become essential for shopping centers to have landscape designs that meet the expectations of visitors.

In accordance with the universal standards set for shopping centers, various practices have been established, encompassing shopping corridors, central squares, floor heights, activity areas, parking facilities, fire safety measures, service and storage areas, earthquake resistance, structural systems, and security measures. Structural landscape design criteria for shopping centers should be evaluated based on functionality, exterior appearance, readability, user guidance, spatial organization, structure and materials, scalability, transitions, lighting, the utilization of landscape features, and color use (Birişçi et al., 2012). Furthermore, when considering the plant design elements such as plants, texture, line, color, and form, as well as principles like balance, emphasis, repetition, proportion, harmony, contrast, and diversity, it becomes possible to contribute to the creation of unique spaces with characteristics like establishing a background, enhancing spatial effects, eliminating monotony, and adding movement and color to the space.

Plants have the potential to influence the dimensions of the space in both vertical and horizontal directions, and their compatibility with each other is crucial. In this context, the design of plants should be in harmony with the dimensions of the space (Khabbazi, 2009; Birişçi et al., 2012).

The Covid-19 pandemic has profoundly reshaped contemporary social life and significantly impacted the dynamics of shopping centers. Measures implemented during the pandemic, such as periodic closures and restricted operating hours, marked the onset of a new era for these spaces. Indeed, shopping centers were prominently featured among the areas where reduced human presence was strongly advocated. This led to a prevalent belief that some shopping centers would face heightened competition due to the pandemic, while those that effectively managed the crisis and survived could potentially emerge in a stronger position. Various viewpoints exist regarding the future of shopping centers in the post-pandemic era, with the prevailing perspective emphasizing more cautious investments compared to previous times.

According to this perspective, shopping centers will be developed based on demand and competition analyses aligned with consumer needs. Consumer expectations are deemed the most critical factor in this context, as the survival and sustainability of shopping centers hinge on their ability to attract consumers. Consequently, it is plausible to predict that architectural changes and landscape design will assume greater prominence.

Given the heightened emphasis on public health resulting from the Covid-19 pandemic, shopping centers must be designed to provide appropriate environments. It is crucial to contemplate the extent to which the design of semi-outdoor and outdoor shopping centers, coupled with the integration of landscape elements, will become more prevalent. Additionally, it is essential to ensure the sustainability of these environments in accordance with consumer preferences.

Indeed, it has been observed that despite the opening and closing phases during the pandemic, people's strong interest in shopping centers for meeting their needs and socializing has continued. Therefore, researching the impact of landscape design on user preferences in shopping centers after the Covid-19 pandemic holds great importance for the sustainability of shopping centers.

In this context, the primary aim of the research is to investigate the criteria used for creating landscape designs in shopping centers, how landscape elements are determined, the significance of landscape from the perspective of visitors, and their expectations. The study aims to uncover the impact of landscape design in shopping centers on visitors, evaluate the changes in landscape

design from the past to the present, and identify the criteria preferred by visitors in landscape design. Within this scope, the hypotheses of the research have been formulated as follows: H1: Landscape design in shopping centers directly affects visitors psychologically. H2: The choice of landscape elements in design varies based on the type of shopping center (indoor/outdoor). H3: Visitors in shopping centers make their preferences based on landscape design. H4: Landscape design in shopping centers is most crucial in circulation areas and dining areas.

1.1. An Overview of Shopping Centers

Shopping is one of the significant activities in the lives of consumers. The concept of shopping is constantly evolving, and understanding and researching this field are essential for ensuring an enjoyable shopping experience and customer satisfaction (De Juan, 2004). Shopping centers are spaces that aim to make the shopping experience more comfortable and can be described as social hubs for various activities (Teller et al., 2008). Generally, shopping centers in the 21st century are seen as living spaces with the goal of meeting all types of consumer needs. The widespread adoption of markets, supermarkets, and subsequently hypermarket designs in metropolises has prepared consumers to conduct their shopping activities in new locations. A shopping center is a place located away from the central business district, designed to meet new shopping needs, and contains retail sales areas (Abrudan, 2011). Every shopping center includes a large retail store, with the supermarket in the shopping center being the primary traffic generator. The shopping area and the types of needs in each shopping center vary (Bloch et al., 1994). It is acknowledged that shopping centers enhance shared economies, and they are intermittent structures where a series of commercial activities operate together to create a general order and rules. These shopping spaces are a result of collaboration between several stakeholder groups and are a naturally evolving planning process (Rahimi & Khazaei, 2018). A shopping center is a commercial center planned and developed in accordance with a concept, managed as an integrated entity by a single management body. Alkibay and colleagues have provided a broader definition of shopping centers. According to their definition, shopping centers are facilities that encompass multiple departments within a planned architectural structure, with various-sized retail stores, as well as establishments such as restaurants, cafeterias, exhibition halls, pharmacies, entertainment centers, banks, and cinemas. These facilities typically vary in size, ranging from 5000 m^2 to up to 300,000 m^2, and are often located outside urban areas, managed from a single center (Alkibay et al., 2007). This definition also includes information about the size of shopping centers.

Shopping centers are unique spaces that encompass not only shops but also various service environments for communication, such as cafes, cinemas, and dining options, in addition to their surroundings. Shopping centers serve as central places where people can access various services, retail sales, and entertainment activities alongside shopping (Wong & Nair, 2018). Changes in shopping habits, the increasing need for open spaces, and people's preference for social areas have transformed shopping centers from being solely indoor spaces for shopping. In addition to enclosed areas, shopping centers have become vibrant lifestyle centers that offer users the opportunity to enjoy their time in semi-outdoor and outdoor spaces. In fact, open-air shopping centers located away from city centers have become more popular compared to enclosed shopping centers remaining in the city center (Ceylan et al., 2018).

1.2. Shopping Centers and Landscape Design

Shopping centers encompass architectural structures that accommodate a multitude of activities, including offices, residential units, dining establishments, cultural and artistic venues, and public amenities, thus giving rise to novel living spaces characterized by a communal nature. It can be noted that projects with open or semi-open typologies are being developed with different concepts, striving to create a street and avenue concept reminiscent of urban spaces. Shopping centers adhere to universal standards, establishing qualitative and quantitative criteria for aspects such as shopping corridors, central voids, parking areas, floor heights, service and storage spaces, activity areas, security measures, and earthquake resilience structures. In the context of shopping

centers, landscape design criteria should be evaluated in terms of the building's exterior appearance, circulation, user guidance, functionality, adaptability, space organization, structure and materials, transitions, color utilization, and the incorporation of landscape elements and lighting fixtures (Birişçi et al., 2012).

Furthermore, when evaluating the plant selection in landscape design based on elements of botanical design such as texture, line, color, and form, along with principles like diversity, proportion, balance, repetition, contrast, emphasis, and suitability, it can be noted that they contribute to the creation of unique spaces by establishing backgrounds, enhancing spatial effects, creating alleys, defining boundaries, and adding color and movement to the environment. The volume gained by plants, both vertically and horizontally, also influences the scale of the designed space. In addition to their individual harmony, plants should harmonize with each other as well. Designs that are proportionate to the scale of the area can have positive impacts on the space (Khabbazi, 2009; Birişçi et al., 2012). Plant materials have become an integral part of human life as natural landscape elements. With a focus on environmental awareness and the continuity of the natural order, plant materials have been increasingly employed in shopping centers (Pakvaran, 2010). Additionally, water features, being an inseparable part of nature and appealing to people both visually and aurally, are included among the natural elements used in the design of shopping centers. In this context, plant materials and water elements are natural components used in shopping center landscape design.

In the field of landscape architecture, plants form the essence of environmental design efforts. Plants hold a significant place in urban and rural space planning and design. Especially in the creation of functional and aesthetically pleasing spaces, plants play an essential role in softening hard elements such as structures, walls, and stone flooring used in landscape design. These types of landscape elements contribute to giving the environment a more natural appearance and make spaces resemble a closer connection to nature for people. The appearance of green spaces develops over time due to plant growth, which adds a temporal dimension to a landscape. From a designer's perspective, due to the effects of plants in terms of form, size, color, texture, light, movement, shade, and more, plants are recognized as landscape elements that offer various design options (Öztan, 2004).

Water elements, on the other hand, are an integral part of natural landscape elements and hold a significant position in landscape design. The use of water elements in shopping centers is increasing due to the visual and auditory effects created by the sound of flowing water, as well as its cooling properties. The preference for incorporating water elements in the design of shopping centers is due to the positive effects it has on the perception of space and the well-being of individuals. In landscape design, the proper utilization of water elements requires an understanding of the flow behavior of water to engage effectively with people. Physical laws alone may not be sufficient to explain how water elements affect and are perceived by individuals. Therefore, the use of water elements can have a substantial impact on spaces (Moore, 1994).

In the realm of architectural landscape design, structural materials encompass various elements, including flooring materials, roofing and upper covering components, boundary features, infrastructure, and equipment elements. Among these, flooring materials hold a pivotal role in landscape design. The horizontal surface, which functions as the structural foundation of the space, becomes a floor when adorned with suitable materials tailored to its intended purpose. This not only serves a functional role but also contributes to the aesthetics of the space, introducing diverse elements such as materials, colors, textures, and dimensions (Uzun, 2007). In the context of shopping center design, structural elements used for the purposes of confinement, privacy provision, preservation of landscape areas, and defining space are considered significant. Boundary elements such as fences, railings, walls, and similar structures serve as both complements to landscape areas and determinants of space and volume. Additionally, they fulfill functions such as demarcation, restriction, control of wind and noise, aesthetic enhancement, and providing support for vegetative elements. Furthermore, the design of boundary elements should harmonize with

other structural components and, if necessary, be integrated into the design alongside elements like seating elements and pergolas (Güney et al., 1995).

Structural elements such as roofs and overhead covering elements are designed as aesthetic elements with the purpose of protecting outdoor spaces from rain and sunlight. These elements serve functions including screening, emphasizing, connecting, creating sheltered spaces, and forming observation areas within spaces (Güney et al., 1995; Uzun, 2007). Outdoor seating units, benches, advertising panels, fountains, trash bins, kiosks, signage boards, and similar elements are considered as furnishing elements in outdoor spaces. Furnishing elements designed for individual use contribute to visual richness with their colors and forms while providing comfort to users (Güney et al., 1995). One of the significant factors influencing the attractiveness of shopping centers is the implementation of satisfactory infrastructure. In landscape design, important infrastructure works for shopping centers include transportation and parking. It is necessary to design a parking area with sufficient capacity for visitors' vehicles (Özkan & Küçükerbaş, 1995).

2. Methodology

A literature review was conducted exploring both scientific and grey literature including academic theses, scientific articles, projects, books, recent reports prepared for shopping centers, translations from foreign sources, and other printed publications. The review helped us to determine the scope of the primary research. Accordingly, selected shopping centers from Turkey and around the world were examined in terms of design criteria, with an attempt to determine their adequacy both qualitatively and quantitatively. As a method of primary data collection, a questionnaire was prepared and administered to shopping center users. The design and planning criteria of the selected sample shopping centers were investigated, and design criteria, landscaping elements used, and reasons for preference were investigated using a comparative method. Shopping center landscape design was analyzed concerning the natural and structural elements used.

2.1. The Universe and Sample of the Study

The research encompasses consumers who frequently attend shopping centers in Turkey. Due to limitations stemming from time, expenses, and pandemic circumstances, the research sample comprises 586 consumers who are patrons of shopping centers. The snowball sampling technique was employed in this study. It is worth noting that this technique concentrates on critical scenarios and individuals from whom comprehensive data can be acquired, and access to the population was achieved by tracking these pivotal scenarios and individuals (Creswell, 2013). The snowball sampling technique is employed when information about the population is lacking or access to the units constituting the population is challenging (Patton, 2005). In this research, one of the reasons for choosing this technique is the assumption that the sample should predominantly consist of the educated segment, given their presumed higher attention to environmental conditions and design. Korhonen and Lappalainen's study concluded that education plays a significant role in creating environmental awareness (Korhonen & Lappalainen, 2004). This research was conducted in 2021 across three major cities in Turkey: Istanbul, Ankara, and Izmir. It included a total of nine shopping centers, with three in each city, and targeted a randomly selected sample of 586 users. It was deemed sufficient for the participants to have used the designated shopping centers to respond to the survey.

2.2. Assumptions and Limitations

It is assumed that the survey participants answered the questions sincerely and candidly. The sample of the study is assumed to represent the population. Additionally, it is assumed that the survey can reveal the expectations of consumers regarding landscape design in shopping centers. The most significant limitation of the study is that, due to the pandemic, the survey could not be conducted in a face-to-face format. Therefore, the survey was conducted online using Google Forms.

2.3. Data Collection Instrument

In the study, a survey form consisting of two sections was used as the data collection instrument, which was created by the researcher. The first section of the survey form aims to obtain data related to participants' demographic information and consists of a socio-demographic information form. This form includes 4 questions that aim to determine participants' age, gender, educational status, and employment status. The second section of the survey form consists of 14 questions aimed at determining the factors influencing participants' preferences for shopping centers, their expectations regarding landscape design, and the impact of preferences on landscape design.

2.4. Data Analysis

The first section of the survey questions created to evaluate consumer expectations regarding landscape design in shopping centers includes questions about participants' demographic information. In the second section of the survey, there are general questions aimed at determining consumers' preferences in landscape design in shopping centers, as well as questions that can be evaluated specifically for the preferred shopping center. To analyze the data in order to understand how the elements used in landscape design influence consumers' shopping center preferences and to evaluate their expectations, statistical methods were employed using the SPSS 22.0 software package. Percentage values were used for data interpretation. To test whether participants' preferences for landscape design in shopping centers differ by age, one-way analysis of variance (ANOVA) was conducted. Descriptive analysis method was used for the question in the survey where participants' opinions were sought.

3. Results

3.1. Demographic Overview

The findings related to the socio-demographic information of the 586 participants who participated in the survey (gender, age, educational status, employment status) are presented in Table 1. All participants completed all the questions in the form.

Table 1 Participants' Demographic Information

Socio-Demographic Characteristics of Survey Participants	Options	Frequency (f)	Percentage (%)
Gender	Female	350	59,7
	Male	236	40,3
Age	18-25	76	13,0
	26-35	117	20,0
	36-45	139	23,7
	46-55	199	34,0
	55 and over	55	9,3
Education Level	Primary School	-	-
	Secondary School	3	0,4
	High School	37	6,4
	Associate's Degree	38	6,5
	Bachelor's Degree	354	60,4
	Master's Degree / Ph.D. (Doctorate Degree)	154	26,3
Employment Status	Employed	399	68,1
	Student	60	10,2
	Housewife / Not employed	54	9,2
	Unable to work due to disability and/or chronic health issues	-	-
	Retired	55	9,4
	Other	18	3,1

3.2. Shopping Habits of the Participants

A table below summarizes participants' shopping habits before and after the pandemic (Table 2).

Table 2 Frequence and Percentage of Participants' Visits to Shopping Centers

	Options	Frequency (f)	Percentage (%)
How often did you go to shopping centers?	Every few months	107	18,3
	Several times a month	180	30,7
	Once in a month	105	17,9
	Once a week	123	21
	Multiple times a week	71	12,1

The data presented in Table 2 reveals that participants frequently visit shopping centers, with the majority indicating several visits per month. It is noteworthy that all 586 participants responded to this question.

In terms of the primary purpose behind participants' visits to shopping centers, the predominant motivations are shopping and dining, as indicated by their responses. It is worth noting that all participants (n=586) provided answers to this survey question.

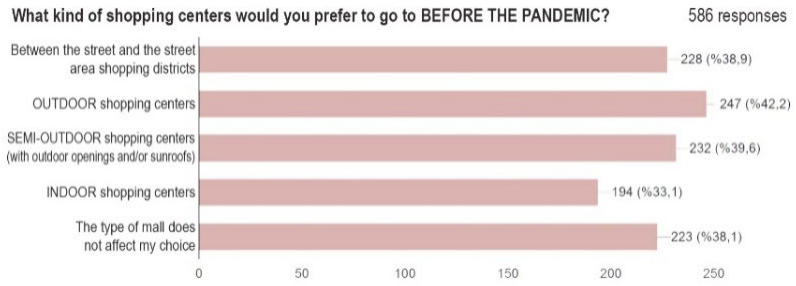

Figure 1 Participant preferences for shopping center types before the pandemic

The results presented in Figure 1 indicate that there was no notable differentiation in participants' preferences for shopping center types prior to the pandemic. It is worth noting that this question was answered by all participants (n=586) in the survey.

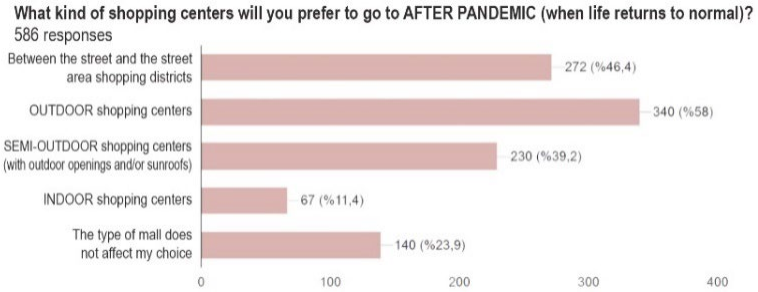

Figure 2 Likely participant preferences for the shopping center type after the pandemic

From the findings presented in Figure 2, it can be inferred that participants will predominantly prefer open-air shopping centers after the pandemic. Additionally, it is noteworthy that participants will choose enclosed shopping centers to a lesser extent. It should be noted that all participants (n=586) responded to this question in the survey.

The findings regarding participants' responses to the question "Do you think the number of open-air shopping centers will increase after the pandemic, as shown in the photo below?" are displayed in Figure 3.

Figure 3 Proportions of respondents based on their opinion on whether the number of shopping centers will increase after the pandemic

From the results presented in Figure 3, it can be observed that participants predominantly expressed the belief that outdoor shopping centers will increase in prominence following the pandemic, and their expectations align with this perspective. It should be noted that all participants (n=586) responded to this question in the survey.

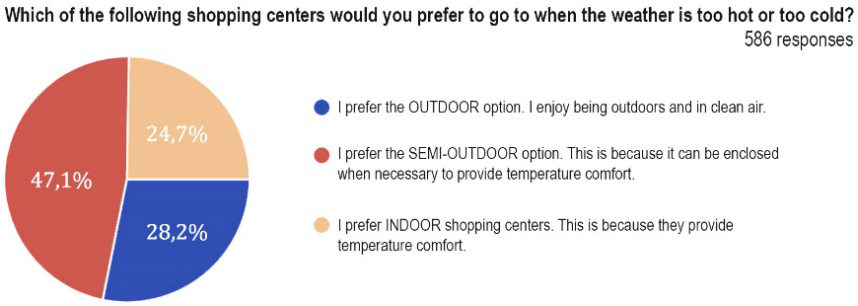

Figure 4 Participant preferences of the shopping center type during hot and cold weather

From the findings in Figure 4, it can be inferred that participants would predominantly prefer semi-outdoor shopping centers when considering weather conditions. It should be noted that all participants (n=586) responded to this question in the survey.

3.3. Findings Regarding Participants' Views on Landscape Design

A table below summarizes participant shopping center preferences based on presence of landscape design elements (Table 3).

Table 3 Participant Shopping Center Preferences Based on Presence of Landscape Design Elements

	Options	Frequency (f)	Percentage (%)
The preference for shopping centers based on landscape elements.	Yes	469	80,0
	No	117	20,9

The findings from Table 3 suggest that the presence of landscaping elements such as plant design, decorative fountains, benches for relaxation, and other landscaping elements is effective in participants' shopping center preferences. It can be concluded that landscaping elements are among the important criteria in shopping centers. It should be noted that all participants (n=586) answered this question in the survey.

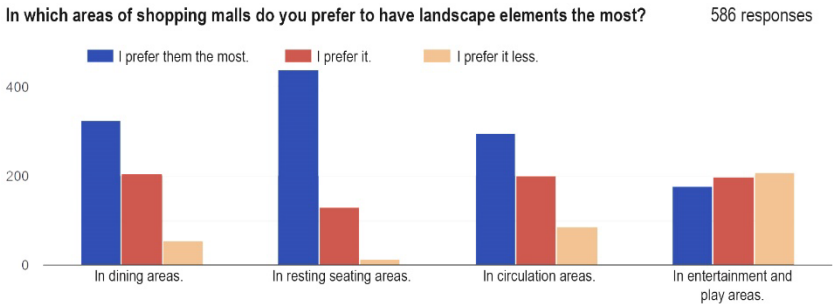

Figure 5 Participant preferences for landscaping elements by different areas of shopping centers

The findings from Figure 5 suggest that the use of landscaping elements in relaxation and seating areas within shopping centers is of particular importance. This question was answered by all participants (n=586) in the survey.

Table 4 Summary of Participant Shopping Center Preferences

Upper-Middle Income Group Shopping Centers		Middle Income Group Shopping Centers		Middle-Low Income Group Shopping Centers	
Zorlu	İstanbul/2013	Kanyon	İstanbul/2006	Meydan	İstanbul/2007
Number of Stores	205	Number of Stores	143	Number of Stores	170
Parking area	2200 Cars	Parking area	2300 Cars	Parking area	5000 Cars
Total Construction	105.000 m²	Total Construction	37.500 m²	Total Construction	55.000 m²
Next Level	Ankara/2013	Kentpark	Ankara/2009	Metromall	Ankara/2017
Number of Stores	145	Number of Stores	236	Number of Stores	200
Parking area	3000 Cars	Parking area	3000 Cars	Parking area	3000 Cars
Total Construction	42.000 m²	Total Construction	224,399 m²	Total Construction	450,000 m²
Hilltown	İzmir/2019	Forum Bornova	İzmir/2006	Mavibahçe	İzmir/2015
Number of Stores	200	Number of Stores	128	Number of Stores	230
Parking area	2750 Cars	Parking Cars	3000 Araç	Parking area	2000 Cars
Total Construction	68.000 m²	Total Construction	200.000 m²	Total Construction	165.000 m²

Table 4 summarizes general information about the participants' most preferred shopping centers, including Kentpark / Ankara, Kanyon / Istanbul, Forum Bornova / Izmir, Zorlu / Istanbul, MaviBahçe / Izmir, Next Level / Ankara, Metromall / Ankara, Hilltown Karşıyaka / Izmir, and Meydan / Istanbul. This table was prepared by the researcher based on information obtained from the shopping centers' websites.

The participants primarily preferred shopping centers that were accessible by car. Furthermore, factors such as the presence of their favorite stores, the shopping center's operating hours, whether it was semi-outdoor or outdoor, and their satisfaction with the landscape design were among the reasons for their preferences. Consequently, it can be inferred that participants' satisfaction with the landscape design could significantly influence their choice of a shopping center.

The findings indicate that participants predominantly preferred plants as landscaping elements in shopping centers. Plants were followed by seating, resting units, water features, artistic elements, ground coverings, and overhead elements in their preferences. Therefore, it can be inferred that, in terms of consumer preferences, plants or natural elements play a significant role in shopping mall landscape design.

The findings indicate that the water feature was the landscaping element that predominantly caught the participants' attention in shopping centers. Additionally, it can be stated that participants primarily preferred natural designs in shopping centers based on the results. This demonstrates that natural landscape designs in shopping centers are preferred by consumers to a greater extent and align with their expectations during their visits to these centers.

Table 5 Participant Shopping Center Preferences by Gender Before and After the Pandemic

Before the pandemic	Female	Male	Total
Street and sidewalk spaces	179	49	228
Outdoor	124	123	247
Semi-Outdoor	136	96	232
Indoor	108	86	223
After the pandemic			
Street and sidewalk spaces	191	81	272
Outdoor	226	114	340
Semi-Outdoor	161	69	230
Indoor	48	19	67

According to the findings in Table 5, it can be interpreted that participants, based on gender variable, preferred all types of shopping centers at relatively similar rates before the pandemic. Additionally, it can be stated that female participants visited shopping centers more frequently than males. From the findings, it can be observed that, after the pandemic, female participants predominantly preferred outdoor shopping centers, followed by street shopping areas, semi-

outdoor, outdoor, and indoor shopping centers. Male participants, on the other hand, predominantly preferred out-door shopping centers after the pandemic, followed by street shopping areas, semi-outdoor, and indoor shopping centers. The findings indicate that, after the pandemic, participants based on gender variable tended to prefer street shopping areas, semi-outdoor, and outdoor shopping centers more, and visited indoor shopping centers less. This situation can be interpreted as participants being reluctant to be in indoor environments to feel safer during the pandemic. Additionally, it can be said that, after the pandemic, street shopping areas, semi-outdoor, and outdoor shopping centers are more likely to be preferred by people compared to indoor shopping centers.

Table 6 Participant Attention to Landscape Elements in Shopping Centers by Gender

Landscaping Elements in Shopping Centers	Female	Male	Total
Seating and Resting Units, etc.	196	155	351
Plants	221	152	373
Water Elements (Decorative Ponds, Fountains)	193	106	299
Artistic Elements (Sculptures, Reliefs, etc.)	105	120	225
Covering Elements (Shade Structures, Pergolas, etc.)	69	66	135
Flooring materials	98	94	192

According to the findings in Table 6, female and male participants have primarily preferred plants and seating and resting units as landscaping elements in shopping centers. Gender appears to affect perception of importance of landscape design elements, and shopping centers are not only chosen for shopping and dining activities but also for relaxation and leisure activities.

3.4. Participant Recommendations for New Shopping Centers

At the end of the survey conducted with 586 participants in the study, participants were asked about their design recommendations for shopping centers to be built after the pandemic and their thoughts on whether future shopping centers should undergo changes. Four hundred and twenty responded to this question and provided their opinions. Descriptive analysis method was employed to elucidate the post-pandemic shopping center designs based on the participants' responses.

Participants' foresights regarding the shopping centers to be constructed after the pandemic generally suggest a preference for semi-outdoor and outdoor designs. They emphasize the importance of avoiding overly complex designs, incorporating landscaping elements such as plants and water features, adjusting distances, and prioritizing open areas with circulation. They also indicate that existing shopping centers with these designs would be preferred. In this context, it would be a sound choice for architects to consider consumer preferences in the design of new-generation shopping centers and contribute to making shopping centers an integral part of life even after the pandemic.

4. Discussion

Our findings are in concordance with other similar studies. In the study titled "Shopping Malls Attractiveness: A Segmentation Approach" conducted by El-Adly (2007), it was determined that consumers have expectations related to the ease of transportation, sufficient parking capacity, and the presence of comfortable resting areas in the design of shopping centers. Similarly, in the current study, it is observed that participants expect shopping centers to have easy vehicular access, simplicity in design, and comfortable resting areas from an architectural standpoint. Paulins and Geistfeld (2016) revealed that consumer expectations from shopping centers vary according to their educational levels, and consumers have expectations related to ease of navigation and the location of stores.

Also, Cengiz and Özden (2002) found that consumers have expectations from shopping centers, including the presence of dining and cinema areas, sufficient variety of stores, play areas for children, and adequate parking capacity.

In addition to that, Demirci (2000) determined that consumers have expectations from shopping centers that include product variety, the availability of parking facilities, the attractiveness of interior design, and the design of stores and their surroundings.

The study conducted by Altunışık and Mert (2001) also identified consumer expectations from shopping centers, which include having a spacious and modern appearance, easy accessibility, sufficient parking space, comfortable navigation, the presence of children's play areas, and social activity areas. These findings are in line with the data obtained in our study.

In Sakarya's study (1997), it is emphasized that the lighting system at the entrance area of shopping centers and areas with different functions such as circulation and information should be attractive. Therefore, it has been determined that in addition to the general lighting system, the use of local lighting systems for specific areas in the shopping center is important. The study also found that visitors were more likely to respond positively to the adequacy and safety of lighting in indoor parking areas compared to shopping center employees. However, in general, it was concluded that 49% of the participants considered it insufficient and unsafe. This study, which supports the findings of the current research, has identified the significant impact of the lighting system in landscaping on the attractiveness of shopping centers. Similarly, Turhan's study (2007) examines how glass has been influential in spatial and architectural design throughout history. In the context of the use of glass in shopping center design, a visual evaluation of shopping centers has been conducted. As a result, it has been reported that the use of glass in landscaping design has a positive impact on users.

In the study conducted by Şenkal-Sezer et al. (2014), landscaping design practices that adhere to specific criteria were implemented in certain shopping centers, typically using solitary and architecturally structured plant species. As a result of the research, it was determined that there is an unfavorable environment for plant growth due to the lack of sufficient natural light openings in shopping centers and the use of LED, spotlight, and fluorescent lighting instead of greenhouse lighting. Considering the participants' preference for natural designs and, consequently, plants in shopping center landscaping designs, it can be emphasized that an environment conducive to plants should be created in accordance with user preferences.

Landscape design can be defined as the synthesis of science and art where nature and culture converge. In addition to design, it primarily involves work based on scientific data, taking into account natural, ecological, cultural, social, economic, environmental, climatic, technological, and land structure factors. It considers geographical, botanical, and local environmental relationships while aiming for sustainability, innovation, and problem-solving. It also focuses on preserving historical, natural, and cultural values within a legal framework, all while prioritizing the relationship between humans, flora, fauna, and their needs (Demiralp, 2009). In this regard, it should not be expected to achieve successful results in applications where landscape planning stages are not taken into account in urban spaces like shopping malls. Non-compliance with the planning stages can lead to irreversible errors in landscape applications (Helfand et al., 2006; Taib & Abdullah, 2012; Özer & Barış, 2013; Kim et al., 2014). In addition to landscape work that aligns with user preferences in shopping centers, it is considered important to design landscaping in line with planning. The results obtained through the survey application and analysis conducted in the study, as well as the recommendations developed by the researcher based on these results, are provided below.

Shopping centers offer a distinct proposition to consumers, aiming to foster extended visits and shopping activities. To achieve this, these spaces should facilitate social gatherings, leisure activities such as gaming, dining, relaxation, and seating. Moreover, they should incorporate thematic areas tailored to specific interests, provide opportunities for sporting activities, and offer informative environments. Consequently, there is merit in designing shopping center landscapes in a manner that aligns with contemporary demands and captivates the interest of consumers.

The selection of the location for a shopping center should begin with a thorough evaluation of environmental factors, considering elements such as transportation and parking that can be

designed to attract consumers effectively. In a sense, the shopping center should coexist harmoniously with the urban environment. In the landscape design of shopping centers, simplicity should be favored over complexity, ensuring straightforward placement of stores and ease of circulation. The importance of landscape design for shopping centers is evident from the results of our study. It can be said that struggling or declining shopping centers can be revitalized with new landscape additions that align with user preferences. However, since this is not the primary focus of the study, it has not been extensively addressed in its content.

The acceptance of a shopping center by consumers hinges significantly upon the quality of its landscape design. Therefore, the design must fulfill consumer expectations and needs, while simultaneously providing an enjoyable experience within its confines. Landscape design should incorporate aesthetic elements like flora, water features, and lighting, all of which contribute to establishing an atmosphere of naturalness and spaciousness in communal areas. In the realm of shopping center landscape design, meticulous attention should be paid to the synergy among different spatial components. The design should convey to visitors that they can find aspects of themselves within the shopping center, maintain a design ethos closely aligned with natural elements, and nurture symbolic imagery, including a sense of belonging and identification with fellow visitors. Consequently, cultivating a sense of belonging and enabling consumers to perceive themselves as an integral part of the whole are essential objectives. Shopping center landscape design should also take local climate conditions into consideration and favor designs that are climate-appropriate. Furthermore, it should ensure a seamless integration of interior and exterior spaces. In the architectural design of a shopping center, it is essential to delineate the target demographic and formulate the design and spatial arrangements accordingly. Recognizing that the influence of landscape elements within the shopping center may not be uniformly distributed among all users; the establishment of design criteria should align with shared characteristics, aesthetic inclinations, expectations, and requisites of the prospective users. The selection of the target demographic necessitates a thorough consideration of variables such as the residents' lifestyles, individual preferences, and socio-economic standings in the vicinity where the shopping center is located, allowing for purposeful categorization.

In landscape design, it is imperative to create an environment that not only caters to the physical needs of users but also places significance on technological infrastructure. This approach ensures that users feel comfortable and secure within the designed space. It is recommended that the design process of shopping center projects involve collaboration between architects, landscape architects, and interior designers from the very beginning, embracing an interdisciplinary approach. Such collaboration enables various disciplines to interact and contribute their expertise to the design process effectively. In landscape design, the preference should lean towards ecologically sensitive designs, where users can encounter fragments of the urban identity that reflect the city's character while also providing them with enjoyable spaces where they can feel a connection to the natural environment.

Shopping centers, in addition to being retail spaces, have evolved into multifaceted environments with various themes and social and cultural functions, catering to the needs of contemporary individuals. These spaces offer users the opportunity to engage in numerous activities and provide socialization opportunities. Therefore, the landscape design of shopping centers should be carried out with consideration of evolving needs over time.

The pandemic period has shed a clearer light on the role of shopping centers in people's lives. During the quarantine measures, as shopping shifted to online platforms, discussions and predictions about the future of shopping centers emerged. However, in line with the findings obtained from this study, it can be emphasized that shopping centers are not merely structures encompassing stores. They are social gathering spaces for consumers, characterized by environmentally friendly designs and the optimal utilization of technology. Despite the significant shift of shopping to the online realm, it is evident that people have not abandoned their preference for in-person interactions and coming together. Therefore, it can be predicted that shopping

centers designed to meet consumers' expectations have the potential to be a source of happiness for everyone.

The pandemic has taken shopping centers by surprise, as it has in all sectors. Adapting to such a situation, ensuring the necessary conditions, and attracting consumers necessitate a strong emphasis on hygiene, along with the provision of natural environments to consumers. This entails not only delivering the pleasure of shopping but also providing social and cultural activities that yield the desired level of satisfaction, thereby stimulating the inclination of consumers to revisit. Structures conceived as shopping centers should strive to create experiences that are etched in the memory of individuals, enabling them to spend joyful moments and, most importantly, kindling the aspiration for a return visit. In this regard, it is of paramount importance to prioritize the design of next-generation shopping centers by drawing instructive insights from the pandemic. Innovative solutions should be devised within the design framework to craft shopping centers adaptable to the post-pandemic era. It is evident that shopping centers failing to align with the altered lifestyles of individuals will not enjoy the same level of demand as before. Architects should contemplate the lessons learned from the pandemic and introduce more imaginative solutions in the design of next-generation shopping centers. Furthermore, it can be anticipated that the designs of previously established shopping centers could be enhanced through aesthetic refinements. The design of shopping centers, which address a wide spectrum of society and are adaptable to any potential events or circumstances that may affect or have the potential to influence society, is regarded as an essential societal imperative.

In anticipation of the pandemic-induced transformation, shopping centers are poised to undergo an evolution that aligns more closely with the innate characteristics of human behavior. These centers are expected to maintain their status as alluring hubs, serving not only as venues for satiating shopping desires but also as focal points for social and cultural activities. It can be asserted that a new phase will commence post-pandemic, marked by the integration of shopping centers into the daily lives of individuals. These centers, which can be perceived as communal spaces where people congregate, must be equipped to provide uninterrupted services under all circumstances and adversities.

5. Conclusion

The aim of this study was to reveal the effects of landscape design in shopping centers on consumers, evaluate changes in landscape design, and determine the criteria and expectations of consumers in landscape design. In the context of this study, we came up with four hypotheses. Our findings confirmed all these hypotheses. First of all, we found that visitors pay attention to landscape design in their preferred shopping centers. Especially in shopping centers, elements such as plants, water features, amenities, art elements, small trees and shrubs, ground cover plants, seasonal flowers, floor coverings, and covering elements attract visitors' attention. Visitors enjoy being in shopping centers with landscape designs they like, and they mention that being in such an environment brings them peace. These findings support our first hypothesis that landscape design in shopping centers directly affects visitors psychologically. Secondly, we found that different landscape elements are used depending on the type of shopping center, with a greater emphasis on natural landscape elements in outdoor shopping centers, and visitors' preferences align with this. This confirms our second hypothesis that landscape elements used in design vary according to the type of shopping center (indoor, semi-outdoor, outdoor). In addition to that, our study revealed that consumers prefer outdoor or semi-outdoor shopping centers with natural elements in landscape design, providing a spacious and comfortable environment. Considering the pandemic period, it is observed that visitors prefer outdoor and semi-outdoor shopping centers more and tend to avoid indoor shopping centers. These findings indicate that visitors to shopping centers make their choices based on landscape design, supporting our third hypothesis. Finally, we found that survey participants place particular importance on landscape design in circulation areas and

dining areas. Thus, it is highly likely that for shopping center visitors landscape design is most important in circulation areas and dining areas, which confirms our fourth hypothesis.

The findings of our study have practical implications for shopping center design in post-pandemic era, indicating a clear need for incorporation of landscape design elements, especially plants and water features, into these facilities. Also, shopping center visitor preferences indicate the need for transition in shopping center design towards semi-outdoor or outdoor types. Future research is needed to determine how different social, cultural, economic and environmental conditions may affect consumer preferences as regards to shopping center types and design.

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References

Abrudan, I. N. (2011). Definitions and classifications of shopping centers. *Marketing from Information to Decision*, *4*, 9-20.

Alkibay, S., Tuncer, D., & Hoşgör, Ş. (2007). Shopping centers and management. *Siyasal Kitabevi*. (In Turkish)

Altunışık, R., & Mert, K. (2001). A field study on consumer purchase behavior in shopping centers: Are consumers losing control? *6th National Marketing Congress*. (In Turkish)

Berman, B., & Evans, J. (2010). Retail management (11th ed.). *Prentice Hall*.

Birişçi, T., Güney, M. A., Türel, S. H., & Kılıçaslan, Ç. (2012). *Plant design (2nd ed.). Üniversiteliler Ofset*. (In Turkish)

Birol, G. (2005). Reinterpreting urban fabric in contemporary shopping centers. *Journal of the Faculty of Engineering and Architecture of Gazi University*, *20*(4), 421-427. (In Turkish)

Bloch, P. H., Ridgway, N. M., & Dawson, S. A. (1994). The shopping mall as consumer habitat. *Journal of Retailing*, *70*(1), 23-42.

Cengiz, E., & Özden, B. (2002). A study on large shopping centers in retailing and determining consumers' attitudes towards large shopping centers. *Ege Academic Perspective Journal*, *2*(1), 1-15. (In Turkish)

Ceylan, R., Özbakır, A., & Işıl, E. (2018). Evaluation of shopping centers within the legal framework in Turkey. *Metu Journal of the Faculty of Architecture*, *34*(2), 245-264. (In Turkish)

Creswell, J. W. (2013). Research design: Qualitative, quantitative, and mixed methods approaches. Sage.

De Juan, M. D. (2004). Why do people choose the shopping malls? The attraction theory revisited: A Spanish case. *Journal of International Consumer Marketing*, *17*(1), 71-96.

Demiralp, S. (2009). Minimum standards and design/drawing techniques for landscape design projects. *Journal of Landscape Architecture*. (In Turkish)

Demirci, F. (2000). The effects of proximity to residential areas on becoming a shopping center customer (shopping center patronage). *Book of the 5th National Marketing Congress*. (In Turkish)

El-Adly, M. I. (2007). Shopping malls attractiveness: A segmentation approach. *International Journal of Retail & Distribution Management*, *35*(11), 936-950.

Helfand, G. E., Park, J. S., Nassauer, J. I., & Kosek, S. (2006). The economics of native plants in residential landscape designs. *Landscape and Urban Planning*, *78*(3), 229-240.

Khabbazi, A. (2012). The fall and rise of British mall. *The Journal of Architectura*, *6*, 317-378.

Khabbazi, A. P. (2009). A study on determining usage parameters of indoor plants used decoratively in shopping centers (Master's thesis). Gazi University, *Institute of Educational Sciences,* Department of Applied Arts Education, Ankara. (In Turkish)

Kim, M. J., Yang, H. S., & Kang, J. (2014). A case study on controlling sound fields in a courtyard by landscape designs. *Landscape and Urban Planning*, *123*(1), 10-20.

Korhonen, K., & Lappalainen, A. (2004). Examining the environmental awareness of children and adolescents in the Ranomafana region, Madagascar. *Environmental Education Research*, *10*(1), 195-215.

Moore, C. (1994). Water and architecture. *Themes and Hudson*.

Özer, B., & Barış, M. E. (2013). Landscape design and park users preferences. *Procedia-Social and Behavioral Sciences*, *82*(1), 604-607.

Öztan, Y. (2004). Our living environment and landscape architecture. *Tisamat Printing Industry*. (In Turkish)

Pakvaran, S. (2010). Uses of the basic landscaping elements in shopping malls, Istanbul and Dubai (Master's thesis). Eastern Mediterranean University, Gazimagosa.

Patton, M. Q. (2005). Qualitative research. *John Wiley & Sons, Ltd.*

Paulins, V. A., & Geistfeld, L. V. (2016). The effect of consumer perceptions of store attributes on apparel store preferences. *Journal of Fashion Marketing and Management*, *4*(1), 371-385.

Rahimi, A., & Khazaei, F. (2018). Designing shopping centers: The position of social interactions. *Journal of History Culture and Art Research*, *7*(2), 239-248.

Sakarya, A. (1997). The effects of technical and aesthetic lighting on spatial design in shopping centers (Master's thesis). MSGSU *Institute of Natural Sciences*, İstanbul. (In Turkish)

Şenkal-Sezer, F., Vural-Arslan, T., & Çahantimur, A. (2014). Assessment of user satisfaction in shopping centers in terms of comfort conditions: The case of Bursa. *Journal of Uludağ University Faculty of Engineering and Architecture*, *19*(1), 81-96. (In Turkish)

Taib, N., & Abdullah, A. (2012). Study of landscape gardens: Expectations and users' perceptions of a high-rise office building. *Procedia-Social and Behavioral Sciences*, *50*(1), 633-642.

Teller, C., Reutterer, T., & Schnedlitz, P. (2008). Hedonic and utilitarian shopper types in evolved and created retail agglomerations. *The International Review of Retail, Distribution and Consumer Research*, *18*(3), 283-309.

Toksözlü, Z. (2011). Examination of Turkish conditions in terms of landscape planning and design criteria for outdoor shopping centers with the example of İzmir Forum Bornova (Master's thesis). Ege University *Graduate School of Natural and Applied Sciences*, Department of Landscape Architecture, İzmir. (In Turkish)

Turhan, E. (2007). The use of glass in architectural design and its evaluation in shopping mall centers (Unpublished Master's thesis). Istanbul University, *Institute of Science*, Department of Architecture, İstanbul. (In Turkish)

Uzun, G. (2007). Landscape construction-1. *Çukurova University Publications* No:162. (In Turkish)

Wong, S. C., & Nair, P. B. (2018). Mall patronage: Dimensions of attractiveness in urban context. *International Journal of Business and Society*, *19*(2), 281-294.

Resume

Özlem Nur Aslantamer completed her Ph.D. in Landscape Architecture at the School of Natural and Applied Sciences, Ankara University, in 2021. With 26 years of combined experience in academia and the professional field of interior architecture & environmental design, she has established a robust foundation in her field. Since 2021, she has been serving as a full-time instructor at Atılım University, dedicating her expertise to both teaching and research endeavors.

Hüseyin Emre Ilgın received his Ph.D. (2018) in Building Sciences about tall building design in Architecture from METU in Ankara. Since December 2019, he has been conducting post-doctoral research on wood construction at Tampere University. Dr. Ilgın worked as a Marie Skłodowska-Curie postdoctoral research fellow on dovetailed massive wood board elements for 2 years between 2021-2023.

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Navigating priorities: Assessing the challenges of curriculum reform in Turkish Urban and Regional Planning Schools

İpek Şen*
Turgay Kerem Koramaz**

Abstract

Planning departments in Türkiye recently witnessed a boom. In less than 20 years, the number of universities offering urban planning programs increased from a dozen to 45, most accepting students with limited resources. Urban planning education has faced many challenges over the last two decades, and offering education with limited resources carried this problem to another level, increasing concerns among scholars about the quality of the education and the learning outcomes a planner should possess at graduation. While planning schools in Türkiye deals with the issues above, global debates in planning education revolve around integrating topics such as climate change, inequality, informality, and decolonization into the curriculum. This study aimed to reveal to what extent global issues find their way into Turkish planning school agendas in an environment where more pressing matters threaten the quality of education. To look further into this issue, all documents published by TUPOB (Türkiye Planning Schools Association) since its foundation were analyzed, and seven in-depth interviews with TUPOB members were conducted. A predominantly qualitative approach was utilized. The findings suggest that the lack of resources is the most critical problem for urban planning schools, followed by insufficient teaching faculty. The curriculum updates and integration of global issues such as climate change and urban poverty come later in the priorities list. This research showed that concerns regarding resources and lack of standards take precedence over global discussions in planning curricula.

Keywords: curriculum revision, planning curriculum, planning schools' association, urban planning education

1. Introduction: The Shortcomings of Urban and Regional Planning Education

Differentiating from other disciplines, urban planning is an area of education and practice that should respond and adapt quickly to emerging urban and social problems (Cuthbert, 2016; Watson, 2016). As climate change, urban sprawl, immense population growth, and inequality become urgent matters for the majority of the world, the need for curriculum reform for the built environment-related higher education program becomes inevitable.

However, current pedagogical approaches and curriculums are not as flexible and agile. They still produce homogenized solutions without truly understanding the human needs beneath the surface and are far from inclusive (Shilon & Eizenberg, 2020; Dawkins, 2016).

Since urban and regional planning became an independent discipline and started to graduate planners, it became the target of a series of critiques that have some recurring patterns, such as lack of interdisciplinary inquiry (Johnston, 2015), strict pedagogy that does not allow the real-world problems to enter into the curriculum in a timely manner (Cuthbert, 2016), heavy reliance on quantitative methods in the expense of their qualitative counterparts (Eizenberg & Shilon, 2016) and the gap between theoretical courses and studio work (Pojani et al., 2018; Olesen, 2018).

*(Corresponding author) Researcher and PhD Candidate, Istanbul Technical University, Türkiye, ipeksen@itu.edu.tr
**Prof. Dr., Istanbul Technical University, Türkiye koramaz@itu.edu.tr
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1.1. Planning Pedagogy

Interdisciplinarity is at the core of the planning discipline since it always requires input from all other disciplines related to the built environment and human behavior. However, the planning curriculum has been criticized for not integrating interdisciplinary work (Scholz et al., 2021) and squeezing other disciplinary inquiries into theoretical courses without making them a part of the studio work, where students are presented with some "real-world" problems. Johnston (2015) argues that planning education overlooks interdisciplinarity to the extent that it does very little to engage with the question of how to educate planning students regarding interdisciplinary inquiry. In other words, interdisciplinarity is not only ignored in how urban and regional planning is being taught but the question of how to teach interdisciplinary inquiry is also overlooked.

Current planning education often leans towards a technocratic approach, emphasizing practicality and quantitative methods over critical thinking and qualitative analysis (Eizenberg & Shilon, 2016; Dawkins, 2016). This focus may disregard the importance of social and cultural factors in urban development, hindering the ability to address complex issues like inequality, poverty, and climate change.

Moreover, the curriculum's inclination towards standardized methodologies not only fails to acknowledge the inherent subjectivity and dynamism of urban spaces (Dandekar, 1986; Eizenberg & Shilon, 2016) but also disregards the value of diverse perspectives (Eser & Koramaz, 2023). As Roakes and Norris Tirrell (2000) argues, the current emphasis in planning education on 'impersonal, objective, and systematic' procedures overlooks the richness of 'partial, fragmented, and often subjective' experiences that shape urban life (2000, p. 101). This approach homogenizes solutions, neglecting entire stakeholders' diverse needs and experiences, and fails to consider the sociocultural specificities of places (Kallus, 2001; Healey, 1997).

This critique aligns with Eizenberg and Shilon's (2016) call for a greater integration of qualitative methods in planning education. They advocate for a shift from "unidirectional and fixed relations" between environment and behavior to socially responsive and evolving planning approaches. Similarly, calls for a relational and constructivist approach highlight the need to move beyond generalized patterns and embrace the dynamic interactions between people and spaces.

Interdisciplinary inquiry is not the only aspect missing in urban planning education. Cuthbert (2016) argues that planning education, in its current form, relies on pedagogy so much that it becomes immune to the changes surrounding academia. He says pedagogy implies "an adherence to formal rules at the expense of a wider view" (2016, p.551), prohibiting planning education from cultivating a critical thinking approach. Although Cuthbert's work is primarily on urban design, it perfectly applies to urban and regional planning education since the two built-environment-related fields can co-exist and have many common courses in faculties.

Similar to Cuthbert, Sletto (2012) also raises some concerns about how planning is being taught and how it impacts the act of planning in the real world when students graduate. He uses his study of Los Platanitos Santo Domingo as an example of how the outcomes of planning education are being implemented in a real-world scenario and argues that the planning educators' interventions "may reproduce instead of challenge the structures of engagement that serve to keep places like Los Platanitos in conditions of dependency (2012, p. 230). Other than being confined to the limits of the pedagogical approach, the learning and teaching are also highly traditional, and the use of technological tools is quite limited (Pojani et al., 2018).

1.2. Planning Theory

An important part of the current planning education curriculum, Planning Theory received its share of critiques for being too abstract for the students (Pojani et al., 2018; Olesen, 2018) or too descriptive (Eizenberg & Shilon, 2016) or for being unable to bridge the gap due to language differences between practice and theory (Kunzmann & Koll-Schretzenmayr, 2015) or not providing any useful guidance on how to actually practice planning (Gunder, 2002).

Planning theory and how it is being taught has always been a contested field. The reason that it is referred to be too constraining to understand and implement is that it is too hard to understand and implement (Olesen, 2018) for students and does not provide enough guidance to do the "actual planning" in a field that was not seen even as an intellectual area of study or a pure science (Thompson, 2000). Critiques go as far as discussing that if planning theory is for the naive (Bengs, 2005). It is not seen as practical knowledge (Olesen, 2018) and, again, not applicable enough while engaging in a real-world situation, as planning students are expected to be ready to work when they graduate. However, they lack the mental and technical tools to solve the problems they are presented with at work. The critiques also point at the university for not including more professional training in their curriculums, potentially preparing the students for the upcoming challenges after graduation (Pojani et al, 2018).

1.3. Outdated Worldviews

Since urban planning has a legacy of being used as a tool for neoliberal policies, unjust resource distribution (Nnkya, 2008), colonization (Watson, 2014 & 2016; Odendaal, 2012), and reproducing the dominant power relationships (Sletto, 2012; Phiri, 2010), the ways in which the curriculum is organized, and the ideas penetrated the teaching are being criticized by many progressive scholars around the world. Scholz et al. (2021) argue that due to institutional problems, urban planning fails to address the current curriculum in urban planning education; it does not effectively respond to the challenges of the Global South, such as climate change, rapid urbanization, or urban poverty.

Odendaal (2012) argues that the current planning system in African cities is the heritage of the former colonial governments. Her critique is twofold. The first one is that the tools and frameworks of the colonial period are top-down and out of touch with how African cities are organized, as these systems used to have a different agenda. Second, she says that today's African cities require solutions that cannot be produced by the modernist planning approach that originates in mid-20th-century planning theories. The master plan approach used in planning schools is irrelevant to the challenges they go through (2012, p. 175). Similar to Odendaal's argument, Nnkya (2008) highlights that in some regions of Africa, the practice goes to an extent to which urban planning is exploited to benefit the elite and fails to solve the actual problems of the cities and the training of urban planners are not tailored to actually address the issues of urban poor (Phiri, 2010).

Another embedded problem that exacerbates the inefficiency of planning education is that the curriculum has been following the British tradition of planning in many regions of the world, which has not deviated from the WWII-era British planning approach. Also, it is argued that the post-war era is when the Northern concepts dominated the concept of planning around the world (Scholz et al., 2021). This "Western bias" inhibits planning schools and educators from focusing on local values (Phiri, 2010, p. 2) and modes of knowledge generation and reproducing the "hegemonic discourses of development" (Sletto, 2012, p. 230).

2. Research Background: Assessment of Urban and Regional Planning Education

The lack of a comprehensive discussion on whether planning education agendas worldwide are mirrored in planning curricula in Türkiye is a critical issue. While these new agendas are referenced in the course and studio contents, they have yet to be the subject of academic discourse. (Akçakaya Waite et al., 2021). This underscores the urgent need for more literature on planning education in Türkiye, especially in comparison to the abundance of journals and special issues dedicated to planning education on a global scale.

In 2017, the Planning Education and Research Journal editors conducted an exciting study that revealed the changing trends in the urban and regional planning field. The editorial board analyzed the titles of the articles submitted to the journal and used the word cloud method to see if there had been any changes in the past 40 years since the journal was established. They saw clear

demarcation lines between trending topics before and after the 2000s when the world underwent global transformations.

The research showed that there had been a significant, almost clear-cut change in keywords that appeared in the journal's published articles after 2000—that is, almost 20 years after the journal's foundation. Between 1980 and 2000, the main interests of the authors who submitted articles to the journal were "change, education, practice, teaching, and theory." However, a directional shift was observed after 2000. The prominent topics became climate change, community, food, sustainability, and transportation (Andrews et al., 2017). Aligned with Andrews et al. 's research, Odendaal (2012) stresses that the common problems of developing countries are climate change, urban growth, housing, and economic disparities.

Not only have priorities shifted in urban planning research and education, but planner roles have also changed over the course of the 21st century. Planners are expected to emphasize partnerships and collaboration (Shilon & Eizenberg, 2020) and be responsive to urban areas' challenges.

Sehested (2009, p. 257) argues that the future of the urban planner might very well depend on the planner's ability to combine and balance different planner roles according to the planning situation. Former top-down and physical space-centric approaches no longer translate into 21st-century urban areas and are not seen as responsive or collaborative. This shift sparked a discussion between groups that advocated tailored contextual approaches and one-world planning education at the beginning of the 21st century (Frank, 2006). Following those debates, the late 2010s clearly showed that there is a need for decolonization of higher education and research in general (Watson, 2014; Odendaal, 2012), involving local knowledge and values more in the decision-making processes rather than applying universalistic solutions (Shilon & Eizenberg, 2020).

In an effort to bridge the gaps in Türkiye's responses to ongoing global discussions, This paper aims to understand how TUPOB is working to modernize urban planning education in Turkey. It focuses on to what extent TUPOB addresses pedagogical shortcomings that hinder planning schools from being innovative and equipped to tackle 21st-century challenges and beyond. The research questions of this study are as follows:

a. How does TUPOB view the current state of planning education in Türkiye? What is their approach to fostering greater innovation and responsiveness within planning schools?
b. In what ways are TUPOB member schools revising their curricula to incorporate courses that address the critical urban and social issues of the 21st century?

3. Institutionalization of Urban and Regional Planning Education in Türkiye

In Türkiye, Urban and Regional Planning has been taught at universities as a 4-year bachelor's degree since 1961, started At Middle East Technical University In the capital of Türkiye, then sprawled Into Istanbul, the most populated city, by the 1980s. However, Türkiye's encounters with urban and regional planning date back to the foundation of the Turkish Republic, that is, to the very beginning of the 20th century. The urban projects were being undertaken by the architects, or foreign urban planners, invited by the then government to generate plans to solve the problems of a war-torn new country. But it is 40 years later that Turkish planning schools have an association to address the issues of all the planning schools across the country (Tekeli, 2011).

Currently, Türkiye has 71 planning schools, 6 of which are private, and the rest are public (YÖK, 2024). Some of these departments are still on paper, namely, not accepting students or providing courses. The rest vary regarding the number of faculty members and the courses they provide. Also, some of these schools only accept first-year students as they are still not "fully established".

3.1. The Scope and Objectives of TUPOB

After its establishment in 2004, TUPOB held its first coordination meeting with the participation of the Chamber of Urban Planners, including nine urban and regional planning departments in long-established schools with longstanding architecture faculties, such as Middle East Technical

University, Istanbul Technical University, Mimar Sinan Fine Arts University, and Yıldız Technical University (TUPOB, 2005-2).

TUPOB's 2009 vision document, also referred to as the initial certificate of association, outlines the main principles and goals of the association, which were "ensuring coordination among national urban planning schools providing education at undergraduate and/or graduate level, continuously improving the quality of the education process and the planning profession, establishing a structure in line with international standards, and thus increasing the legitimacy and effectiveness of the planning profession.

TUPOB assumes a unifying role in communication and interaction between planning schools, to carry out joint and coordinated studies on the improvement and restructuring of the training programs of planning schools by taking into account national and international criteria, to organize the studies on the determination of minimum common standards in planning education and training provided at the national level (TUPOB, 2009).

What makes this vision even more important is that higher education in Türkiye has been regulated by the governmental body Council of Higher Education (YÖK), and there are no other independent organizations involved in establishing standards in urban and regional planning education. TUPOB aimed to provide a space for planning schools to monitor each other and their own progress, evaluate their curriculum, share their problems, and receive feedback. However, since they are concerned about setting standards among universities with varying needs and capacities, their evaluation became more quantitative rather than qualitative. It limited their ability to look further than what is quantifiable.

3.2. Current Problems of Türkiye's Planning Education in Literature

TUPOB has been publishing annual reports and organized educational sessions on planning as part of the program of the World Urbanism Day Colloquium, though inconsistently trying to give problems of urban planning schools a voice. However, the themes usually revolve around the quantifiable needs of planning schools that need to be addressed by YÖK or university administration.

In the 2010s, the agenda of the planning schools included issues such as the accreditation process, institutional discrepancies, establishment of a national accreditation framework, improvements on curriculums, the challenges of unexpected and sharp increase in the number of planning schools, determining minimum requirements for opening new undergraduate programs based on optimum numbers on academic staff, and discussions about the "success ranking requirement" in the higher education exam (first 300,000) and "program admission quotas" (Başaran Uysal et al., 2021).

However late, to address this agenda, in 2020, The Urban and Regional Planning Education and Accreditation Foundation (PLANED) was established as a secondary organization. PLANED explains the purpose of its establishment on its website as follows: "The Urban and Regional Planning Education and Accreditation Foundation is based on the pioneering work of the Association of Planning Schools of Türkiye (TUPOB), which was established in 2004. It consists of the heads and representatives of the Departments of Urban and Regional Planning in Türkiye, which provide undergraduate education in Türkiye intending to improve the quality of education. In 2020, with the commission's work established within TUPOB, preparations for the association's establishment began. The Association of Urban and Regional Planning Education and Accreditation (PLANED) was established in July 2023 with the founding membership of the commission members of the association. (PLANED, 2024).

On the other hand, the problems of planning schools in Türkiye are more complicated and are not limited to accreditation issues or quantitative deficiencies in both human and infrastructural resources. Updating curriculum to address current urban issues, essential learning outcomes,

critical thinking abilities, the necessary toolkit and skills that planners are expected to have at graduation, managing expectations, and influencing the practice is rarely given a seat at the table.

Unfortunately, less than a handful of studies in Türkiye have examined these issues in depth. A study by Cömertler (2018) also criticized the sudden increase in the number of universities. It noted that this decision of YÖK is especially problematic because the funding that is allocated to these universities is far less than the optimal budget a new-established department should have.

In a recent study, Aksümer (2022) found a deep disconnect between academics and practitioners. The practitioners find academics too theoretical, even though theoretical courses are rarely prioritized in universities in Türkiye. Over 80% of planners find theory impractical and irrelevant to navigating public approval processes and regulations and "ignore conceptual discussions" (2023:238). However, Aksümer's study (2022) also revealed a paradox: while a strong theoretical background is not considered a desired skill in planners, planning graduates often face criticism for their inability to apply technical findings to practical planning strategies effectively. This criticism underscores the practical implications of the disconnect between theory and practice in planning education.

On the other hand, another study (Özkazanç & Korkmaz, 2019) argued that planning education's problems are more deeply rooted than the superficial theory-practice tension. The dated hierarchical small-to-big-scale approach, placing design and beautification issues at the center of education, and disregarding the decision-making processes that usually undermine planning efforts are suggested as more prominent problems that must be addressed.

Penpecioğlu and Tasan-Kok (2016) also emphasized a different side of the discord between planning education and the profession, looking into the mental states of young planners. Planners who graduate with high hopes and idealistic agendas quickly face the powerful push of the market interests that drive planning decisions, which leads them to disenchantment and, in time, alienation.

All these studies focusing on the different parts of the pipeline of planning education reveal that the dissonance is so deep that planning education is far from satisfying the needs of any of the parties involved, that is, academics, students, and practitioners. This highlights a nationwide issue in Turkish planning education, where theory struggles to bridge the gap to real-world practice, planning graduates lack the skills that are required by the profession, and the young professionals are mostly disappointed as they see no room for self-improvement or solving urban issues that they have been taught at the university.

4. Methodology

To find out how TUPOB approached improving urban planning education in universities across Türkiye and how they address the criticisms planning education receives, this research took a direct and indirect approach. The direct approach involved asking the current and former members of the association how they structure their agenda, aims, and goals for the upcoming terms using semi-structured, in-depth interviews between March and August 2023 to understand their points of view and experiences, which differed from the documents produced by the association. The interviews were conducted with seven people and consisted of 15 questions sent to the respondents before the interview. The questions were mostly used as a guideline to keep the interview focused; however, the respondents mostly led the conversation.

The respondents were selected with the purposive sampling method (Robinson, 2014), and the main criteria of the selection are that they contributed to the development of the curriculum in their own institutions, or they are either active members or previously served in Education Committees in their own institutions. For this purpose, the members of the TUPOB and its spin-off organization PLANED (Urban and Regional Planning Education and Accreditation Foundation) were reached via snowballing. At the end of each interview, they were asked to refer another person they thought might be suitable for the topic.

All respondents were asked questions about the TUPOB's priorities in planning education, the goals, and objectives of the association, and if these goals have been reached over the course of 15 years since the association was founded, the institutional agenda, the common and different courses that different schools have in their curriculum, the current challenges they are facing (if they are former members, they were asked to evaluate the current situation), the measures their schools have been taking to address these issues. The final question asked the respondents to understand what actions they think need to be taken in order to make urban planning education more responsive and reflective of social and urban problems of the 21st century.

All interviews were recorded with the interviewees' consent and then transcribed. All interviews were conducted via Google Meet, as all members live in different cities. The reports were downloaded to be analyzed, and since they are public and open access, there have been no complications in obtaining them.

4.1. Data Analysis

TUPOB has published four reports (2007-1; 2007-2; 2011-2; 2018) and six miscellaneous documents (Vision Document; Foundation Protocols 2009; 2010; 2011; 1st Coordination Meeting Leaflet & a Panel Transcript in 2005) over the past 15 years. While not all documents contain comprehensive information about the association's annual meeting outcomes, they provide valuable insights into its goals and objectives. All obtained documents of TUPOB were meticulously analyzed using the inductive content analysis and co-occurrence (a method to analyze codes that frequently emerge together throughout the text) methods to reveal the frequently mentioned phrases and words regarding the improvement of urban planning education and urban planning schools across the country. The names of the reports and their mission and goals sections were used as a guide to generate codes and their respective categories. Using Atlas.ti, all documents were coded and re-coded until the recurring themes were saturated. In the analyzed reports, tables and figures were excluded from the content analysis to ensure the integrity of the analysis.

The in-depth interviews were conducted in Turkish via Google Meet and recorded separately by an audio recorder. The recordings were transcribed with the AI-based app Transkriptor and then reread to correct mistranscribed words and sentences. First, a descriptive content analysis is used to categorize the answers of the different scholars to understand the common tendencies of the group. As all respondents have varying opinions and perspectives about the future of urban planning education, a thematic analysis was applied to reveal recurring and overarching themes that refer to common concerns and solutions for improving urban planning education. The codes and quotes were then translated into English for reporting.

4.2. Limitations

There are two main limitations during the research process. The first one is reaching out to people for in-depth interviews, as they are busy scholars with overpacked agendas and need to undertake different roles in their institutions, especially the ones in smaller universities. Therefore, even with the snowballing method and references from their fellow TUPOB and PLANED members, getting interviews was one of the major obstacles in the fieldwork process.

The second obstacle was to create meaningful code categories from the published documents of TUPOB that would provide deeper insight into the curriculums of different member schools. First, the reports were inconsistent; not every annual meeting was turned into a published document that summarized the problems faced, actions taken, and future goals, which complicated the analysis process as there was not enough data for comparison. Second, mostly the reports were focused on quantifiable data, such as the scores of the students, the number of studios or teaching faculty, etc. This quantitative focus stripped the reports of meaningful insights from each member university about the problems they face while trying to improve their curriculum.

5. Findings

At the end of the data collection, nine published TUPOB documents (three reports and six miscellaneous documents) were analyzed using content and co-occurrence analysis, and the in-depth interviews were analyzed using thematic analysis. The content analysis showed that there had been ongoing concerns about the standards of urban planning education across new and old departments, and quality is one of the highest-mentioned words in the analyzed documents (=358). Interestingly, all efforts about standardization and quality evaluation were directed toward accreditation, and the high frequency of the word shows that this is one of the major challenges of the TUPOB member schools over the years. The interviews provided a deeper insight into the concerns, challenges, and limitations of urban planning schools across Turkey and painted a picture of the major obstacles hindering the teaching faculty's efforts to update and reform the planning education curriculum.

5.1. TUPOB Reports

The most frequent words that appear repeatedly in almost every document are “accreditation” “international,” “quality,” and “standards” of urban planning education. The word accreditation is mentioned 486 times since two lengthy reports are dedicated to discussing the accreditation situation of urban planning schools in Türkiye. Here, it is important to note that these numbers do not include the repeated use of the same word in the same sentence and in the tables and figures to reduce noise.

Interestingly, the word quality is mentioned 358 times across all reports, followed by Europe (346) (Table 1). However, what it means by the quality of education is not thoroughly explained in any documents, suggesting a potential area for further research and understanding. The word quality is used throughout the reports to loosely describe the education and the students, but its precise meaning remains elusive.

In the co-occurrence table, the codes “quality” and “accreditation” often appear together. In 85 occurrences, these words are used together, usually followed by the word Europe (42 times).

When the reports were produced, accreditation agreements were being made with the European accreditation boards in compliance with the Bologna criteria; therefore, the references usually mention Europe more than the United States of America.

Other important words that repeatedly appear in the documents are competence and qualification. In some parts of the documents, these words are accompanied by the word “professional,” such as professional competence and professional qualification.

Qualification and competence are usually mentioned when describing the goals and objectives of the TUPOB; however, again, it is not entirely explained what it means to be a qualified and/or competent urban planning professional. One reason for this is that the published reports include merely an account of the completed works of the previous term rather than a discussion of the process.

Table 1 Energy TUPOB Reports Content and Cooccurrence Analysis

	World	America	USA	Asia	EU	Europe	Bologna	international	accreditation	accredited	equivalent	quality	standard	competence	pro. competence	proficiency	competition
World Gr=201		11	0	2	3	27	2	18	24	2	16	24	11	0	1	6	23
America Gr=85	11		0	10	1	36	3	10	17	4	0	3	4	0	0	0	2
USA Gr=3	0	0		0	0	4	0	0	1	0	0	0	0	0	0	0	0
Asia Gr=21	2	10	0		0	8	2	3	2	0	0	0	2	0	0	0	0
EU Gr=87	3	1	0	0		5	2	1	2	0	0	4	1	1	0	6	1
Europe Gr=346	27	36	4	8	5		19	20	36	6	4	42	7	0	11	13	8
Bologna Gr=60	2	3	0	2	2	19		2	3	0	0	12	2	0	1	1	2
international Gr=213	18	10	0	3	1	20	2		47	1	14	32	20	0	4	5	11
accreditation Gr=486	24	17	1	2	2	36	3	47		24	7	85	25	9	13	10	3
accredited Gr=35	2	4	0	0	0	6	0	1	24		0	5	2	0	0	0	0
equivalent Gr=42	16	0	0	0	0	4	0	14	7	0		6	4	0	0	0	8
quality Gr=358	24	3	0	0	4	42	12	32	85	5	6		29	1	10	14	6
standard Gr=82	11	4	0	2	1	7	2	20	25	2	4	29		0	0	7	2
competence Gr=57	0	0	0	0	1	0	0	0	9	0	0	1	0		2	15	0
professional competence Gr=39	1	0	0	0	0	11	1	4	13	0	0	10	0	2		31	0
proficiency Gr=114	6	0	0	0	6	13	1	5	10	0	0	14	7	15	31		0
competition Gr=40	23	2	0	0	1	8	2	11	3	0	8	6	2	0	0	0	

5.2. The In-Depth Interviews

The in-depth interviews with the current and former members of TUPOB provided more insight into the reports, inner workings, and accreditation process that have been ongoing for the past decade. At the end of the coding process of responses from the interviews, a total of 113 codes in 11 categories were found. The overwhelming majority of the themes were related to the concerns about the current situation of urban planning schools, learning outcomes, and the students' future

opportunities. Some categories overlap with the questions asked during the interviews. However, most of them emerged from inductive and repeated coding. Following is a brief deconstruction of the categories and some quotes from respondents. The names of the respondents are anonymized, and they are given codes such as R1, R2, etc., for identification.

5.2.1. The Limiting Perspectives in the Planning Departments

The respondents mention that a group of faculty members are stuck in past experiences, the ways in which planning has been taught in the past, which usually thwart the curriculum reform discussions. Furthermore, it is argued that the dominant school of teaching, in other words, the qualities that the schools identify themselves with, play a major role in these discussions, inhibiting a thorough examination of the curriculum. A couple of respondents refer to some interpersonal relationships, sensitivities, and resentments that sometimes surface during the meetings that cause a change of course in the discussions.

"All these years, it has always come to this: This professor is retired. Who will teach this course? This has been one of the major determinants of the curriculum, not the learning outcomes or the needs of the curriculum." (R7)

"The discussion mainly revolves around a professor who used to teach that course and how we should revive it exactly as it was, like 20 years ago. We rarely discuss if we actually need that course anymore." (R3)

"There are established approaches: the academic does this, the urban planner does that. They even try to teach this to every newcomer. There is no effort or desire to go beyond or question that." (R2)

5.2.2. The Gap Between Practice and Education

The common concern among participants is that there is a growing gap between planning education and planning practice, which causes planning students to feel frustrated and disenchanted with their futures. Most respondents agree that planning practice should be more in accordance with planning education, and the latter should guide and direct the former. However, the participants state that the current tendency of the planning schools is the opposite. They also mention that the feedback loop between planning education and planning practice is broken, obstructing a healthy exchange of ideas and experiences to find lasting solutions that benefit both sides.

"We need to correct the practice, not reconsider education to fit it into it. Today, planners are expected to be technical implementers, but this is not what a planner is or should be." (R7)

"When we prepare curriculums, we say things like, let's add this tool or this skill; it will be needed when they become practitioners. We let these market-led concerns direct the curriculum." (R3)

5.2.3. The Dominant Approaches in Planning Education

Another concern the participants raise is that, similar to the limiting approaches in the planning departments, there are some dominant teaching perspectives ingrained in the practices of the faculty. The need to produce physical master plans that focus on land use and the implementability of the plans is seen as an obstacle between the current situation and a potential change. The respondents also mention that this approach favors the "technical planner" role over others, another theme that surfaced during the interviews.

"The dominant approach is producing a physical plan as an end product. Most faculty expect the students to develop an implementable physical plan by the end of a semester. However, we have seen over the years that this is no longer relevant and not the best way to approach the space. Physical plans alone cannot achieve success." (R1)

"Planning should go beyond comprehensive planning. I am not sure how we make it more up-to-date, but we try different approaches and move between scales. I believe this is very important for

a planner to truly understand what scale is. Comprehensive planning alone does not give that perspective." (R5)

5.2.4. Planner's Toolkit and Planner Roles

The planner's role is seen as one of the most contested themes in the planning society. Since the group of planners who believe that more technical skills must be included in the curriculum represents the dominant approach, the respondents say that other roles and skills are overlooked, such as being a critical thinker, not being afraid of opposing mainstream solutions and approaches, prioritizing ethics and public good, and having agency.

"They graduate without fully developing any skills. They can learn some of them later in life, but we must teach critical thinking before all else." (R1)

"It is important to know what we mean when we talk about critical planning theory. Being critical does not mean criticizing everything and not appreciating anything. It is about questioning our own methods and actions. We are still teaching rational planning without looking at it critically. We are just accepting it as it is. [. . .] This is not what a planner should be." (R5)

"We always talk about a planner profile. We fetishize that profile and burden it with all sorts of responsibilities and actions. We determine the content of our education by assuming that every planner will work in the market and worrying about what kind of planning they will do. We try to teach "skills" we assume they would need in the private sector but with little to no context. And then worry about why planning graduates are so disenchanted and unhappy." (R3)

5.2.5. The Lack of Ground for Discussion

The participants see the lack of ground for discussion as a major setback preventing the planning departments from growing and adapting to the present conditions. Especially the lack of theoretical/conceptual discussions is seen as the culprit of a better curriculum that would prepare the students for future challenges. Some participants argue that even if these discussions find their way into the meetings, their unstructured nature causes the discussions to fail to reach a fruitful conclusion. One last concern raised by a couple of participants is that the critical stance some faculty members take is seen as cynicism rather than progressiveness.

"One of the main reasons why we cannot move forward is that we cannot talk to each other. There is a lack of communication between faculty members. Today's academic environment does not provide fertile ground for these issues to be discussed." (R7)

"It is like there are certain topics that a planner cannot discuss. When someone raises an issue, the response immediately, "That is not a planner's problem, that is a social policy issue." or "That is a design issue," and the discussion is over. Those who look and think more critically face some issues. This has even turned into a veiled threat like "Don't shake the boat." (R3)

5.2.6. Global Discussions

Most respondents agree that there is a paradigm shift in urban planning and other scientific research areas regarding urban space. Schools in Türkiye are seen having difficulties keeping up with the conceptual changes and refusing to change their own convictions about how urban planning should be taught. The participants see this as a country-wide problem affecting many areas of education and practice, and the faculties are being affected by this flawed approach.

"The planning agenda changes constantly, but not for the reasons you might expect, such as addressing current global issues. It usually revolves around some pressing matters. Even if it does address global issues, the discussions develop and ripen in the West, and only then do we start to include them in our agenda." (R4)

"We rarely discuss planning in a broad sense. I mean the whole economic life created in the city, production, consumption, distribution, etc., or actor collaboration, social context, and human rights

inequality that truly affects urban space. Even if all those concepts are almost always transferred from the West, let us say localized, they never get included in the discussion in planning discipline in Türkiye." (R7)

5.2.7. TUPOB's Priorities

The participants find TUPOB important for ensuring the continuity of knowledge and think the association offers a space for educators to share their concerns and experiences. However, they also mention that the unstructured nature of the meetings and the lack of moderation usually lead to digression and dilution of the important topics. Moreover, the participants mention that TUPOB, in its current form and capacity, can only solve so many problems, and the urgency of the situations is usually what dictates the agenda of discussions; in other words, high-priority problems such as the lack of the number of teaching faculty, teaching space or materials, or increased available places for each university take center stage as they are deemed more important than the theoretical discussions.

5.2.8. Comparison Cycle

Respondents indicate that schools tend to focus on quantifiable aspects of education rather than non-quantifiable ones, which creates an optimization illusion but does not lead to a lasting change. Most assessment and evaluation criteria consist of factors such as the number of teaching staff, available studios, the number of courses that should be included in the curriculum, or the students that chose that specific university - which respondents say becomes a determinant for many things for the departments and many aspects of urban planning education are design to increase the preferability of the university.

"Evaluation and assessment are predominantly focused on quantifiable data, overlooking most other tissues regarding the quality of education. Our education system is at the point of comparing everything by the number and determining one's superiority over the other." (R5)

"Planning department debate over things like "What is the ranking of the students who chose urban planning?" Instead of focusing on quality and learning outcomes, we find reasons such as "This happens because we don't offer enough courses in English." People do not feel the need to look elsewhere for the answer. They look for quick fixes." (R3)

5.2.9. Interdisciplinarity

While raising concerns about the lack of teaching capacity in newly established departments, the participants drew attention to the lack of elective courses. Some of the participants point to the lack of interest in the faculty members toward other disciplines, such as social sciences, which became a contributing factor to the decreasing number of elective courses in departments. Additionally, limiting the number of electives that can be taken from other departments is also a common practice among old and new departments, which in turn limits the interdisciplinary thinking urban planning education requires, and it is also thought to hinder the collaboration possibilities among departments.

5.2.10. Curriculum Reform

Another highly contested theme on which the participants expressed varying opinions is curriculum reform. Most participants described the discussions around curriculum reform as "a field of struggle." All participants agreed that space concept itself and the act of planning are political and should not be diminished to a strictly technical subject. Therefore, the current focus on physical planning derived from the 20th-century planning schools should be left behind.

However, what to include in the planning curriculum is up for debate. Some participants argue that pressing issues such as climate crisis, overpopulation, and urban poverty should have their own space instead of being mentioned in various courses; other participants advocate that these are tangential themes not directly related to planning education.

5.2.11. Localization / De-localization / Decolonialization

The last theme that emerged in the interviews is the localization of urban and regional planning concepts. All participants mentioned, in one way or another, that the concepts and approaches ingrained in urban planning education are almost entirely imported and rarely address the problems Türkiye's cities face.

"We always take concepts from outside, somehow integrate them into us, and glorify them as if they are suitable for us whether in terms of terminology or concepts which makes it difficult for us to understand them. We don't question if it is suitable for our conditions or our society." (R5)

Some participants raised concerns that it is common practice to copy not only the curriculums of schools in the developed world but also the new departments implementing older departments' curricula almost verbatim, reproducing the same problems, usually due to the lack of time and resources. Participants agree that the source of knowledge should become diversified and mentioned that the urban planning departments need to develop a Türkiye-specific approach that would focus on different regions' problems and refrain from directly translating theories and concepts that do not apply to Türkiye's problems.

"Because the education language is English, we can always give sources in English. I still put one or two Turkish sources I have written myself or others I know, but I can't hold anyone responsible. Therefore, now that we are talking about Türkiye, how many resources can you provide the students? You have very few resources in Turkish." (R4)

"There is a futile endeavor in which we idealize what is better than us and strive to reach it rather than learning from the experience of those like us. We have a preconception about planning education in the West, in America and England, that it is very good. We say, "Let's take inspiration from there." No, we have to realize our reality, our current context, that we are among the countries of the Global South, and learn from there." (R7)

Findings show an ongoing concern about ensuring the quality of urban and regional planning education. However, the reports show that the quality is measured by a series of quantitative criteria. On the other hand, the interview findings suggest that there are deeper issues that need to be solved in order to change the dominant pedagogical approaches that guide planning education to this day. The lack of interdisciplinary teaching methodologies, the pressure of the job market, the technical planner role ingrained into the "planner perspective," and the lack of ground for discussion in urban planning departments are considered fundamental problems of the planning schools across the country.

6. Discussion

This analysis of TUPOB reports and in-depth interviews with TUPOB members showed that there are a series of challenges inside the planning departments that need to be overcome in order to update the urban and regional planning curriculum to address current challenges. The interesting outcome of the study is that the findings of the TUPOB report analysis and the in-depth interviews revealed two different paths to achieve this and set different sets of priorities for urban planning schools in Türkiye.

While reports suggest that the basic needs, such as studio space, the number of teaching faculty the optimization of credits of the existing coursework, should be prioritized and the Bologna criteria should be met in order to achieve an international level, the in-depth interviews suggest that there are other issues that prevent urban and regional planning departments graduate planners who are able to address the important issues of the 21st century, and Bologna criteria could only be a stepping stone in this long road.

The findings of the interviews also painted a contrasting picture to the common perception about the shortcomings of planning education. Planning education is usually blamed for being too

abstract and too theoretical for a discipline in which graduates are expected to be "ready to work" the minute they leave school (Pojani et al., 2018), Interestingly, all participants argued otherwise that the conceptual, wider understanding of the major issues affecting the urban and social space is lacking in the current planning curriculum.

Closely related to this, the planner's role is no longer seen as a "technical" problem-solver concerned with merely physical issues of the urban space. Since the late 20th century, the cultural turn and shifting perspectives in social sciences have shown that the future planner should be more reflective rather than technical (Schön, 2017) The findings also suggest that being a critical thinker (Pojani et al., 2018), 'inviting different political and social values' (Sehested, 2009, p. 250), possessing a good knowledge of socio-cultural context and global political agenda, and prioritizing ethics and public good (Filion, 2021) are stated as the most desirable skills in the future planner's toolkit. Findings are also in line with the existing approaches in the literature about the ways in which knowledge is generated and structured in planning education, such as better integration of theory and methods in primary research (Johnston, 2015), learning interdisciplinary methodologies to structure knowledge in different ways and bridge epistemological differences across disciplines (Bradbeer, 1999), and using planning theory to generate different perspectives (Innes, 1995; Harris, 2000; Allmendinger, 2002) to be able to plan with the other (Healey, 1997; Shilon & Eizenberg, 2020).

The shifting priorities suggested by the findings made a curriculum reform in urban planning schools inevitable. However, it is easier said than done due to the shortcomings of the planning departments in terms of teaching faculty and agency (Filion, 2021). In fact, TUPOB originated from the need to address these issues; however, the sharp and unforeseen increase in the number of newly established departments turned this into a moving target and altered the course of the discussions, and the priority became to at least maintaining the standards of the education across schools before diving deep into a curriculum reform.

Last but not least, the lack of openness and ground for discussion are found as one of the major obstacles to achieving a curriculum that is better equipped to address issues such as climate change, urban poverty, access to shelter, and safe and sustainable transportation.

7. Conclusion

Urban and regional planning education remains a relatively unexplored field, particularly within the context of Türkiye. Since this discipline is seen as an applied science, this perspective causes scholars to overlook the theoretical and pedagogical needs of the discipline.

However, since the number of urban and regional planning departments increased, so have disenchanted graduates whose prospects of finding a job or shifting fields have grown immensely vague. Findings of other studies indicate that there is a discrepancy between the practice and education of the field and suggest a series of solutions to reduce the gap. However, no one-size-fits-all approach can be applied to all urban planning schools across the globe to eliminate this problem.

Therefore, this study uniquely focuses on the approaches of the only institution in Türkiye concerned specifically with urban planning education (TUPOB) towards this problem, highlighting its significance in the field. This study unequivocally demonstrates that structural change and curriculum reform are not just desirable but inevitable. Merely adhering to the Bologna criteria and aiming for accreditation is insufficient to propel urban planning education to the next level, necessitating immediate and comprehensive changes.

Despite only a few published documents and a small number of participants, the study provided deep insight into the discussion surrounding urban and regional planning education. It was able to draw a roadmap that would hopefully help future curriculum-building efforts of scholars in the field.

Drawing on the findings of the analyses, the recommendations of this research are as follows. First, the curriculum needs to be redesigned to incorporate more interdisciplinary inquiry and elective courses to address the increasing number of problems of 21st-century urban space. The overall pedagogical approach should be reviewed not to accommodate the needs of the planning practice as it is now but to influence and transform it. There is also a need for a functioning feedback loop between planning practice and education to remove the current friction. Also, the current studio course design should integrate the global agenda more extensively among critical thinking and collaboration skills.

Last but not least, rather than a direct translation of concepts and approaches, a localized knowledge generation method is needed to provide solutions for the pressing problems of rapidly urbanizing Türkiye. These suggestions are meant to provide a framework for future studies, which are needed to deconstruct the curriculum further and offer more tailored solutions for schools with different qualifications.

References

Akçakaya Waite, İ., Alkay, E., & Becerik Altındiş, S. (2021). *Transforming Planning Education*. In Routledge eBooks (pp. 121–139). https://doi.org/10.4324/9781003178545-10.

Aksümer, G. (2022). Planning practice and academic knowledge: different perspectives of urban planners in Türkiye. *European Planning Studies*, *31*(2), 231–251. https://doi.org/10.1080/09654313.2022.2106552.

Allmendinger, P. (2002). Towards a Post-Positivist Typology of Planning Theory. *Planning Theory, 1*(1), 77-99. https://doi.org/10.1177/147309520200100105.

Andrews, C. J., Popper, F. J., Lowrie, K., & Stiles, J. (2017). A Planners' Rorschach: The Most Frequent Words in JPER's Article Titles. *Journal of Planning Education and Research, 37*(3), 269-270. https://doi.org/10.1177/0739456X17722952.

Başaran Uysal, A., Albayrak, A.N., & Başaran, C. (2021). Şehir ve Bölge Planlama Bölümlerinin Yeterlikleri Üzerine Bir Değerlendirme, 9 Kasım Dünya Şehircilik Günü, 45. Kolokyumu, Planlamanın Birikimi, Zemini, Ufku. Yıldız Teknik Üniversitesi, TMMOB Şehir Plancıları Odası, Ankara, Türkiye.

Bengs, C. (2005). Planning Theory for the naive?. European Journal of Spatial Development, *3*(7), 1–12. https://doi.org/10.5281/zenodo.5148363.

Bradbeer, J. (1999). Barriers to Interdisciplinarity: Disciplinary discourses and student learning. Journal of Geography in Higher Education, *23*(3), 381–396. https://doi.org/10.1080/03098269985326.

Cömertler, S. (2018). Şehir ve Bölge Planlama Bölümlerinin Öğretim Kadrolarının TUPOB Ölçütlerine Göre Analizi, Sosyal Bilimler Enstitüsü Dergisi *5*(1), 65-89.

Cuthbert, A (2016) Emergent pedagogy or critical thinking?, Journal of Urban Design, *21*:5, 551-554, DOI: 10.1080/13574809.2016.1220139.

Dandekar, H. C. (1986). Some Uses and Potentials of Qualitative Methods in Planning. *Journal of Planning Education and Research*, *6*(1), 42-49. https://doi.org/10.1177/0739456X8600600110.

Dawkins, C. J. (2016). Preparing Planners: The Role of Graduate Planning Education. Journal of Planning Education and Research, *36*(4), 414-426. https://doi.org/10.1177/0739456X15627193.

Eizenberg, E., & Shilon, M. (2016). Pedagogy for the new planner: Refining the qualitative toolbox. *Environment and Planning B: Planning and Design, 43*(6), 1118-1135. https://doi.org/10.1177/0265813515604477.

Eser, B., & Koramaz, T.K. (2023), Şehir ve Bölge Planlama Stüdyosunda "Sinema Evreninden Öğrenmek". İTÜ Vakfı Dergisi, sayı:90, s. 46 - 50.

Filion, P. (2021). Creative or instrumental planners? Agency and structure in their institutional and political economy context. Planning Theory, *20*(3), 255-274. https://doi.org/10.1177/1473095220980499.

Frank, A. I. (2006). Three Decades of Thought on Planning Education. *Journal of Planning Literature*, *21*(1), 15-67. https://doi.org/10.1177/0885412206288904.

Gunder, M. (2002). Bridging theory and practice in planning: A story from Auckland. *Australian Planner*, *39*(4), 202–206. https://doi.org/10.1080/07293682.2002.9982320.

Harris, N. (2000). Practice through a lens: A metaphor for planning theory. *Journal of Planning Education and Research*, *19*, 309–315. doi:10.1177/0739456X0001900310.

Healey, P. (1997). Collaborative planning: Shaping places in fragmented societies. Vancouver: UBC Press.

Innes, J.E. (1995). Planning theory's emerging paradigm: Communicative action and the interactive practice. Journal of Planning Education and Research, *14*, 183–189. doi:10.1177/0739456X9501400307.

Johnston, A. S. (2015). CitySection: A Pedagogy for Interdisciplinary Research and Collaboration in Planning and Environmental Design. *Journal of Planning Education and Research, 35*(1), 86-92. https://doi.org/10.1177/0739456X14557641.

Kallus, R. (2001). From Abstract to Concrete: Subjective Reading of Urban Space. *Journal of Urban Design, 6*(2), 129–150. https://doi.org/10.1080/13574800120057818.

Kunzmann, K. R., & Koll-Schretzenmayr, M. (2015). Introduction: Planning and Planning Education in 2015. *disP - The Planning Review*, *51*(1), 16–17. https://doi.org/10.1080/02513625.2015.1038042.

Nnkya, T. J. (2008). *Why planning does not work. Land use planning and residents' rights in Tanzania*. Dar es Salaam: Mkuki na Nyota Publishers.

Odendaal, N. (2012). Reality check: planning education in the African urban century. *Cities, 29*(3), 174-182. https://doi.org/10.1016/j.cities.2011.10.001.

Olesen, K. (2018). Teaching planning theory as planner roles in urban planning education. Higher Education Pedagogies, *3*(1), 302–318. https://doi.org/10.1080/23752696.2018.1425098.

Özkazanç, S., & Korkmaz, C. (2019). Şehir ve Bölge Planlama Disiplininde Eğitim, İş Bulma ve Mesleki Öz Yeterliliğe İlişkin Kaygı ve Beklentiler. *Journal of Architectural Sciences and Applications*, *4*(2), 122-139. https://doi.org/10.30785/mbud.582936.

Penpecioğlu, M., & Taşan-Kok, T. (2016). Alienated and politicized? Young planners' confrontation with entrepreneurial and authoritarian state intervention in urban development in Türkiye. *European Planning Studies*, *24*(6), 1037–1055. https://doi.org/10.1080/09654313.2015.1135233.

Phiri, D. (2010). Revitalising planning education in Zambia. *Journal of Building and Land Development*, 9–22.

PLANED (2024) *Kuruluş Amacı Şehir ve Bölge Planlama Eğitimi ve Akreditasyonu Derneği*, Retrieved 17th July, 2024 from https://www.planed-planak.org/.

Pojani, D., Johnson, L., Darchen, S., & Yang, K. (2018). Learning by Doing: Employer Expectations of Planning Studio Education. *Urban Policy and Research*, *36*(1), 11-19. https://doi.org/10.1080/08111146.2016.1221814.

Roakes, S. L., & Norris-Tirrell, D. (2000). Community Service Learning in Planning Education: A Framework for Course Development. *Journal of Planning Education and Research*, *20*(1), 100-110. https://doi.org/10.1177/073945600128992636.

Robinson, O. C. (2014). Sampling in Interview-Based Qualitative Research: A Theoretical and Practical Guide. Qualitative Research in Psychology, *11*(1), 25-41. https://doi.org/10.1080/14780887.2013.801543.

Scholz, W., Stober, T., & Sassen, H. (2021). Are Urban Planning Schools in the Global South Prepared for Current Challenges of Climate Change and Disaster Risks? *Sustainability, 13*(3), 1064. https://doi.org/10.3390/su13031064.

Schön, D. A. (2017). The Reflective Practitioner. Routledge. Retrieved 17th July, 2024 from http://books.google.ie/books?id=OT9BDgAAQBAJ&printsec=frontcover&dq=The+reflective+practicioner&hl=&cd=1&source=gbs_api.

Sehested, K. (2009). Urban planners as network managers and metagovernors. *Planning Theory & Practice*, *10*, 245–263. doi:10.1080/14649350902884516.

Shilon, M., & Eizenberg, E. (2020). Critical pedagogy for the new planner: Mastering an inclusive perception of 'The Other.' *Cities, 97*, 102500. https://doi.org/10.1016/j.cities.2019.102500.

Sletto, B. (2012). Insurgent Planning and Its Interlocutors. *Journal of Planning Education and Research*, *33*(2), 228–240. https://doi.org/10.1177/0739456x12467375.

Tekeli, İ. (2011). Toplu eserler (15) Türkiye'nin kent planlama ve kent araştırmaları tarihi yazıları. Tarih Vakfı.

Thompson, R. (2000). Re-defining Planning: The Roles of Theory and Practice. *Planning Theory & Practice*, *1*(1), 126–133. https://doi.org/10.1080/14649350050135248.

TUPOB (2004). Vizyon, Retrieved 17th July, 2024, from https://www.spo.org.tr/tupob/detay.php?kod=12130&tipi=56&sube=0.

TUPOB (2005). *AB Sürecinde "Hizmetlerin Serbest Dolaşımı" Ve Şehir Plancılarının Geleceği*, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=608&tipi=76&sube=0.

TUPOB (2005). *Türkiye Planlama Okulları Birliği 1. Koordinasyon Toplantısı Yıldız Teknik Üniversitesi Buluşması* Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=605&tipi=76&sube=0.

TUPOB (2007). Türkiye Planlama Okulları Birliği 3. Koordinasyon Toplantısı İstanbul Teknik Üniversitesi Buluşması, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=607&tipi=76&sube=0.

TUPOB (2007) Türkiye'de Şehir ve Bölge Planlama Eğitiminde Kalite Geliştirme ve Akreditasyon ve Mesleki Yetkinlik ve Yeterlilik, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=609&tipi=76&sube=0.

TUPOB (2009). Kuruluş Protokolü, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=1147&tipi=73.

TUPOB (2010). Kuruluş Protokolü, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=2853&tipi=73.

TUPOB (2011). Kuruluş Protokolü, Retrieved 17th July, 2024 from https://www.spo.org.tr/tupob/detay.php?kod=4341&tipi=73.

TUPOB (2011) Türkiye Planlama Okulları Birliği Lisans Düzeyinde Açılacak Şehir ve Bölge Planlama Bölümleri İçin Gerekli Asgari Ölçütler.

TUPOB (2018) Türkiye Planlama Okulları Birliği 12. Dönem II. Olağan Toplantısı Koordinasyon "Planlama Okulları ve Planlama Eğitimi," Retrieved 17th July, 2024 from https://www.spo.org.tr/resimler/ekler/f0a9a508a474253_ek.pdf.

Watson, V. (2014). The Case for a Southern Perspective in Planning Theory. International Journal of E-planning Research, *3*(1), 23–37. https://doi.org/10.4018/ijepr.2014010103.

Watson, V. (2016). Shifting Approaches to Planning Theory: Global North and South. Urban Planning, *1*(4), 32–41. https://doi.org/10.17645/up.v1i4.727.

YÖK (2024). YÖK İstatistikler. Retrieved 17th July, 2024 from https://istatistik.yok.gov.tr/.

Resume

Ipek Sen is a researcher and PhD candidate at Istanbul Technical University who lives and works in Istanbul. After graduating from Mimar Sinan Fine Arts University Urban and Regional Planning, she completed her M.A. at Istanbul Bilgi University Cultural Studies Program. She was accepted as a visiting researcher at Cardiff University in 2015. Her research is gathered around the topics of urban poverty, inequality, and decolonization. After teaching at ITU and Istanbul Bilgi University for six years, she transitioned to the private sector as a market researcher and strategist and is now working as a consultant for various companies around the world.

Turgay Kerem Koramaz has been an academic staff member at ITU Faculty of Architecture, Department of Urban and Regional Planning since 2000. He completed his PhD there, with a thesis on computer-aided 3D visualization techniques in urban historic sites. In 2008, he was a visiting researcher at the Royal Institute of Technology in Stockholm. His research focuses on ICT and spatial analysis in urban planning and conservation. He is an associate editor at the Journal of Urban Planning and Development (ASCE) and a member of AESOP (Association of European Schools of Planning), ICOMOS (International Council on Monuments and Sites), ERSA (European Regional Science Association).

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An insight into architectural design studio education space from a "time" perspective

Ayşegül Kıdık*
Burak Asiliskender**

Abstract

This study offers a comprehensive literature review of the evolution of design studio education, focusing on the integration of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) technologies. The research explores current and future design studio models by examining the development of architectural design studio education and the importance of its physical spaces within a timeline framework. The literature review identifies key insights, analyzes patterns, and integrates findings to present a narrative of architectural education's historical evolution and prospects. The study highlights significant shifts in design studio education, moving from the traditional master-apprentice relationship to contemporary design studio spaces within architecture schools. It emphasizes the impact of social, economic, and technological developments on these models, particularly the shift to remote education necessitated by COVID-19. This transition highlighted the need for alternatives to physical studio spaces, directing attention to VR, AR, and MR technologies as potential solutions. Through a meticulous review process, this study examines how these emerging technologies can provide immersive and interactive learning experiences, enhancing flexibility and accessibility in design education. It discusses the benefits and challenges of integrating these technologies, considering their potential to function without needing a specific physical studio. Ultimately, this study contributes to the field by offering theoretical insights and practical guidelines for educators. It explores alternative models to enhance adaptability and addresses the implications of technological adaptation and crisis management. The findings enrich the academic literature and foster future research and discussion on the evolution of design studio education in the digital era.

Keywords: the evolution of architectural design studio education, the future of architectural design studio education and its space, architectural design education, space of the architectural design education, quality education

1. Introduction

In contrast to conventional classroom settings, architectural design education studios are highly dynamic environments distinguished by activities such as sketching, creating models, engaging in discussions, and deliberations, all of which require critical, creative, and critical thinking processes. These characteristics highlight the unique role of studios in facilitating student learning (Dutton, 1991).

Architectural design education is unique and can be clearly distinguished from other fields due to its components, such as its pedagogy, people, tools, spaces, environments, and hidden contents, which create its own culture. Each component in the design studio education communicates and interacts with the others, and any change in one affects the others.

Significant factors have shaped and developed architectural and design studio education, ultimately forming the current structure.

The origins of this education can be traced back to the writings of Vitruvius during the years 30-20 BC, representing the earliest documented source on the subject (Costanzo, 2016). As

*(Corresponding author) Lecturer and PhD Candidate, Abdullah Gul University, Türkiye, kidikaysegul@gmail.com
**Prof. Dr., Abdullah Gul University, Türkiye burak.asiliskender@agu.edu.tr
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architectural education continued to evolve, establishing the first school within the Royal Academy marked a pivotal moment (Barrell, 2013). This evolution also witnessed a shift in the location of design studios, moving from individual master's offices to becoming integral components of educational institutions, as exemplified notably by Ecole de Beaux (Griffin, 2019). The establishment of structured architectural education in the seventeenth century, driven by governmental regulations and societal values, initially followed a uniform model - the Beaux-Arts system in France (Salama & Wilkinson, 2007). The Bauhaus education laid the foundation for studio-centered design education, integrating architecture theory and practice in an interdisciplinary environment. Unlike the two-sectioned formal and practical structure of the Beaux-Arts, the Weimar Bauhaus School intertwined practical and theoretical studies, especially in the last three years. From 1930 to 1960, architecture schools worldwide adopted either the Beaux-Arts' separated ateliers and theoretical courses or the Bauhaus' integrated approach (Hacihasanoglu, 2019). Today, the lasting impact of Beaux and Bauhaus education and the tradition of design studios remains evident in contemporary architectural education.

The educational and spatial aspects of architectural studio education, which two educational models have influenced, have undergone continuous evolution and transformation due to technological advancements. The architectural academic community conducted extensive research on the computability of architectural design in the 1960s and early 1970s (Andia, 2001; Andia, 2002; Reffat, 2007). A significant transformation in design education and technology occurred with the introduction of computers and IT in the late 1980s. IT-related courses gained importance in architectural curricula, and by the 1990s, CAD and digital tools became essential in architecture, with many schools worldwide adopting these technologies (Reffat, 2007).

The advent of virtual reality offered entirely virtual environments, while more recently, extended reality (XR) has emerged (Reffat, 2007). Within the XR framework, virtual, augmented, and mixed-reality environments provide compelling alternatives to physical reality in design studio education. In today's rapidly advancing technological landscape, physical spaces undergo profound transformations as they become intertwined with alternative reality environments. This multidimensional and dynamic evolution has significant implications for various domains, including higher education, regarding research and spatial configurations.

Unexpectedly, during these technological developments and influences, the global COVID-19 pandemic in 2019 led to the widespread adoption of distance education across higher education institutions worldwide (IAU et al., 2020; Seeletso, 2022). The COVID-19 pandemic affected architectural education by shifting to remote learning, leading to challenges such as the absence of physical studio spaces, decreased peer engagement, and digital literacy issues. This emphasized the importance of active online learning communities and strategic planning to simulate the advantages of physical studios (Grover & Wright, 2020; Asfour & Alkharoubi, 2023).

In light of these historical developments, technological advancements, and unexpected disruptions, especially the COVID-19 process results, the subsequent sections of this paper explore the architectural design studio's journey with extended reality technologies within the technological advances. Extended technologies -virtual, augmented, and mixed realities- can enable design studio education without a physical studio, offering flexibility and access from anywhere.

Virtual Reality (VR) creates immersive digital environments for games, training, and education using devices like headsets. Augmented Reality (AR) overlays virtual objects in the real world, enhancing interaction in education and commerce with AR headsets. Mixed Reality (MR) combines VR and AR, allowing interaction with both environments, applied in engineering, healthcare, and education with devices like HoloLens (Salama, 2007).

In conclusion, the article illustrates and discusses the significant transformations that architectural design studio education has undergone up to the present day and examines the potential impact factors of today. Focusing on its future model regarding space and environment, particularly in light of the COVID-19 process, emphasizes the need to evolve this education.

Smart urban governance enhances the management and maintenance of green spaces using data-based technology and solutions as shown 2, such as:

1.1. Aim

The paper aims to underline the need for change and/or evolution within design studio education today. To achieve this, the study explores the historical and contemporary progression of Architectural Design Studio education, with a particular focus on the integration of emerging technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). Through a comprehensive literature review and analysis of historical trends, the research seeks to identify significant shifts in design studio models, especially in the context of space and environment. The study highlights how these technologies can transform design education by providing flexibility and accessibility, addressing the challenges posed by the COVID-19 pandemic. Additionally, this research offers theoretical insights and practical guidelines for educators, fostering the evolution of design studio education to meet the demands of the digital era.

1.2. Methodology

This study utilizes a comprehensive literature review to discuss current and future design studio models by exploring the development of architectural design studio education and the importance of its physical spaces in a timeline framework. The process requires identifying appropriate literature, selecting relevant sources, extracting and combining key insights, analyzing patterns, integrating findings, discussing implications, and ultimately making conclusions. Through a meticulous approach, this study aims to thoroughly examine the historical progression of architectural education, the remarkable events influencing it, and its future potential, as well as discuss the recreation or renewal of design studio education and its models.

A methodical search was conducted across electronic databases, academic books, and academic journals using keywords such as “The Evolution and the Future of Architectural Design Studio Education and its Space, Architectural Design Education, Space of the Architectural Design Education” to gather relevant information. The review using these specified keywords included the most frequently repeated and prevalent events or influences in the evolutionary process. Then, in the literature review, efforts were made to access the primary sources most frequently referenced regarding these events and influences.

The selected studies' essential insights and findings were carefully reviewed. For the first phase, the reviews are focused on the thresholds of architectural education to create the historical timeline of the design studio education and its space framework. To seek the thresholds: “the first architectural education,” “the first architectural school,” “the first design studio,” etc., used to understand the evolution from two perspectives: how architectural education started, developed, and how this process reflected onto the educational space. The literature review focuses on this frame’s repeated “the firsts” terms and extracts. The thresholds’ historical timeline was concluded in 1919, and then the review continued by focusing on the factors affecting architectural education from 1919 to the present. For this phase of evolution, general reviews highlighted that from this period until now, it has been seen that the two design studio education models - *The Ecole des Beaux-Arts* (The first design studio space in architectural school) and *the Bauhaus (the first studio-oriented architectural design education)*- are continued in a general frame. Still, these models have had parallel changes depending on worldwide technological developments and dominant changes with the COVID-19 pandemic. So, for the second timeline, reviews focused on these developments and events. After all these reviews, as part of the technological advances and for the alternative model to distance education – *all architectural schools experienced*- the emerging technologies - *already started to influence architectural education and space parallel with the technological developments*- are foreseen as the continuation of this evolution. So, for the last reviews, the study focused on these technologies and architectural education. When the COVID-19 process necessitated the removal of the design studio from its physical space, the experiences of remote education indicated new pursuits for design studio education, highlighting the need for alternatives

to the physical space. Therefore, the review studies have focused on VR, AR, MR, and XR technologies, which hold the potential to offer alternatives to design education and its environment. The synthesized findings were then integrated to construct a comprehensive narrative of architectural education's historical evolution, current practices, and prospects. Drawing upon the synthesized findings, the study presents its conclusions, emphasizing key insights and identifying areas that warrant further research.

2. Evolution of Design Studio Education "Firsts"

2.1. The First Written Resource: Vitruvius, The Ten Books on Architecture, (Prob.) 30-20 BC

The earliest written resource on architecture is attributed to Vitruvius, a Roman architect who resided from approximately 80 to 10 BCE. In his publication "The Ten Books on Architecture," Vitruvius accentuates the significance of proficient architects in creating exceptional architecture. In his work "Elements of Architecture," Vitruvius presents the earliest known depiction of an architect's education and competencies. Vitruvius distinguishes between the practical and theoretical aspects of architecture. The practical facet, termed "fabrica," entails continuous and consistent practical experience, encompassing physical labor and utilizing fundamental materials guided by a design's depiction. Conversely, the theoretical aspect, known as "ratiocinatio," encompasses the capability to manifest and elucidate skillful creations founded on proportional principles (Pont, 2005).

According to Vitruvius, an architect's education necessitates an array of knowledge and diverse learning styles. This stems from the architect's responsibility to assess the works produced by other disciplines, thus rendering proficiency in various domains indispensable. Theory and practice both constitute pivotal constituents of an architect's education. Within architecture, two elements hold particular prominence: the object being denoted and the entity ascribing its meaning. The discussed subject is signified, while a demonstration grounded in scientific principles confers significance. Consequently, an architect ought to possess inherent talent and an inclination toward acquiring knowledge, as they must exhibit expertise in theory and practice. In conclusion, Vitruvius's work furnishes invaluable insights into the requisites of education and competencies for architects, highlighting the significance of theory and practice in pursuing exceptional architecture (Morgan & Warren, 1914).

Vitruvius's writings on architecture serve as a first and foundational guide, highlighting the essential balance between theory and practice in architectural education. Vitruvius emphasizes the multifaceted knowledge and skills necessary to create exceptional architectural works in the early times.

2.2. The First Academic Architectural Institution: The Academie D'architecture, 1671

The establishment of the Académie d'Architecture in France on December 3, 1671, marked the beginning of formal architectural education. It was the first institution dedicated to the comprehensive study of architecture and was established specifically to train aspiring architects. However, during the turbulent times of the late 18th century in France, the Academy was officially dissolved in 1793. Nevertheless, the legacy of architectural education it initiated was revived with the creation of the Beaux-Arts and continues to influence architecture schools worldwide to this day (Griffin, 2019).

Lectures at this academy were in mathematics, mechanics, construction, perspective drawing, and the science of fortification (Lueth, 2003; Weatherhead, 1941). Furthermore, the establishment and subsequent revival of architectural education in France, from the Académie d'Architecture to the École des Beaux-Arts, have left an enduring legacy that continues to shape architectural education worldwide, emphasizing the significance of its historical roots and the resilience of architectural pedagogy.

2.3. The First Design Studio: The Ecole des Beaux-Arts, 1819

The initiation of organized architectural instruction in the seventeenth century, propelled by governmental requisites and societal principles, initially adhered to a single archetype - the Beaux-Arts system in France (Salama & Wilkinson, 2007). This customary method of architectural education commenced with the establishment of the Ecole des Beaux-Arts in Paris in 1819, thereby introducing the design studio concept, which subsequently emerged as a fundamental pillar of formal architectural education across Europe, North America, and beyond (Anthony, 1991). The design studio, having endured for three centuries, has played a pivotal role in architectural education, constituting an essential component of contemporary design pedagogy (Salama & Wilkinson, 2007).

The design studio originates from the “atelier” within the Beaux-Arts education system as the primary means of instructing architects. Ateliers served as spaces for architecture students to engage in their work. The Beaux-Arts, a fine arts institution in Paris, served as a model for education adopted by numerous architecture schools in the nascent stages of architectural education (Anthony, 1991; Weatherhead, 1941).

The establishment of the Ecole des Beaux-Arts in 1819 introduced a groundbreaking paradigm for architectural education. This paradigm integrated design work within a studio environment supervised by experienced mentors. This pivotal development paved the way for the institutionalization of architectural education and profoundly influenced contemporary design pedagogy in France and beyond.

2.4. The First Design Studio-Centered Education: Bauhaus, 1919

Salama and Wilkinson assert that the dominant architectural education model for more than two centuries was the Beaux-Arts paradigm. However, in response to society's changing values in the late 19th century, the German Bauhaus model emerged as the sole alternative pedagogical approach before World War I. This emergence was a direct result of the technological advancements brought about by the Industrial Revolution. Despite their apparent disparities, both approaches emphasize architecture's formal and technical aspects, prioritizing the construction and dynamics of buildings, often neglecting social and cultural considerations (Salama & Wilkinson, 2007). Balamir notes that the Bauhaus education model strongly prioritized cultivating architectural creativity rather than replicating past masterpieces. The most significant distinction between the Bauhaus education and the Beaux-Arts model is that the former liberated students from strict technical constraints, highlighting the significance of creativity, imagination, and individual expression inherent in the arts (Balamir, 1985). The Bauhaus education can be seen as the foundation of a studio-centered design education, where architecture theory and practice are integrated in an interdisciplinary environment. In contrast to the two-sectioned formal and practical structure of the École des Beaux-Arts, the practical studies in material workshops of the Weimar Bauhaus School were closely intertwined with theoretical studies of color, composition, construction, and nature, particularly in the last three years of education. Between 1930 and 1960, schools of architecture in various countries adopted two different approaches: the two-sectioned formal practical structure of the École des Beaux-Arts, where ateliers were separated from theoretical courses, and the three-staged Bauhaus system, where practical and theoretical studies were integrated into ateliers (Hacihasanoglu, 2019).

Essentially, the Bauhaus model, which emerged as an alternative to the longstanding Beaux-Arts paradigm, introduced a unique architectural education approach emphasizing creativity, imagination, and individual expression over technical conditioning. This shift in architectural pedagogy paved the way for greater artistic freedom and innovation.

3. Evolution of Design Studio Education & Space 1920 to 2019

The architecture profession can be traced back to the 3rd millennium BC when architects conventionally gained knowledge through apprenticeships for a prolonged period. However, in

recent times, this approach has been replaced by what is known as a "studio-based environment" (Glasser, 2000; Nanda & Solovyova, 2005). According to Bender and Vredevoogd (2006), modern learning studios share similarities with the studios of the French Royal Academy and the École des Beaux-Arts from the 19th century. In the industrialized world, design studios typically follow a consistent structure. Typically, students participate in weekly studio sessions where they receive guidance from a professor. These sessions usually take place in small groups. During these sessions, students are assigned to develop designs based on specific project briefs, which reflect real-world architectural tasks, and they receive regular feedback from their professors. Frequently, the design project itself serves as the primary assessment method for the studio, culminating in its presentation during the final "critique" session at the end of the semester, which is evaluated by a panel of experts (Bender & Vredevoogd, 2006). Stevens (1998) emphasizes that the design studio is widely recognized as the most distinctive and critical activity within the architectural curriculum (Crowther, 2013; Stevens, 1998). In design studios, semi-structured learning approaches, such as problem-based learning, are often employed (Crowther, 2013; Delahaye, 2005). This approach involves students working on design projects while tutors provide formative feedback through individual reviews during weekly classes. According to Biggs (1999) and Schön (1984), the primary mode of learning in studios is through dialogue, facilitating the development, elaboration, and enrichment of understanding (Biggs, 1999; Crowther, 2013; Schön, 1984).

The transition of design studio education from the apprenticeship model to the contemporary studio-based environment has positioned the design studio as the cornerstone of architectural education. This shift has fostered the implementation of semi-structured learning strategies and emphasized the importance of dialogue in enhancing students' understanding and creativity in architecture.

3.1. Evolution of Design Studio Education & Space with Technology 1950 to Ongoing Process

In the late 1950s, attempts were made to bridge the domains of architecture and computer science. These early initiatives were predominantly academic and arose from the problem-solving and systematic methods prevalent in the computer science community during the 1960s. The primary objective was to automate various aspects of architectural design to capture as much of designers' thought processes as possible. The architectural academic community conducted extensive research on the computability of architectural design throughout the 1960s and early 1970s (Andia, 2001; Andia, 2002; Reffat, 2007). Reffat describes a significant transformation in design education and technology, noting that architecture and architectural education underwent a substantial shift with the introduction of computers and information technology in the late 1980s. The integration of IT into architectural education is evident in the increasing importance of IT-related courses in architectural school curricula. In the 1990s, modern information technology and digital tools became essential in architecture and the profession. The field embraced computer-aided design (CAD) and became the primary working environment. Many architectural schools worldwide have adopted CAD and digital media (Reffat, 2007).

Crowther highlights changes in the architecture studio, observing that its informality distinguishes it. The physical space lacks a conventional front of the classroom. Instead, it includes movable furniture, sketching and drafting desks, model-making areas, computers, projection screens, and spaces for displaying models and drawings during critiques. The aim is to provide a flexible physical infrastructure to support adaptable teaching methods (Crowther, 2013; Taylor, 2008). Reffat notes that it has become common practice in many architecture schools for students to use notebook computers. The primary factors driving this approach are high enrollment numbers, limited physical space, and the costs associated with technical computing support and maintenance services. Advances in wireless networking technology, which enable mobility and access to the internet and network resources, have made this strategy more feasible for institutions and organizations (Reffat, 2007).

Furthermore, integrating technology into architectural education, particularly the adoption of computer-aided design and digital tools has fundamentally transformed the design studio environment. This transformation has resulted in flexible pedagogical spaces and the use of mobile technology, facilitating greater adaptability and connectivity within architectural education and practice.

3.2. Design Studio Timeless

Crowther (2013) argues that the term "studio" is widely employed in design, encompassing both a physical space dedicated to learning and teaching and a method of pedagogical engagement.

This concept parallels the notion of an artist's workspace, similar to an artist's studio. In many respects, the educational studio endeavors to replicate the professional studio environment by merging the physical setting with cultural and educational activities.

According to Akyildiz (2020), two distinct descriptions of a design studio highlight its multifaceted nature. First, it can be understood as a physical learning environment, serving as a fundamental unit of pedagogy and an approach to design education. Secondly, the studio is a climate where aspiring architects, individually or in groups, explore design challenges through experimentation. Collaborating with the studio instructor, they acquire the art of design in the process.

In contrast to conventional classrooms, Dutton (1991) emphasizes that studios are dynamic spaces in which students actively participate in activities such as drawing, model-making, discussions, and debates. These activities demand analytical, synthetic, and evaluative modes of thinking. The dynamism inherent in the studio setting underscores its unique position as an educational method.

The studio, as both a social and organizational context, provides an optimal atmosphere for refining the skill of discernment. This is of particular significance since architecture necessitates more than mere analysis and logical reasoning; it encompasses the capacity to create unified wholes from diverse, often elusive, components (Habraken, 2007). Dutton highlights that architectural education in most institutions during the 20th century has predominantly focused on design. Students may spend most of their time and effort in the design studio, which functions as a tangible outcome, materializing architectural concepts and a mode of thinking that amalgamates various aspects of architectural knowledge, possibilities, and limitations (Dutton, 1991).

The design studio is the foundation of architectural education, demanding a comprehensive comprehension of design studio pedagogy. Education is the fundamental basis of any design profession, and its approach and content play a crucial role in shaping adaptable built environments. It is imperative to approach this subject as a rich field of study, with its knowledge base, information, methodologies, tools, and procedures subject to examination and discussion (Crowther, 2013).

Salama and Wilkinson (2007) emphasize the significance of the design studio as a primary realm for students to explore and develop their creative abilities, which are greatly valued in architecture. They liken the design studio to a crucible, wherein students are shaped and molded.

A comprehensive examination conducted by the American Institute of Architecture Students (AIAS) task force in 2002 produced a report that provides definitions, insights, and recommendations regarding the culture of the design studio. According to the report, the design studio is a nurturing ground for students to cultivate critical thinking skills and challenge conventional norms to generate improved designs. Consequently, the studio courses and their corresponding environments foster the development of unique cultures that become deeply intertwined with the students' lives.

Improvement in studio pedagogies can sometimes be overlooked, hindering the effectiveness of teaching methods. The prevailing studio culture often manifests in normalized hierarchical

relationships, limited communication, and a preference for individual information consumption within a demanding atmosphere. These tendencies underscore the interconnectedness between education and broader societal processes, wherein social power dynamics influence knowledge distribution, selection, and arrangement. Within the design studio, this includes contemporary issues such as unequal relationships, class disparities, ethnic distinctions, and gender discrimination (Dutton, 1991).

Architectural design education's primary objective is cultivating students' imaginative capabilities. The core focus of this form of education is the design studio, where architectural design principles are imparted. While adhering to building regulations, students are encouraged to unleash their creative potential and generate novel concepts. These studios can be best understood as a well-structured and interconnected series of stages that span eight semesters, encompassing both the content taught and the methods employed for course delivery (Turgut, 2007).

At its most effective, the design studio sequence serves as a cohesive element that progressively connects the various components of architectural education. Encouragingly, several "integrative" studios have been identified where knowledge discovery, application, and design integration are actively explored (Dutton, 1991).

The design studio is a versatile and integral component of architectural education. The studio encompasses a physical space and a pedagogical strategy fostering creativity, critical thinking, and practical skills. It provides a dynamic environment in which students engage in diverse activities, promoting analytical, synthetic, and evaluative modes of thinking while also serving as a platform for developing the essential skill of sound judgment in architectural creation. The significance of the design studio in architectural education cannot be overstated, as it functions as a forge where students are shaped into imaginative thinkers and problem solvers. Nevertheless, it is crucial to recognize the need for continuous evaluation and enhancement of instructional approaches within the studio atmosphere to guarantee each student's comprehensive, fair, and productive learning setting.

4. Mandatory Break of Design Studio Education & Space Rapid Evolution, 2020-2021 Covid-19 Process

In light of the COVID-19 pandemic, numerous universities transitioned to remote learning, heavily relying on platforms such as Zoom, Google Hangouts, and Microsoft Teams (IAU et al., 2020; Seeletso, 2022). The primary modes of instruction became audio and video conferencing (Chan et al., 2023). Still, this shift presented various challenges, including the issues of digital literacy, infrastructure, engagement, confidentiality, and privacy (Wood-Harper, 2021). Research conducted on architectural education during the pandemic shed light on several key aspects:

- Asadpour observed how the pandemic disrupted the conventional approach to architectural design courses, presenting opportunities for examination and reform (Asadpour, 2021).

- Asfour et al. conducted surveys at a university in Saudi Arabia and found that while there were benefits in terms of time management and flexibility, challenges arose due to the absence of a group design studio atmosphere (Asfour & Alkharoubi, 2023).

- Grover and Wright discussed students' dissatisfaction with emergency remote learning in architecture, highlighting the difficulty of transitioning from a pedagogy rooted in physical spaces to an online format (Grover & Wright, 2023).

- Alnusairat et al.'s study revealed that participants expressed uncertainty regarding their online learning experiences and emphasized the need for more support and guidance. This uncertainty was attributed to personal circumstances, tutors' lack of experience with online teaching, and limited peer interaction (Alnusairat et al., 2021).

These findings underscore the significance of fostering vibrant online learning communities and peer-to-peer support in digital education. Converting studio-based teaching to online requires thoughtful planning (Grover & Wright, 2020).

Exploring alternative pedagogies is crucial for effectively delivering remote architectural education, even if adjustments are made to digital studios. While moving away from a pedagogy centered on physical spaces is essential, the effectiveness of alternative methods remains to be determined, particularly in replicating the social support provided by physical studios. Recreating intangible elements such as peer support digitally presents a challenge in online learning despite its potential to replace face-to-face interactions. The physical proximity, touch, and engagement integral to building a studio community and fostering lasting relationships significantly impact students' educational experiences and creative patterns (Grover & Wright, 2020).

Place-based pedagogy, supported by essential facilities, promotes educational equity. However, the absence of such resources can disadvantage students who rely on peer or tutor assistance, affecting their performance and well-being. Addressing this issue in the online learning environment is paramount, as it affects architecture schools with design studio traditions (Grover & Wright, 2020).

Blended learning presents a promising approach to enhancing in-person design studio classes by incorporating interactive online tools. This approach entails developing course materials and requirements for collaborative group projects and teamwork and improving existing digital educational platforms. However, it is essential to exercise caution and only partially substitute conventional teaching methods with online instruction, particularly in the initial stages of design study programs (Asfour & Alkharoubi, 2023).

The challenges encountered in architectural education are deeply rooted in conventional roles and curriculum content. A preliminary model known as Strategic Design Pedagogy (SDP) has been suggested to handle these challenges. However, despite efforts to transform tutors into facilitators and counselors, students are reluctant to participate actively in online design studios. Many significant solutions have been recommended to handle this matter. Firstly, short-term workshops and courses can assist students and professors in adapting to new circumstances and bridging the gap between existing knowledge and emerging challenges.

Furthermore, it is imperative to redefine the content, procedures, and learning outcomes of e-studio courses, focusing on enhancing communication skills and media literacy to facilitate effective student learning and assessment. Furthermore, when establishing new e-design studios and planning curricula, it is essential to consider factors such as peer support, emotional well-being, social interactions, and financial assistance. Strategic planning should also consider problems associated with seclusion, solitude, and the adverse effects of social media usage. In light of recent research highlighting the widening disparities between affluent and disadvantaged students in e-learning, structural adjustments should be made to accommodate limitations associated with national resources and university facilities. Finally, fostering global online connections among architectural institutions and leveraging the resources of other universities through virtual collaboration can promote empathy, bridge gaps, and facilitate the exchange of experiences (Adapted from Asadpour, 2021).

During the COVID-19 pandemic, architectural education has shifted from conventional in-person teaching to online distance learning, posing noteworthy challenges. While this shift has provided opportunities for examination and reform, it has also illuminated several challenges, such as difficulties with digital literacy, limitations in infrastructure, and the complexities of replicating the interactive studio environment online. Research conducted during the pandemic has underscored the significance of cultivating vibrant online learning communities and peer-to-peer support in digital education. A thoughtful and meticulous approach to converting studio-based teaching into an online format is essential, and exploring alternative pedagogical strategies is crucial for the successful delivery of remote architectural education. While blended learning methods hold

promise, they should supplement rather than supplant conventional teaching approaches, especially in the initial stages of design study programs. Furthermore, addressing disparities in resources and fostering global connections among architectural institutions can enhance the quality of online architectural education. As architectural education continues to adapt to the challenges of the digital era, these insights will play a pivotal role in shaping its future.

5. Evolution of Design Studio Education & Space with Emerging Technologies, Ongoing Process

Education strives to accomplish more than simply transmitting knowledge and skills; it aims to foster in students a passion for acquiring knowledge, effective collaboration, critical thinking, problem-solving abilities, adaptability in the face of unforeseen challenges, and an unwavering thirst for learning. This equips them to effectively apply their acquired knowledge, including digital literacy, in practical, real-world scenarios (Estes et al., 2021). The start of technology has dramatically affected higher education, completely changing the way teaching and learning occur. When strategically employed to align with educational objectives and standards, technology enriches the student experience and fosters meaningful engagement. Its combination comprises various elements of higher education, encompassing teaching, learning, curriculum design, and assessment (Alhazmi, 2021). Discussions and observations surrounding the transformation of conventional design studio education and its spatial elements have been ongoing since the early 2000s. There has been a significant increase in the number of research and development studies carried out in recent years, which coincides with the greater accessibility to technology. The ongoing discourse and observations regarding the transformation of conventional design studio education and its physical environment have persisted since the 2000s. The past few years have witnessed a surge in research and development endeavors, mainly due to the enhanced availability of technology (Salama & Wilkinson, 2007). The conventional design studio thrives in an environment that is dedicated and free from distractions.

Nevertheless, the introduction of modern technology has brought about significant disruptions, thereby challenging the efficacy of this model (Weiner, 2005). Architectural education has shifted away from the intensive and protracted studio format of the past, transitioning towards a more structured Bachelor/Master's degree system that aligns with other disciplines. To preserve its distinctive identity, architectural education must reevaluate this trend, as the studio serves as a privileged space for exploring both tangible and abstract facets of architecture (McQuillan, 2005). The influence of information technology on our lives has changed teaching methods and architectural design. Although technology allows immediate access to information, it lacks the sensory and physical encounters of the real world (McCann, 2005).

The improvement in computer-aided design (CAD), visualization, digital modeling, and data transmission technologies has made it feasible to include virtual elements in design education. Some argue that physical presence in a studio is no longer necessary, suggesting a departure from the conventional approach (Salama & Wilkinson, 2007). The emergence of virtual design studios (VDS) enables students from different locations to cooperate effectively in a computer-mediated environment. This transformation in studio format significantly impacts architectural education (Salama & Wilkinson, 2007). Despite the shift towards virtuality, the physical aspect of the studio remains essential, although it is now replaced by electronic means. Critics highlight the challenges of maintaining the studio's sanctity and the increasing trend toward individualization (Weiner, 2005).

Design pedagogy has embraced information technology, leading to the rise of paperless and virtual design studios. These studios prioritize digital design theory and practice (Salama & Wilkinson, 2007).

Architectural education examines fresh approaches to adjusting to the digital age using augmented reality and virtual learning environments. Students must learn to differentiate between virtual and real experiences critically. Design education should encourage students to consider the

significance of physical location and the value of hands-on experiences in an increasingly virtual world. Striking a balance between simulation and practical encounters is crucial in design education (Sorvig, 2005).

Distance learning frequently harnesses intelligent technology in education, offering advantages such as increased enrollment, efficient feedback mechanisms, and enhanced communication between students and educators through ubiquitous technologies. Nonetheless, it presents challenges such as the absence of face-to-face interaction, considerations regarding cost, the absence of a physical classroom, concerns surrounding privacy, and deliberations regarding the role of AI in human-centric activities (Chukwukelu et al., 2021).

Given the transformation in how students access information through technology, architectural education must adapt accordingly. Architecture programs now integrate digital technologies, particularly augmented reality (XR), in design education (Darwish et al., 2023). Evaluated with these improvements and unexpected shifts, extended Reality (XR), characterized by Gownder, incorporates the mix of genuine and virtual universes and the associations between people and machines encouraged by PC innovation and wearable gadgets. XR includes Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), and the intersections between these realms (Darwish et al., 2023; Gownder et al., 2016). The inquiry posed by Sala and the subsequent response revolve around the suitability of virtual and augmented reality as instructional tools in classroom settings. While the answer might be affirmative, it is imperative to remember that not all educational environments derive advantages from implementing virtual and augmented reality (Sala, 2021).

Sala provides comprehensive definitions of virtual reality, augmented reality, and mixed reality, highlighting their distinctive characteristics, practical applications, and utilization within education (Table 1).

Table 1 The Criterion Identified in the Literature Review for Smart Urban Management of Green Spaces

	Virtual Reality	**Augmented Reality**	**Mixed Reality**
What is it?	digital environment that shut out the real world.	virtual objects overlaid on a real-world environment.	virtual environment combined with the real world
Features	closed and fully immersive. complete immersion in the VE. movement freedom in the digital atmosphere with sound effects.	open and partial immersive. real world enhanced with digital objects. digital on the real world.	interaction with both virtual and real environment. digital contents interact with the real world.
Applications	video games, training, collaboration, simulation, virtual worlds, edutainment.	video games, training, commerce, education, park themes, edutainment.	engineering, healthcare, education, edutainment.
Devices	data gloves, headset, special hand controllers	special AR headset	Microsoft Hololens, MR headset.
Application in education fields	can be used to enhance student learning and engagement.	can help make classes more interactive and allow learners to focus more.	touching and manipulating objects generates greater understanding, integrating with data sets, complex formulas etc.

As technology progresses, it becomes apparent that virtual reality (VR) can support these advancements, holding the promise of a positive future. When reflecting on VR's evolution from its inception to its current state of development, it is imperative to contemplate its journey, heightened accessibility, and potential for integration within the realm of education (Estes et al., 2021).

Sala furnishes a concise account of the historical progression of virtual reality (VR), augmented reality (AR), and mixed reality (MR) within the educational sphere as follows:

- 1989-1999: The initial endeavors to employ VR and AR in education.

- 2000-2010: The rapid advancement of electronic components improved the accessibility of VR and AR technology, facilitating their application in educational domains. MR began to gain popularity.

- 2011-2020: The continual refinement of VR, AR, and MR drives the expansion of their applications, bolstering interactivity and advocating for their utilization in teaching and learning (Sala, 2021).

As technological advancements continue, virtual reality (VR) holds great potential, particularly in education (Estes et al., 2021). In online settings, virtual worlds provide 3D representations of real objects or environments, whether realistic or fantastical and possess the capacity to influence communication significantly. Within the context of higher education, these 3D virtual worlds serve various purposes, such as facilitating virtual lectures (49%), discussions (32%), field trips (14%), simulations (28%), and gaming (11%). The existing literature typically backs the notion that conventional lectures in real-world settings yield superior results to those conducted in virtual environments. Seventeen primary categories of virtual environments are employed for educational purposes, including virtual classrooms, laboratories, meeting spaces, and replicas of actual locations. Guidelines have been established to harness these technologies for innovative teaching and learning methods. Utilizing virtual excursions within 3D virtual worlds proves viable for educational objectives, enabling students to explore sites across the globe (Ghanbarzadeh & Ghapanchi, 2021).

However, despite VR's potential for education, it encounters challenges such as limited device resolution, maintaining high frame rates on personal computers, and cost concerns, particularly in technical fields like architecture (Sala, 2021). Regarding the efficiency of 3D virtual universes in higher education, students' and educators' responses indicate that they can significantly improve learning results and offer valuable alternatives to conventional classes. This assertion is supported by existing literature (Ghanbarzadeh & Ghapanchi, 2021).

Design schools may need to revisit curricula and provide more hands-on experiences as we navigate the information age. The rise of the virtual world emphasizes the importance of tangible skills and material creation (Sorvig, 2005).

In the face of an increasingly virtual world, design education must find a balance and reinforce the value of tangible and material experiences (Sorvig, 2005).

To summarize, incorporating emerging technologies, specifically Extended Reality (XR), in higher education fundamentally alters how students engage with educational materials. Technology has become a dispensable tool for enhancing the student learning experience, facilitating meaningful interaction, and accommodating the changing demands of modern education. The utilization of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) within educational contexts, coupled with the restructuring of conventional design studio education, underscores both the promise and obstacles associated with technological progress in education. These technologies, along with space-time tools and methods, hold the potential to conduct design studio education without the need for a specific physical studio. This approach allows for greater flexibility and accessibility, enabling students and educators to interact with design concepts and collaborate from any location at any time. Furthermore, as we navigate the ever-changing educational landscape in the digital era, it is evident that technology will be pivotal in shaping the trajectory of higher education, providing students with the essential skills, adaptability, and digital literacy required to thrive in an increasingly dynamic world.

6. Conclusion and Discussion

This study explores the evolution of design studio education with its firsts. It presents crucial shifts in design studio education, instruction method, and space, such as transitioning from the master's place/space to the contemporary design studio space within architecture schools (Table 2).

Table 2 Evolution of Design Studio Education Instruction and Design Studio Education Space by Time

Time	Design Studio Education Instruction	Design Studio Education Space
Before 1671	master-apprentice relationship	master's place, site, built environment
Between 1671-1819	master-apprentice relationship	master's place
1819 - Beaux	architecture practice experienced master/ instructor-student as an apprentice	design studio in school
1919 - Bauhaus	instructor- student as apprentice	design studio in school
1919-2019	instructor- student as apprentice	design studio in school
2019-2021	instructor- student as apprentice	online design studio (zoom, teams etc.)
2021-2022	instructor- student as apprentice	design studio in school
2023-…	instructor- student as apprentice?	alternative environments?

From its firsts until 2019, architectural design studio education was predominantly influenced by the globally acknowledged Beaux and Bauhaus architectural design education models (Figure 1).

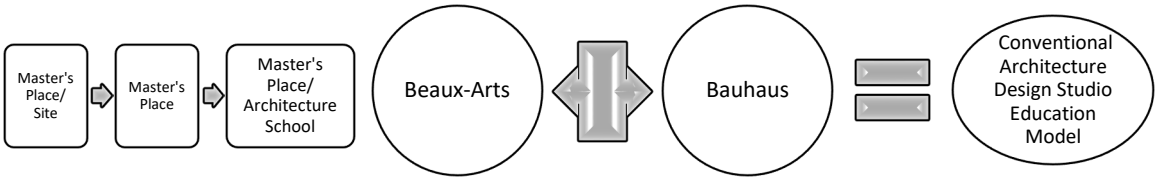

Figure 1 Conventional architectural design studio education model formation diagram

In these design education models, especially Bauhaus, design studio education has a structure that goes far beyond just being education in a studio space; it encompasses a diverse history and a variety of dynamic components. People, pedagogy, tools, spaces, and hidden content establish the basis of the design studio as its components. Each component interacts and communicates with the others, indicating that alterations in one can impact all others (Table 3).

Table 3 Design Studio Education Components

Architectural Design Studio Education & Culture Components	Contents of each Component
People	students, instructors, jury, other students around, and other people around, etc.
Pedagogy	methods, approaches, theories, syllabus, curriculum, etc.
Tools	papers, pencils, notebooks, computers, tablets, models, model materials, tables, chairs, boards, screens, clipboards, etc.
Spaces	studio, school, campus, site, built environment, daily-life students' spaces, etc.
Hidden Content	actions, interactions, socializing, encounters, ambiance, discussions, everyday experiences, learning from the environment, peer relations, synergy, etc.

Social, economic, and technological developments have significantly altered the components, especially the tools of the two conventional design studio education models by the period. Particularly concerning the technological impacts, the emergence of portable computers and tablets has rendered it feasible to operate from various locations, introducing an aspect of adaptability to the design studio space. This technological transition has not merely affected the outfitting and adaptability of these spaces but has also redefined what constitutes a design studio again (Figure 2).

Figure 2 Computer science development and architectural design education interaction process

However, as developments continue, the most notable factor accentuating the need for the conventional design studio education—which has persisted for more than two centuries based on

two primary models and whose components generally exhibit resemblances across numerous design studio educations worldwide—to evolve and hasten technological assimilation has been the architectural education experience encountered during the COVID-19 process. The COVID-19 crisis prompted an abrupt transition to remote education in architectural education, leading to significant changes. This transition made video conferencing, digital equipment, and social media platforms indispensable. Traditional design studio environments were shifted to digital spaces, and course materials and equipment were reorganized for online education. However, these changes in the environment and the associated tools led to differences compared to traditional face-to-face design education. Online design studio education could not achieve the same learning and teaching outcomes as face-to-face education. In the process, perhaps just changing the conventional design studio environment has led to differences in each education component and, consequently, in learning outcomes. This situation underscored the necessity to evaluate online and remote education and highlighted the importance of each component within the educational framework. Therefore, the need for alternative design studio education in different conditions and environments, and considering the interaction and content of its components while analyzing these alternatives, was found to be of vital importance. As the educational system reverts to normalcy after the crisis episode, the question of how architectural design studio education can be organized beyond technological measures and a studio setting for the present and future has commenced to be re-evaluated with all its components. In this context, alternative realities and their technologies have gained significance for creating another design studio education model or re-novating conventional design studio education models.

Given the current developments (Figure 3), integrating or shifting VR (Virtual Reality), AR (Augmented Reality), and MR (Mixed Reality) technologies into design studio education has the potential to provide immersive and interactive learning experiences beyond traditional methods. Each technology can offer the design studio's education and environment different opportunities.

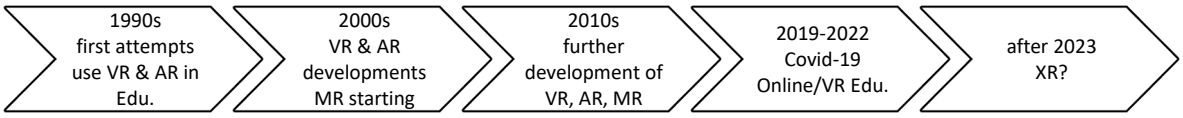

Figure 3 VR, AR and MR technologies developments and their educational usage process

VR can establish a fully immersive digital design studio. Learners can utilize VR headsets to enter a virtual realm, engaging with 3D representations of their designs. This enables a more profound comprehension of spatial connections and the consequences of design choices. VR studios can replicate real-life scenarios, allowing students to explore their designs at actual size and from various viewpoints. Virtual collaboration areas can also link learners and educators from diverse locations, fostering cooperation and input. An advantage of VR is its potential to eliminate the necessity for a physical design studio venue, as the immersive setting can be accessed from any location equipped with the required technology.

AR improves the physical design studio by layering digital elements onto the real world. Using AR eyewear or mobile gadgets, scholars can observe virtual components overlaid on their physical models or studio spaces. This proves valuable for site assessment, where digital facts regarding site conditions can be superimposed on a physical model. AR can also enable interactive demonstrations, with lively visual representations responding to user engagement. While AR typically enhances an existing physical setting, it can be applied in diverse environments, be it enclosed, open, or partially open spaces, providing adaptability in design studio tasks.

MR merges VR and AR, allowing students to engage with physical and digital entities concurrently. In an MR design studio, learners can manipulate virtual models manually while remaining conscious of the physical studio setting. This technology promotes collaborative efforts, permitting multiple users to engage with the same digital entities from separate locations. MR can

also integrate real-time information and simulations into the design procedure, providing comprehensive insight into design repercussions. MR allows versatility to function in various settings, whether enclosed, open, or partially open, providing a flexible approach to executing design studio tasks.

These technologies can substantially diminish the dependence on conventional physical design studios. Scholars can access design studio education from any location with the necessary equipment and internet connectivity, boosting accessibility and enabling a broader spectrum of participants.

As a result, this study contributes to the field by providing a comprehensive analysis of the evolution of design studio education and the integration of VR, AR, and MR technologies. It offers educators theoretical insights and practical guidelines and explores alternative models to enhance flexibility and adaptability. Additionally, it addresses technological adaptation and crisis management, enriching the academic literature and fostering future research and discussion.

References

AIAS, American Institute of Architecture Students, & Koch, A. (2002). *The redesign of studio culture: A report of the AIAS studio culture task force*. American Institute of Architecture Students.

Akyıldız, E. C. (2020). Bir öğrenme ortamı olarak tasarım stüdyosu: Maltepe üniversitesi tasarım stüdyosu 1 deneyimi. *Turkish Online Journal of Design Art and Communication*, *10*(4), 389-407.

Alhazmi, F. N. (2021). Cloud computing big data adoption impacts on teaching and learning in higher education: a systematic review. *Fostering Communication and Learning with Underutilized Technologies in Higher Education*, 53-66. http://doi.org/10.4018/978-1-7998-4846-2.ch004.

Alnusairat, S., Al Maani, D., & Al-Jokhadar, A. (2021). Architecture students' satisfaction with and perceptions of online design studios during COVID-19 lockdown: the case of Jordan universities. *Archnet-IJAR: International Journal of Architectural Research*, *15*(1), 219-236.

Andia, A. (2001, October). Integrating digital design and architecture during the past three decades. In *Proceedings Seventh International Conference on Virtual Systems and Multimedia* (pp. 677-686). IEEE. http://doi.org/10.1109/VSMM.2001.969728.

Andia, A. (2002). Reconstructing the effects of computers on practice and education during the past three decades. *Journal of Architectural Education, 56*(2), 7-13. http://doi.org/10.1162/10464880260472512.

Anthony, K. H. (1991). *Design juries on trial: The renaissance of the design studio*. Van Nostrand Reinhold.

Asadpour, A. (2021). Student challenges in online architectural design courses in Iran during the COVID-19 pandemic. *E-Learning and Digital Media, 18*(6), 511-529. http://doi.org/10.1177/20427530211022923.

Asfour, O. S., & Alkharoubi, A. M. (2023). Challenges and opportunities in online education in Architecture: Lessons learned for Post-Pandemic education. *Ain Shams Engineering Journal, 14*(9), 102131. http://doi.org/10.1016/j.asej.2023.102131.

Balamir, A. K. (1985). The change of architectural discourse and education programs. *Mimarlık, 23*(8), 9-15.

Barrell, J. (2013). *Living with the Royal Academy: Artistic ideals and experiences in England, 1768–1848*. Ashgate Publishing Ltd.

Bender, D. M., & Vredevoogd, J. D. (2006). Using online education technologies to support studio instruction. *Journal of Educational Technology & Society, 9*(4), 114-122. http://doi.org/10.1207/s15389286ajde1802_4.

Biggs, J. (1999). *Teaching for quality learning at university: What the student does*. Open University Press.

Chan, C. K. Y. (2023). A review of the changes in higher education assessment and grading policy during COVID-19. *Assessment & Evaluation in Higher Education*, *48*(6), 874–887. https://doi.org/10.1080/02602938.2022.2140780.

Chukwukelu, G., Essien, A., & Essien, V. (2021). Opportunities and challenges of adopting artificial intelligence for learning and teaching in higher education. *Fostering communication and learning with underutilized technologies in higher education*, 67-78.

Costanzo, D. (2016). Architecture's oldest book: Vitruvius. In D. Costanzo (Ed.), *What architecture means* (pp. 100–109). Routledge.

Crowther, P. (2013). Understanding the signature pedagogy of the design studio and the opportunities for its technological enhancement. *Journal of Learning Design, 6*(3), 18–28. http://doi.org/10.5204/jld.v6i3.155.

Darwish, M., Kamel, S., & Assem, A. (2023). A theoretical model of using extended reality in architecture design education. *Engineering Research Journal - Faculty of Engineering, 52*(1), 36-45. http://doi.org/10.21608/erjsh.2022.168677.1099.

Delahaye, B.L. (2005). *Human resource development: Adult learning and knowledge management*. John Wiley and Sons Australia.

Dutton, T. A. (1991). The hidden curriculum and the design studio: Toward a critical studio pedagogy. In T. A. Dutton (Ed.), *Voices in architectural education: Cultural politics and pedagogy* (pp. 165-194). Bergin & Garvey.

Estes, J. S., Dailey-Hebert, A., & Choi, D. H. (2021). The history and evolution of virtual reality. In *Current and prospective applications of virtual reality in higher education* (pp. 1-20). IGI Global.

Ghanbarzadeh, R., & Ghapanchi, A. H. (2021). A literature review on the use of three-dimensional virtual worlds in higher education. In *Current and prospective applications of virtual reality in higher education* (pp. 21-47). IGI Global.

Glasser, D. E. (2000). Reflections on architectural education. *Journal of Architectural Education, 53*(4), 250-252. http://doi.org/10.1162/104648800564662.

Gownder, J. P., Voce, C., Mai, M., & Lynch, D. (2016). Breakout vendors: virtual and augmented reality. *Retrieved August*, *17*, 2016.

Griffin, A. (2019). *The rise of academic architectural education: The origins and enduring influence of the académie d'Architecture*. Routledge.

Grover, R., & Wright, A. (2020). National design studio survey: findings. Retrieved from [https://purehost.bath.ac.uk/ws/portalfiles/portal/212263888/National_Design_Studio_Survey_FINDINGS.pdf].

Grover, R., & Wright, A. (2023). Shutting the studio: The impact of the Covid-19 pandemic on architectural education in the United Kingdom. *International Journal of Technology and Design Education, 33*(3), 1173-1197. http://doi.org/10.1007/s10798-022-09765-y.

Habraken, N.J. (2007). To tend a garden: thoughts on the strengths and limits of studio pedagogy. In *Design Studio Pedagogy: Horizons for the Future, ed. Ashraf Salama and Nicholas Wilkinson* (pp. 11-20). The Urban International Press.

Hacıhasanoğlu, O., & Toprak, İ. (2019). Terms and concepts on design studio in the research articles of 2010. *JAE, 1* (I:2), 13-22.

IAU. International Association of Universities. (2020). *The impact of COVID-19 on higher education around the world: IAU Global Survey Report*. IAU.

Lueth, P. L. O. (2003). *The culture of architectural design studio: A qualitative pilot study on the interaction of the instructor and the student in their culture and the identification of the instructor's teaching styles* [Thesis, Iowa State University]. https://dr.lib.iastate.edu/entities/publication/09e77630-e1fa-47ff-b9d3-aac99069fb47.

McQuillan, T. (2005). Informed architecture: three tensions. In *Writings in architectural education* (p. 49). EAAE PRIZE.

Morgan, M. H., & Warren, H. L. (1914). *Vitruvius: The ten books on architecture*. Harvard University Press.

Nanda, U., & Solovyova, I. (2005). The embodiment of the eye in architectural education. In *Writings in architectural education* (pp. 150-161). EAAE PRIZE.

On the Hither Side of Depth A Pedagogy of Engagement, 3RD PRIZE Rachel McCann, Mississippi State University, USA, WILLEY, D. S. (2005). Architectural Education in the Digital Environment. *EAAE PRIZE 2003-2005*, 200.

Pont, G. (2005). The education of the classical architects from Plato to Vitruvius. *Nexus Network Journal, 7*(1), 76-85. http://doi.org/10.1007/s00004-005-0008-0.

Reffat, R. (2007). Revitalizing architectural design studio teaching using ICT: reflections on practical implementations. *International Journal of Education and Development using ICT*, *3*(1), 39-53.

Sala, N. (2021). Virtual reality, augmented reality, and mixed reality in education: A brief overview. In *Current and prospective applications of virtual reality in higher education* (pp. 48-73). IGI Global.

Salama, A. M. (2007). *Design studio pedagogy: Horizons for the future*. Urban International Press.

Salama, A. M., & Wilkinson, N. (2007). *Design studio pedagogy: Horizons for the future*: Urban International Press.

Schön, D. A. (1984). The architectural studio as an exemplar of education for reflection-in-action. *Journal of Architectural Education, 38*(1), 2-9. http://doi.org/10.1080/10464883.1984.10758345.

Seeletso, M. K. (2022). Teacher education in the digital age: Opportunities and challenges. *Perspectives on Teacher Education in the Digital Age*, 11-23.

Sorvig, K. (2005). *Virtual and real: Teaching the paradoxes of design*. In *Writings in architectural education* (p. 85). EAAE PRIZE.

Stevens, G. (1998). The favored circle: The social foundations of architectural distinction. MIT Press.
Taylor, S. S. (2008). Effects of studio space on teaching and learning: Preliminary findings from two case studies. *Innovative Higher Education, 33*(4), 217-228. http://doi.org/10.1007/s10755-008-9079-7.
Weatherhead, A. C. (1941). *The history of collegiate education in architecture in the United States* [Unpublished doctoral dissertation]. Columbia University.
Weiner, F. (2005). Five critical horizons for architectural educators in an age of distraction. In *Writings in architectural education* (p. 21). EAAE PRIZE.
Wood-Harper, T. (2021). Emerging EdTechs amidst the COVID-19 pandemic: Cases in higher education institutions. In M. Ali & T. Wood-Harper (Eds.), *Fostering communication and learning with underutilized technologies in higher education* (pp. 93-107). IGI Global.

Note

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Resume

Aysegul Kidik (ERU, ITU, AGU) is a Ph.D. candidate in Architecture at Abdullah Gul University (AGU). She is currently a Lecturer at the Faculty of Architecture AGU, Turkey. She has experience in architectural design. Her research interests focus on architectural design, architectural design education, and extended reality technologies. In her research, she delves into the transformation of architectural design education, exploring the future horizons and potential thresholds in this evolving field.

Burak Asiliskender (YTU, ITU) is a Professor of Architecture at Abdullah Gül University and the Dean of the School of Architecture. He has also worked as the Advisor to the Rector for Education. He was the former and founding chair of the AGU Department of Architecture. He studies, teaches, and extensively publishes on architectural theory and design. He has been involved in the design and implementation projects of the former Sümerbank Kayseri Textile Factory for AGU.

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Digital game-based learning in architecture education: Consolidating visual design principles in freshmen

Aslı Çekmiş*
Mert Karakaya**

Abstract

Using games as educational tools has been a captivating subject in the academic domain. There is an increasing number of digital games designed to support architectural education. This paper introduces a serious game aimed at enhancing basic design knowledge for first-year architecture students. The game focuses on teaching and testing visual design principles such as emphasis, balance, and rhythm. Based on these principles, it allows students to create 2D compositions on a grid pattern by placing and manipulating simple shapes in terms of color, shape, and size. The final composition is evaluated by an artificial intelligence (AI) tool integrated into the game. This AI tool predicts the design principles present in the composition, providing three possible outcomes with associated percentages. The game, currently in the testing phase, has been played by 126 first-year students, and user experience has been assessed through questionnaires, surveys, and basic game metrics. The use of this game to teach visual design principles has proven to be an effective method for engaging students in active learning and enhancing their understanding and application of design concepts. The innovative use of AI to provide real-time feedback and the interactive nature of the game have fostered a deeper, experiential learning process. Additionally, students have proposed various innovative ideas to improve the gaming experience, suggesting potential enhancements that could lead to a more refined and enjoyable gameplay. These insights highlight the potential of digital game-based learning (DGBL) and AI-enhanced tools in creating an engaging and effective educational environment.

Keywords: architectural education, basic design principles, digital game-based learning (DGBL), artificial intelligence (AI), first-year architecture students

1. Introduction

Education should not be strictly adherent to a unidirectional approach. The integration of games as educational resources has received significant attention in academic circles. Games, typically associated with enjoyment, have shown considerable potential to enhance students' learning outcomes within a game-based learning framework (Gros, 2007). Several studies affirm the beneficial effects of incorporating games into education. Chuang et al. (2007) conducted a study involving 108 third-grade university students, providing experimental evidence that video games surpassed computer-assisted education in fostering cognitive growth. Barron's (2015) study compared college students' performance in video game-based learning (using SimCityEdu) with traditional learning methods (lectures/debates), revealing superior knowledge retention and information access among the game-based group. Zhonggen's (2019) study underscored that serious games –designed specifically for educational purposes rather than entertainment, hold the potential to boost players' positive mood and happiness, thereby cultivating favorable attitudes toward academic tasks. In 2020, Coleman and Money discovered that inquiries into 'student-centered digital game-based learning' consistently emphasized elements such as active learning, autonomy development, and increased responsibility and accountability. Furthermore, Oksuz and Cordan's (2022) article demonstrated that enabling players to manipulate the game environment with design tools enhances interaction, promoting experiential and active learning engagement.

*(Corresponding author) Assist. Prof. Dr., Istanbul Technical University, Türkiye, aslicekmis@gmail.com
**Independent Researcher and MSc. Engineer, Türkiye krkymert1@gmail.com
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Games inherently possess motivational capabilities, starting from teaching fundamental concepts and aiding in the establishment of a knowledge base. As players progress, the levels and tasks become more complex, encouraging strategic thinking, goal setting, critical analysis, and problem-solving (Westera, 2015). Moreover, games provide a flexible environment, avoiding rigidly predefined problems and solutions, thus accommodating various approaches based on individual differences. Kang et al. (2017) stress that "… open-ended serious games can facilitate students' development of specific skills and improve learning performance through scientific problem-solving." Javid's (2014) study, though non-digital, demonstrated the impact of game-based learning on architecture students, helping them identify connections within design problems to develop unique and integrated solutions. Javid also highlighted that freedom from failure in games correlates with motivation, leading to positive learning outcomes.

This paper presents empirical research on the educational benefits of an open-ended game augmented by artificial intelligence (AI) for students studying art and architecture. While interest in incorporating digital games into architecture education is increasing, current applications are often limited by preset game settings or focus solely on 3D design visualization in simulated environments. The game developed in this study provides students with foundational knowledge of basic design principles and offers opportunities to practice utilizing various elements and implicit rules to create compositions aligned with these principles. This method of learning, utilizing a game with multiple pathways to success and numerous options for player choice and creativity, is crucial for design education and curriculum development.

The originality of this study also lies in its integration with AI technology, allowing students to assess their compositions against predictions made by a machine learning model developed by Demir et al. (2021). This model is proficient at identifying visual design principles evident in artworks, photographs, and contemporary building façades. The incorporation of this AI model offers real-time feedback, facilitating a continuous trial process without the need for constant validation from educators and alleviating concerns about repeated failure. Here the AI-integrated game is expected to aid students by establishing an objective framework for aesthetic analysis grounded in basic design principles, thereby supporting and exploring self-directed learning.

This paper begins with an examination of the current landscape of digital game-based learning (DGBL); including learning models, examples from architecture education, and AI support in game design and development. It then discusses the process of designing a digital game and evaluating its effectiveness as a gaming experience. Following the literature review, the third section provides details on a specific application—an original digital game developed by the authors and voluntarily played by a group of first-year architecture students at Istanbul Technical University (ITU). The paper concludes with the presentation of results and outlines future prospects.

2. Literature Review

2.1. Digital Games and Learning Models

Games provide a platform for students to explore, experiment, and make impactful decisions. Several educational theories support the use of game-based learning, emphasizing its role in fostering active learning and creating meaningful environments where learners can construct knowledge (Harikrishnan et al., 2019). Constructivist Learning Theory (CLT), which suggests that learning is enhanced when students actively engage with phenomena, principles, and practices through pertinent experience-based learning exercises or projects, is one of the most widely used theoretical foundations in research on gamification, serious games, and game-based learning. Pavlik and Pavlik (2024) highlight a practical application of CLT in a classroom setting, where students with minimal technical artistic skills generated visuals emulating a particular painting style using generative AI (DALL-E 2). The integration of AI allowed educators to immerse students in critical analysis of art or art-like materials through an experience-based approach. Similarly, architecture schools utilize experience-based learning to merge abstract concepts with concrete applications, thereby providing students with a holistic and engaging knowledge.

Educational games offer students the chance to experience various scenarios and reflect on their designs, aligning with Experiential Learning Theory (ELT) introduced by David A. Kolb (2015). This theory emphasizes the significance of direct experience and reflection in the learning process (Nadeem et al., 2023). Additionally, Flow Theory describes a state of deep engagement and enjoyment achieved when an individual is fully immersed in an activity, balancing skill level and challenge to prevent anxiety and maintain the flow of the game. Kiili's Experiential Gaming Model (2005) integrates Experiential Learning Theory, Flow Theory, and game design to develop an effective game-based learning framework. This model emphasizes the continuous nature of learning and the importance of appropriate feedback which provides the basis for a continuous process of goal-directed action. It highlights that immediate feedback, coupled with clear goals and challenges tailored to the player's skill level, facilitates meaningful and engaging learning experiences through the sensation of flow.

Video games can be effectively utilized to develop self-directed (incidental) learning (SDL), possessing features conducive for independent learning (Toh & Kirschner, 2020). These games provide a risk-free environment for learners to experiment and fail without real-world consequences. This setting allows learners to progress at their own pace, receiving immediate in-game feedback to enhance various skills and competencies. Li et al. (2024) focused on AI-facilitated SDL, examining how generative AI (ChatGPT) can support and enhance language learning through conversational interaction, personalized feedback, and content generation. Additionally, Shaheen and Fotaris (2023) highlight that digital games implicitly promote reflective learning by encouraging critical thinking, self-awareness, problem-solving skills, and motivation. Reflective learning, characterized by immediate feedback, further supports self-directed learning by enabling students to engage in continuous self-assessment and improvement.

Paciarotti et al. (2021) introduced the 'Learner-Designer Approach' to serious games, which engages students in a process to learn assigned content by actively participating in its design. This new perspective integrates gamification with active learning and social constructivist methods, including project-based learning, self-regulated learning, reciprocal teaching, and cooperative learning. The approach emphasizes metacognitive elements through active monitoring and decision-making. Designers (students) must comprehend, organize, and reason through the learning material to convey it effectively to the players (their fellow students), thereby enhancing their understanding compared to traditional lecturing. Similarly, Örnekoğlu-Selçuk et al. (2024) propose a 'game-design' approach, another way integrating constructivist paradigm into education on a pedagogical basis. This method allows students to design their own games, offering a richer learning experience compared to merely playing games. This concept, referred to as "co-design," transforms students into active producers rather than passive recipients. The 'learning-by-doing' model is emphasized as a fundamental aspect of design education. While designing a game, students engage in higher-order thinking processes, including iterative design, critical thinking, and systemic thinking.

In addition, serious games are studied not only for their learning outcomes (performance) but also for their motivational capacities, which are considered essential for both effective gaming and learning. Hartmann and Gommer (2021) explored student motivation in educational games using Self-Determination Theory (SDT), which posits that individuals' engagement in activities is driven by intrinsic needs for competence, relatedness, and autonomy. Their study indicates that various motivational forms coexist during gameplay, emerging from the interplay of game operativeness (user-friendliness, clarity, technical performance), game attractiveness (challenge, engagement, appearance), and game learning (relevance to course content, educational contribution). The study suggests that designing games for (engineering) education should incorporate diverse mechanics to meet intrinsic human needs and enhance motivational potential. Bertozzi et al. (2024) also referred to the framework of the Self-Determination Theory to investigate psychological factors that may positively and negatively affect motivation in educational contexts and activities. They

employed the Self-Report Situational Motivational Scale (SIMS) questionnaire to measure the constructs of intrinsic motivation, identified regulation, external regulation, and amotivation. These constructs were combined into a single motivational score known as the Self-Determination Index (SDI).

The proposed game in this paper is grounded in constructivist educational theory, emphasizing discovering the knowledge by doing, rather than taking it as it is (Bakan & Bakan, 2018). Students are encouraged to create their own compositions based on design principles by engaging with various scenarios and appropriate game mechanics. Moving beyond simple memorization, the game aims to achieve a deeper understanding through practical activities, embodying experiential learning. The game provides a safe environment for students to experiment and use trial and error, exploring multiple patterns without the fear of penalties, such as losing course points or grades. This approach adapts self-directed learning principles, offering opportunities for experimentation and independent learning. The AI component of the game allows students to engage actively in design tasks by providing real-time feedback and enabling continuous self-assessment. It encourages students to reflect on their work, make adjustments, and learn through doing. This hands-on, iterative process helps students construct their understanding of basic design principles. Additionally, the challenges of creating principle-dominant design patterns, comparison with the AI model's feedback, and aligning with its labeling as the achievement goal are expected to increase intrinsic motivation, enhancing the overall gaming and learning experience.

2.2. DGBL in Architecture Education

In architectural education, commercial games, originally designed without educational priorities, are employed to enhance designing skills and complement theoretical lectures (Taşçı, 2016). Simulation games such as 'SimCity' and 'The Sims' are commonly utilized, along with role-playing games like 'Second Life,' offering interactive experiences that foster user engagement and learning. Strategy games including 'Civilization,' 'Caesar,' and 'Age of Empires' are also integrated into various courses, facilitating discussions on urban and historical contexts through real events and places. For example, in a computer-aided landscape design course, Örnek (2013) substituted mainstream drawing and modeling software with RollerCoaster Tycoon 3 (RCT3). Post-test results from 19 students indicated that RCT3, with its user-friendly interface and effective navigation providing an eye-level view, outperformed CAD software. Despite limitations in design flexibility due to predefined components, the game was evaluated as a time and effort-saving tool for design representation.

Current 3D game engines are also utilized in education, enabling users to navigate ultra-realistic virtual environments from a first-person perspective (Elsamahy, 2017), while incorporating game mechanics and cinematic features. In Redondo et al.'s (2020) study, architecture and urban design students were encouraged to use Unreal and Unity game engines along with head-mounted displays (HMDs) to create interactive virtual environments. The integration of gamification through augmented and immersive visual technologies aimed to enhance spatial engagement by enabling users to manipulate, explore, or modify the virtual surroundings.

On the other hand, an increasing number of studies are focusing on the development of games specifically tailored for architectural education. For instance, Utian (2015) introduced "Space Place Play," a game in which spatial design and narratives evolve through collaborative processes among players. The game involved 26 postgraduate students in the 'Cinematic Space' course within the Master of Architecture program at the University of New South Wales, organized into small groups of three to four students across seven teams. The study aimed to investigate how digital games foster learning and associated outcomes in architectural design. Survey responses from students indicate the game's positive impact on various aspects, including understanding the spatial design process, the creative use of time, storyboarding, the utilization of films for spatial comprehension, as well as the development of critical thinking and problem-solving skills.

In a study conducted by Şahbaz and Özköse (2018), a 3D first-person computer game titled 'Escape from Haunted Building,' featuring a basic puzzle-solving and thriller-type scenario, was developed to instruct architecture students on historical buildings, specifically focusing on a Greek Bathhouse. 45 undergraduate students from Karabük University's Architecture Department participated in a three-method experiment, divided into equal-sized groups. The first group learned about the historical bathhouse in the classroom using traditional course materials; the second group visited the building on-site, while the last group engaged with the game developed for the study. Post-questionnaire results pertaining to architectural details, building construction, and architectural style suggested that playing the game enhanced students' knowledge about the building, with the exception of the building construction category.

Goli et al. (2022) introduced a serious open-ended game, 'GaoDe,' which engages students through a multi-modal natural user interface, involving gesture and speech recognition. In a familiar CAD environment, students could simulate the design process of various iconic buildings, gaining hands-on experience with the complexities involved. GaoDe fosters an environment where there are no strict or predetermined correct or incorrect answers, promoting a more open and exploratory learning atmosphere without fear of failure. In a design studio attended by 41 first-year architecture students, feedback on the game's utility, learning improvement, and satisfaction was collected. Participants strongly agreed on the game's ease of use and effective interactivity during the design process. GaoDe was acknowledged for its potential to boost motivation and support continuous engagement in design activities through user-friendly gameplay.

In a designed workshop, Babacan Çörekci (2023) explored the impact of game-based learning on the comprehension of design processes and time management among second-year interior architecture students. 'Miro boards' served as both the gaming and design interface. The game included tasks for students to complete within specified timeframes, requiring knowledge of architectural structures such as construction dates, heights, and lengths. Participants, acting as clients or end users, evaluated the process, assigning scores and prizes in end-of-day appraisals. This gamified approach aimed to foster various learning outcomes, including multitasking skills, attention to details, and self-confidence. To sum up, incorporating DGBL into design encompasses various aspects, including the design process, knowledge acquisition, collaborative practices, and the development of management and communicative skills.

Our study aims to instruct architecture students in 'visual design principles' through a digital game, with the potential to benefit first-year architecture education in academic institutions. Specifically to our topic, in the context of basic design education, Coşkun and Çağdaş (2022) recently developed a game module where students become active players and experience their compositions within the game universe. The multiplayer, interactive, digital, and open-ended environments provided by the games allowed for various scenarios in basic design education. Within this framework, students explored fundamental design principles such as balance, rhythm, and proportion through specific geometric forms and color selections within a game structure. Compared to traditional practices, it was observed that students could express themselves better with predefined elements and rules in the design exercise. The study concluded that the digital 3D game environment is significant for encouraging the development of different representations and allowing students to revisit and refine design outputs repeatedly.

2.3. AI Enhanced Games in Education

AI techniques have been employed in DGBL in order to improve player engagement and learning outcomes (Hammedi et al., 2020). Sun et al. (2023) review intelligent game-based learning environments, which integrate commercial game technologies with AI methods from intelligent tutoring systems (ITS) and intelligent narrative features. These ITS-integrated games aim to replicate human tutors by assessing player responses in real-time and providing appropriate feedback and guidance (Chen & Chang, 2024). The combination of gamification techniques and

dynamic AI support offers personalized learning experiences (Romero et al., 2024). AI plays a crucial role in tailoring the educational journey to each student's unique needs and preferences. For example, AI algorithms can analyze a student's progress, learning style, and interests, and then suggest 'personalized exploration paths' based on their progress and preferences (Perlaza Rodríguez et al., 2024). This approach keeps students engaged and ensures they receive the most relevant and practical learning experiences.

McLaren and Nguyen (2023) conceptualized the role of digital games in "Artificial Intelligence in Education (AIED)" in two ways; (1) games that employ AI within their operation and interaction with players, and (2) games that have been developed and/or extended using AI techniques. They also defined four major ways in which AI has been utilized in the context of learning games: where AI is used to perform real-time adaptation during gameplay, AI-powered interactive dashboards or recommendations are featured, AI-driven non-player characters are employed, and AI is used for post-game analysis rather than in gameplay or game mechanics.

AI-driven interactive learning methods are also used to evaluate the quality of art and design teaching because they provide objective evaluation and can be automated, saving time and resources (Fan & Li, 2023). AI can function as a virtual tutor, offering adaptive cues and supplemental resources when students encounter obstacles during their design challenges. It offers performance analysis and individualized feedback to enhance problem-solving skills. Ahmed et al. (2023) found that AI-supported serious simulation games transform urban planning education into an immersive and experiential journey, empowering students to become proactive urban planners capable of anticipating and addressing the complex challenges of creating sustainable, resilient, and livable cities. These games leverage AI to create more realistic and engaging learning experiences, providing students with personalized feedback and support. Le and Kim (2023) utilized a deep learning model to predict daylight performance in a cubic building game environment. Since especially first-year students (users) often find simulation techniques challenging, a game-based platform is a promising alternative, making analysis more engaging and accessible to students of all skill levels. This initial project aims to develop for larger building layouts with more floors in a shared virtual space.

Our research uniquely integrates a customized AI model into an open-ended game for basic design education, enabling real-time identification of student compositions. This fosters self-assessment and offers a tailored learning experience for first-year architecture students, which is not targeted in the existing design literature. The immediate AI-generated feedback allows students to iteratively improve their designs, significantly advancing traditional and digital methods while promoting creativity and independent problem-solving skills.

2.4. Digital Game Design and Assessment of Gaming Experience

Video games can be categorized into four main aspects according to Schell (2008): Mechanics, Story, Aesthetics, and Technology. Some aspects are more apparent to players than others; with aesthetics being the most visible, and technology being the least visible. Game mechanics comprise the general rules and procedures, while the story involves the sequence of events, which may be linear, branching, or non-existent. Aesthetics pertain to the visual and sensory aspects of the game, often influenced by the underlying technology. Together with story and mechanics, aesthetics establish a relationship between the player and the game. Technology dictates the systems utilized for gameplay, including the chosen game engine, texture quality, and programming language. It serves as the medium for delivering the story, executing mechanics, and housing aesthetics.

The transition of a game from the designer's concept to the player involves several stages. In the Pre-production phase, activities such as planning, visual scenario drafting, game design, and early prototyping take place, encompassing all steps before moving into production. A critical outcome of this stage is the game design document (GDD), deemed the "blueprint" of game development (Baldwin, 2005). This reference document, though varying across game genres, must comprehensively address all aspects and tasks leading to the final product. Typically, a GDD includes

sections such as overview (description, genre, target audience), gameplay and mechanics, story, characters, game world, levels, interface (visual, auditory, and control), technical content, art design, and management (budget, timeline, risk analysis, etc.).

The second stage is the Production phase, wherein prototypes undergo a comprehensive transformation into a fully developed game (Dalmau, 2004). This stage involves activities: modeling the game world, rendering, coding/programming, incorporating visual-audio effects, and designing the user interface. Game coding can be accomplished through an existing game engine or by creating a new one, often requiring proficiency in different programming languages such as C++ or Python, and the implementation of AI algorithms for additional functionalities. As the production phase nears completion, the testing phase is initiated to scrutinize every aspect of the game, identifying and addressing any bugs. Subsequently, the pre-launch phase focuses on advertising, generating anticipation, and building hype among the general audience. This step is typically less relevant for serious games. Finally, the launch phase marks the game's release for play, followed by the discovery of unforeseen bugs and additional problem-solving. Post-launch, ongoing attention from the game designers, including collecting player feedback, plays a crucial role in determining the life expectancy of the game.

Considering that the primary objective of any game is to be enjoyable, providing surprises, challenges, and opportunities for skill application, as well as delivering a hedonic experience at the end, the evaluation of user experience (UX) in games and interactive environments has been a longstanding practice. UX evaluation methods can be implemented at various stages of the design and development lifecycle, and they can be categorized as follows (Bernhaupt, 2015):

- User-oriented methods, spanning from concept to post-production phases, encompass a range of techniques including Focus Groups, Interviews, Observations, PIFF and CEGE questionnaires, Play-testing, Physiological UX evaluation, and Experiments including game controller evaluation.
- The methods based on user data enable automated testing or analysis. Game metrics, which are interpretable measures derived from raw telemetry data, involve logging player interactions, positions in the game world, camera angles, and all data related to gameplay interaction processes, including time spent playing and session length.
- Expert-driven approaches include Game Approachability Principles (GAP), which offers valuable guidelines for game designers to create better tutorials during the conceptual design phase. Heuristic evaluation, another expert-based inspection method, follows recognized and established usability principles.
- Game-specific strategies address the distinctive requirements of game developers by concentrating on techniques and standards for evaluation processes designed for diverse game genres, including social games and exertion games.

3. Case: “VDP Mania” Game

3.1. Basic Design Course at ITU and Its Application in the Game

Introductory architecture courses play a critical role in shaping the path of architecture students as they progress toward becoming professional architects. According to Farivarsadri (2001), these initial educational experiences are pivotal, providing not only fundamental skills and essential design knowledge but also shaping students’ ideas about their future roles and responsibilities. Among these courses, the Basic Design course holds particular significance by acquainting freshman students with both the conceptual and practical aspects of creativity (Makaklı & Özker, 2016). This course typically encourages students to create 2D and 3D compositions focusing on design principles and elements (Boucharenc, 2006; Gungor & Yorgancıoğlu 2019; Uluçay 2023).

At ITU, the first-year curriculum includes a set of courses known as the “Foundation Studio,” (Temel Eğitim Stüdyosu: TES) which is mandatory for students across all five majors within the

Faculty of Architecture. This collective initiative aims to instill fundamental concepts related to design, which students are expected to apply throughout their undergraduate studies. The Foundation Studio consists of three main courses: Project (PR), Visual Communication (VC), and Basic Design & Visual Arts (BD-VA). BD-VA, similar to its counterparts in other Turkish architecture schools, is a studio-based course designed to facilitate students in exploring, discussing, and interpreting basic design issues rooted in visual design principles. ITU's BD-VA course covers basic design elements such as point, line, surface, and form; and design principles (including gestalt principles) like repetition, rhythm, balance, harmony, contrast, and continuity; all organized in both 2D and 3D works. It explores the concept of space, scale, proportion, color, texture, and light; addresses visual perception; and analyzes patterns in both natural and man-made environments.

Visual design principles (VDPs), evident across various forms of art disciplines (Fichner-Rathus, 2011), pertain to design principles taught in basic design courses within architectural curricula. VDPs involve systematic methods that utilize design components to create a perceptual structure aiding visual processing (Puhalla, 2011). These principles include unity, proportion, contrast, repetition, movement, harmony, balance, rhythm, and emphasis (Landa, 2010). Exploring VDPs within 2D and 3D compositions is a subject in basic design courses, including first-year BD-VA courses at the ITU Faculty of Architecture. In the BD-VA course during the 2019-2020 Fall Semester (TES 113E Section 5, the first author was one of the tutors), two weeks were dedicated to the project "Pattern-ing 1." In this project, students were tasked with abstracting shapes from letters, dance figures, maps, etc., and then using and modifying these shapes to create either a 2D composition or a 2.5D low relief. They were instructed to adhere to three fundamental VDPs: emphasis (achieved through color, shape, or isolation), balance (symmetrical, asymmetrical, and crystallographic), and rhythm (regular, progressive, and flowing/movement). Another two weeks were allocated to the project "Pattern-ing 2," where students were asked to work with 3D forms, starting from solid geometry and then altering them in terms of size and shape at various levels such as vertex, face, and edges. Once again, VDPs remained central to the development of unique compositional ideas. Examples from students' works of both Project 1 and 2 are provided in Figure 1.

Building upon the findings of Salem and Dündar (2019), which highlight a growing interest in exploring digital technologies in basic design education, this study aims to integrate digital game-based learning of VDPs as a standalone resource in first-year architecture education. The proposed game incorporates a VDP-detecting AI into its system, providing self-feedback and flexibility for students to access it at any time and from anywhere. This innovative learning approach is expected to aid students in understanding and consolidating the design concepts. The game targets three VDPs: emphasis via color, isolation, or shape; crystallographic balance; and progressive rhythm, all conforming to AI classification.

Emphasis involves creating dominant elements within a composition. Lauer and Pentak (2011) describe it as a 'focal point' that "attracts attention and encourages the viewer to look closer" (p.56). Color emphasis occurs when an element with a contrasting or distinct color is used in a composition. Isolation achieves emphasis by positioning an element separately from others in the composition. Shape emphasis is employed when a uniquely shaped element stands out in form or scale within the composition.

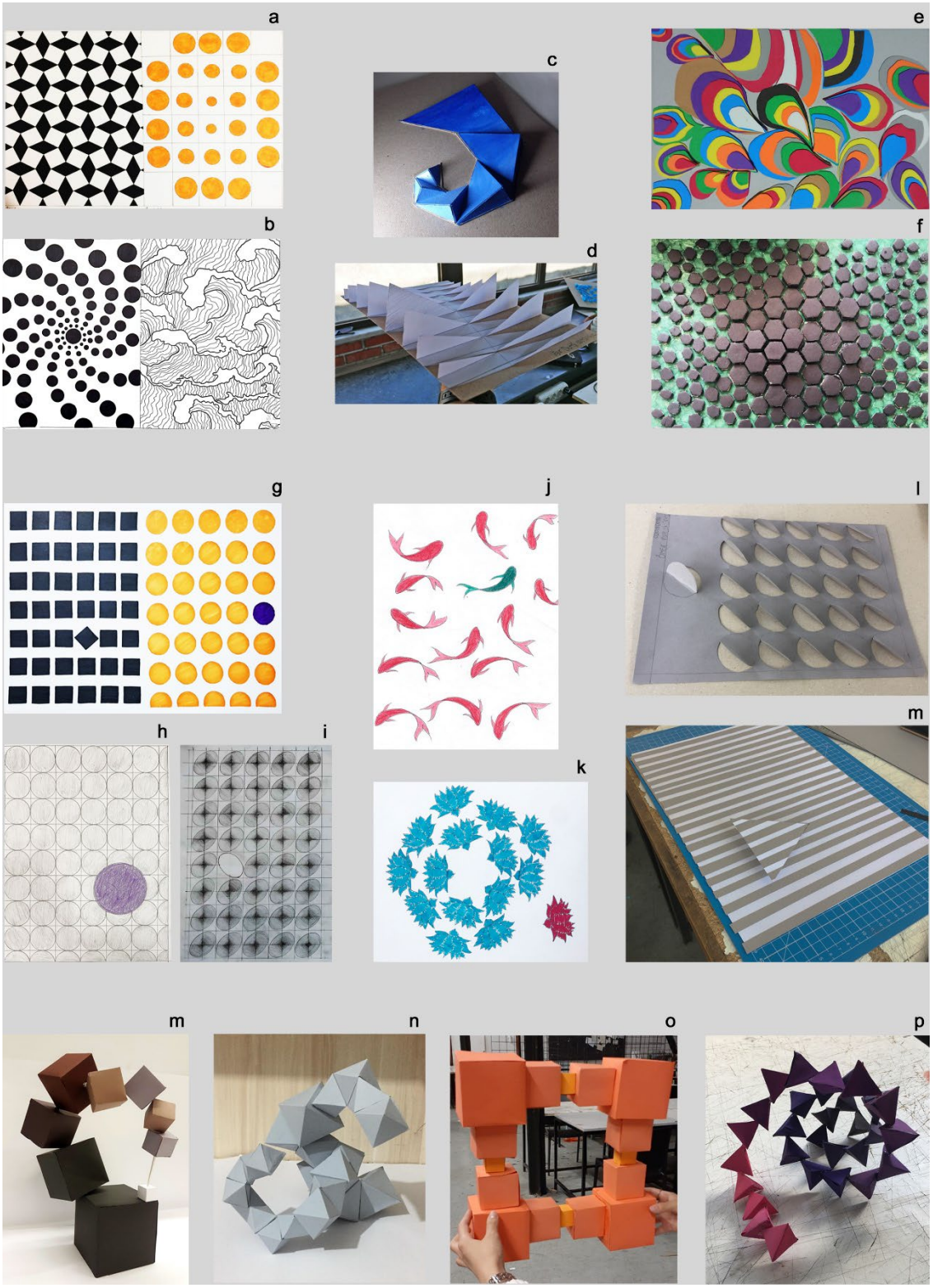

Figure 1 Works by (a) Yusuf Ziya Özaltın (b) Hatice Akgür (c) Hande Beril Küçükler (d) Uğur Dertli (e) Şeyma Kaya (f) Umut Sacalar (g) Didem Kılıç (h) Ege Ayaksız (i) Songül Özyurt (j) Zeynep Yaren Karabulut (k) Aybüke Yarbasan (l) Ömer Ruhlukürkçü (m) Güleycan Genç (n) Hüseyin Can Çiçek (o) Berzan Sönmez (p) Ayşe Nur Yılmaz (r) Güleycan Genç

Balance in composition refers to achieving visual equilibrium. Arntson (2011) defines it as "two forces of equal strength that pull in opposite directions, or by multiple forces pulling in different directions whose strengths offset each other" (p.64). Crystallographic (mosaic) balance is about arrangement of a large number of elements, incorporating variations in color, size, or shape throughout the composition. Despite appearing chaotic and diverse in nature, an image employing

this principle achieves an overall effect of a calm and uniform whole. Rhythm involves creating repetition in elements, colors, forms, positive and negative spaces, and textures. According to Landa (2010), rhythm is "a sequence of visual elements at prescribed intervals" that develops "a coherent visual flow" from one element to another (p.35). Progressive rhythm refers to the gradual hierarchical change in a group of recurring elements within the composition, such as squares increasing slightly in size or a square transitioning into a circle over several frames. Figure 2 exhibits several examples belonging to the relevant VDP classes used in the AI model.

Figure 2 Sample images from the photography dataset. Taken originally from Demir et al. (2021)

3.2. VDP Detecting AI Model

The AI model employed within the game has been developed in the research conducted by Demir et al. (2021) and has been approved for use in this game. As part of the model development process, researchers initially created a computer-generated dataset to detect nine VDPs in images. This synthetic dataset comprises basic geometric shapes and a patchwork of simple images with backgrounds. To address the complexity of the task, datasets were then prepared from various domains. For the photography dataset, the majority of images were sourced from stock image websites such as iStock and the 500px collection of Getty Images. For the art dataset, 23 contemporary art museum online databases were examined for the selection of both analogue and digital paintings, prints, works on paper, graphic art, and posters. Additionally, architectural data featuring facades with evident utilization of VDPs was downloaded from two primary web applications: Instagram and ArchDaily. Approximately 100,000 images were collected for the photography dataset, 91,800 images for the art dataset, and 90,736 images for the architecture dataset (totaling 282,536 images) to be inspected and annotated in the final phase. A web application facilitated the data annotation process. The platform stores data and provides a selection interface, through which experts identify the most apparent VDPs and assign labels accordingly. The curated final dataset consists of 23,825 labeled images.

The researchers used PyTorch (Paszke et al., 2019) as the deep learning framework for all experiments. During the optimization process for supervised classification, they utilized EfficientNet-B7, pretrained on ImageNet, without freezing any layer parameters. Given that a visual composition typically encompasses multiple principles, they adopted an approach of evaluating the

top three accuracy scores rather than solely relying on the highest accuracy score of the computer model. This methodology enables the assessment of secondary and tertiary predictions of the data. The model's top three scoring classes are highly likely to include the correct labels compared to considering only the top score label. Across all experiments, the top accuracy ranged from 56% to 77%, while the top three accuracies ranged from 80% to 93%. Further elucidation on the technical integration of the model into the gaming platform is provided in Section 3.3.2.

The learning-based model's principal and solitary input comprises the cumulative knowledge extracted from a vast collection of meticulously curated products in art and architecture, along with their annotations by expert designers. This extensive dataset of real products allows the AI model to perform objective evaluations. This capacity is advantageous for both learners and educators as it ensures fair and consistent assessments. For learners, it means receiving unbiased feedback on their designs. For educators, it provides valuable insights to refine their teaching strategies based on objective data. The AI model, adept at detecting VDPs, exhibits the capability to identify compositions generated by users within the game environment. This real-time analysis helps students understand their mistakes and make necessary adjustments promptly, enhancing their learning experience.

We can cite the limitations of the AI model used in the game as follows. The model is not designed to adapt to different student skill levels. While it can offer detailed feedback, it does not differentiate between beginners and more experienced students. Additionally, the lack of generative features limits the model's ability to make suggestions or improvements related to the compositions. The accuracy and effectiveness of the AI model are heavily dependent on the quality and diversity of the training data. Currently, the data encompass certain art objects from a specific time period and are limited to nine design principles. This limitation means that the model may not fully capture the variety and evolution of design styles over time.

3.3. Creation of the Game

A simple casual game was aimed that would aid students in learning VDPs through various steps. All game icons were sourced from freepik.com. The game's design was chosen to be 2D, aligning with the AI's training on images. The game's intended platforms were identified as Windows PC and MAC. Its genre can be classified as a serious game. The target audience, established at the outset of the research, comprises architecture freshmen students. The decision to utilize the 'Unity Editor, 2021' as the game engine stemmed from its reputation for being beginner-friendly in the gaming industry, combined with the authors' prior experience with the software.

3.3.1. Game Mechanics & Controls

The game is navigated solely through mouse inputs. Upon launching, players encounter a welcome screen presenting four options: START, LEARN, ABOUT, and QUIT (refer to Figure 3). Clicking on the LEARN button directs users to the "LEARN Menu," which lists the VDP names along with respective buttons. Each button leads to a dedicated screen providing detailed information about the corresponding VDP, accompanied by three images illustrating examples of its application. Selecting the ABOUT button reveals additional options: Feedback and Article. The Feedback button directs users to a questionnaire, while the Article button provides access to the scholarly article serving as the basis for the AI model. Lastly, clicking on the QUIT button exits the game and closes the application.

The game commences upon the player pressing the START button. Upon initiation, the player is presented with the option to choose between two game modes. The first mode is the QUIZ game mode. In this mode, players are presented with three pictures and tasked with selecting the correct one corresponding to the given VDP task (refer to Figure 4). Each correct answer earns the player a point. To enhance player engagement, a score-based approach has been integrated. Displaying the

player's score provides extrinsic motivation in the form of a reward, encouraging continued participation and interaction with the game.

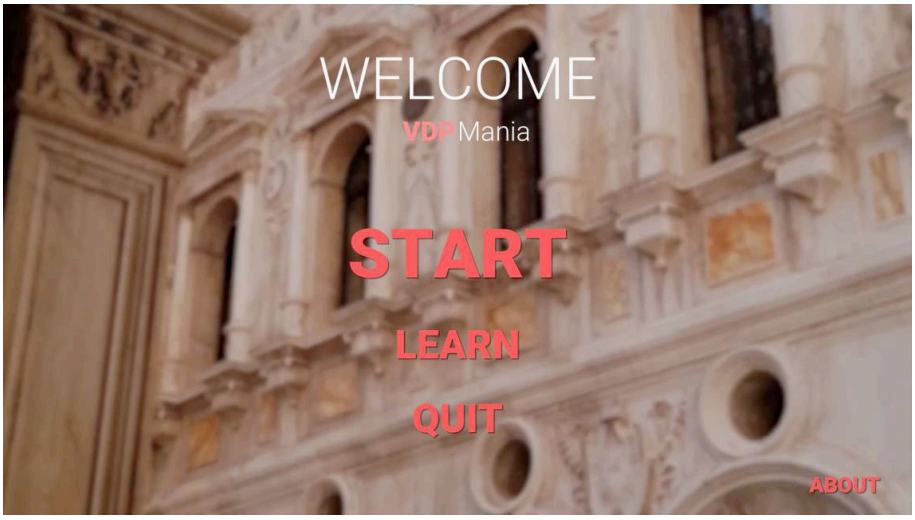

Figure 3 The "Welcome Screen" of the game

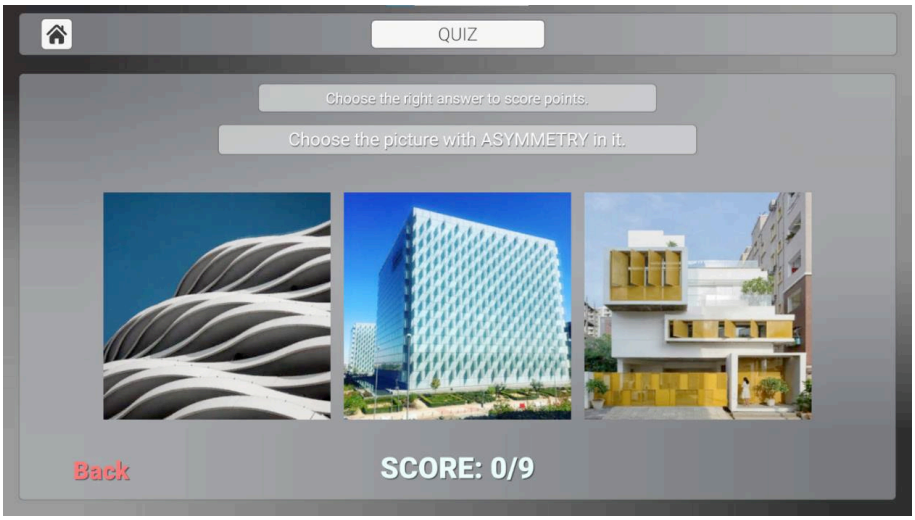

Figure 4 Quiz game mode

In the CREATE section within the "START Menu," players are presented with a task outlining which VDP(s) must be adhered to in the composition to achieve a higher score. A column displays various tools for creation: materials (objects and shapes for addition), delete, rotation, color change, color saturation change, and scale change. Each button in the game is labeled with text explaining its respective function. The main portion of the screen is dedicated to a grid, serving as the canvas for composition creation (Figure 5). Shapes and objects can be moved around the grid via mouse button drag-and-drop, with automatic snapping to the nearest grid slot upon release. New elements can be continually added to the grid, while unwanted elements can be deleted through a dropdown menu on the right-hand side. Once players have completed their composition in accordance with the objective displayed, they must press SUBMIT. Upon submission, a screenshot of their composition is captured and sent to the AI model. Following image processing, VDP class ratings generated by the AI are displayed on the screen. Players have the option to either retry or return to the main menu, with respective buttons displayed alongside their score.

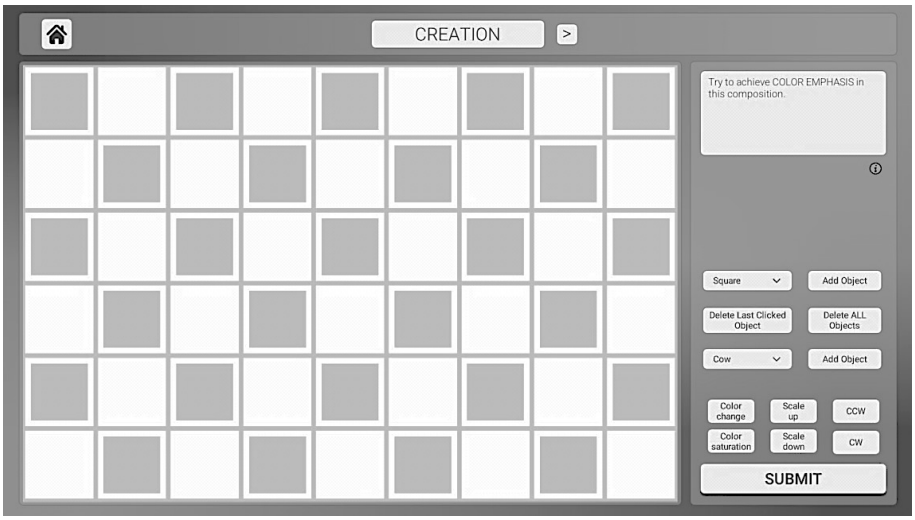

Figure 5 Creation section of the game

A tutorial video detailing the gameplay mechanics was prepared and accompanied by a QR code for easy access. Additionally, a flowchart outlining the sequential steps taken by the player during gameplay was created. These supplementary materials are available from Karakaya (2023).

3.3.2. Integration of AI

The integration of the machine learning model into the game is facilitated through Python. The AI operates on an image provided to it, which, in the context of the game, comprises compositions generated by students in the CREATE section. A screenshot of the student's creation is captured and stored in the game's data path. The image's path is then passed to the transforms.Compose() function of the Torchvision library to prepare the image for input into the model. Torchvision offers numerous common image transformations within the torchvision.transforms module. The image is resized to match the dimensions of the images used for training the model, ensuring uniformity in size. Subsequently, normalization is conducted using the mean and standard deviation values obtained during model training. Following this, the model is loaded using the parameters acquired during training. The eval() function from the PyTorch library is utilized to record the model's output for the new image. Upon passing the output through the torch.sigmoid() function, probabilities are obtained for each category. By utilizing the torch.topk() function with a parameter k set to 3, the three categories with the highest probabilities are extracted. Subsequently, the top three categories, along with their corresponding probability values, are written to an output file. Earlier, the category names were defined as: ["symmetric", "color", "progressive", "regular", "crystallographic", "flowing", "isolation", "shape", "asymmetric"].

Once the Python code completes execution, an output text file containing the results is generated in the game's data path. These results indicate the VDPs present in the student's composition as evaluated by the AI. A C# script, created via the Unity Editor, reads this text file and incorporates the results into the game, displaying them on the score screen at the end of the CREATE section. As the Unity Editor exclusively supports JAVA or C#, the steps involving the Python code cannot be directly implemented into the game. To address this challenge, all aspects of the Python code for the AI were packaged into a single .exe file. This file format is compatible only with computers operating on Windows systems, thereby restricting the game's accessibility to computers with iOS operating systems, as a constraint for the experiments. Despite the relatively small size of all other assets used in the game, packaging all libraries into a single file significantly increased the game's size, resulting in a final product size of 543 megabytes.

3.4. Evaluation Criteria

This study employs several methods to comprehensively assess the holistic gaming experience, including aspects such as overall quality, usability, enjoyment, narrative flow, technical performance, and player satisfaction. Questionnaires or surveys serve as main instruments for eliciting subjective evaluations concerning various facets of gameplay. The CEGE-Q ("Core Elements of the Gaming Experience-Questionnaire," given in Appendix-1) emerged as the most suitable user-centric methodology for this research due to its conciseness and manageable length, consisting of 38 items. It is notably succinct compared to the extensive 163-item "Presence-Involvement-Flow Framework" (PIFF) scale (Takatalo et al., 2015), which is a psychological research framework to study experiences in digital games. The CEGE Model, introduced by Calvillo-Gámez et al. (2015), draws upon the realms of 'video games' and 'puppetry' to engender enjoyment within players. Video game components are game-play and environment. Game-play outlines the core mechanics, rules, and storyline of the game. The environment pertains to the game's presentation, including its visual and auditory elements. Puppetry refers to the player's interaction with the video game. Puppetry describes how the player engages with the game, leading to the game's outcome based on the player's actions. This interaction is influenced by three factors: control, ownership, and facilitators.

Observable variables associated with these elements (such as scenario and rules for game-play, or graphics and sound for environment) are considered as items in the questionnaire context. Constructed with 38 items distributed across 10 scales (refer to Table 1), the CEGE-Q underwent modifications in this study, involving the removal of items 10-12, 19, 23-25, 27, 28, and 30-32, which pertained to aspects like achieving victory in the game, sound effects, and musical accompaniment. Consequently, the questionnaire was refined to include a total of 26 items. Participants rated each item on a 7-point Likert scale to indicate their opinions, attitudes, and feelings about their gaming experiences. This scale was chosen for its ease of use and ability to simplify working with quantitative data, allowing straightforward conclusions, reports, and graphs from the responses.

Table 1 The Items in the Questionnaire Belongs to Different Scales, Calvillo-Gámez et al. (2015)

Items	Scale 1	Scale 2
1, 4, 5	Enjoyment	-
2, 3	Frustration	-
6–38	CEGE	-
6–12, 38	Puppetry	Control
13–18	Puppetry	Facilitators
19–24	Puppetry	Ownership
25	Puppetry	Control/Ownership
26–31	Video-Game	Environment
32–37	Video-Game	Game-Play

Students are provided with additional open-ended follow-up surveys pertaining to the educational objectives of the game, integration of artificial intelligence, and subjective feedback concerning gameplay. They are listed as:

- S1: Did the preceding sections of the game (educational and quiz segments) provide supportive contributions to the subsequent design phase?
- S2: How did you find the artificial intelligence module's predictions on the composition you generated in the design phase? Was this feedback enjoyable? Did it motivate you to explore alternative patterns?
- S3: Did the game support your learning or enhancement of basic visual design principles?
- S4: What were the features you liked and disliked in the game? (Including technical aspects of the game)

- S5: Were there things you wanted to do in the game but couldn't due to the constraints of the game's storyline and mechanics? If so, what were they?
- S6: Is there any other topic you would like to address regarding game development and further improvement?

Moreover, two game metrics are employed in this study to enhance understanding of gameplay dynamics. Due to the inability to establish suitable hooks in the game engine for logging user data, students were queried about their playtime and duration spent in the game. These metrics offer a quantitative measure of players' overall commitment to the game. They can also map patterns of usage; such as whether players tend to engage in shorter, more frequent sessions or longer, less frequent sessions. CEGE-Q and other game-specific questions were web based structured by using Google Forms and accessible through the MAIN MENU: ABOUT section in the game.

3.5. Experiment

Testing a game during its developmental phase is crucial for ensuring the successful delivery of a high-quality software product. This examination takes the form of "beta testing," wherein the game is made accessible to a select group of external users who represent the target audience. Game testing experiment is structured as follows:

Objective:

The experiment was designed to evaluate the effectiveness of the AI-supported game in enhancing students' understanding of basic design principles. Beta testers play a pivotal role by providing valuable feedback and identifying issues or areas requiring improvement.

Participant Selection:

We recruited participants from a cohort of first-year architecture students enrolled in the 2023-24 Spring Semester ITU, Faculty of Architecture mandatory course "Introduction to Architectural Design Computing." Prior knowledge of design principles was not a requirement for participation. To assist students who might be unfamiliar with these concepts, we included an explanatory section within the game (see Section 3.3.1). Most of the selected students had also completed 'Foundation Studio' courses, including 'Basic Design and Visual Arts,' during the preceding Fall Semester. These courses provided them with experience in understanding and applying design elements and principles in both 2D and 3D formats.

A total of 126 freshmen students (89 female and 37 male) agreed to participate in the game testing and subsequent questionnaire. The participants' ages ranged from 18 to 22 years old. It was emphasized that all data, including participant responses, would remain anonymous and solely used for the purposes of the study. Considering the straightforward mechanics and controls of the game, the gaming experience was not a decisive factor in participant selection.

Intervention (Game play):

The experiment commenced within the classroom setting, with students receiving both verbal and written briefings detailing the procedures for downloading and installing the game documents. The QR code, serving as a tutorial for the game, was distributed to the students. This preparatory phase was overseen by both authors and two instructors of the course, who addressed any inquiries pertaining to the process. Following the introduction session, participants were instructed to individually play the game during class time, utilizing their personal computers. They were apprised that the game was not constrained by time limits and could be continued at their discretion, albeit with a requirement to submit their findings and responses within a one-week timeframe. Those using MAC computers running iOS were advised to utilize a device with a Windows operating system or access one of the computers in the faculty's laboratory.

Data collection:

The gaming session of the experiment entails two distinct phases: design and pre-design (learn and quiz) phases. Upon completion of pre-design phase, students are tasked with generating three compositions that reflect three VDPs: emphasis (involving color, isolation, or shape), crystallographic balance, and progressive rhythm. Upon completion of each composition, students are prompted to capture a screenshot, inclusive of AI predictions, and subsequently upload them to a cloud folder opened by the administrator. Students are directed to arrange each output image on a Miro board, categorizing them by VDP, thereby creating a collective presentation of all productions. Examples of student work for each group, focusing on emphasis, rhythm, and balance, are given in Figure 6, 7, and 8 respectively.

For collecting behavioral metrics, the records of students' gameplay interactions were gathered, including the amount of time spent on tasks and the frequency of tool usage. These metrics help in quantitatively understanding engagement levels. After completing the game, students were asked to fill out surveys that included both Likert-scale CEGE questions and six additional interview-like questions about their experiences. These surveys provide subjective data and valuable insights related to the students' perceptions of the game.

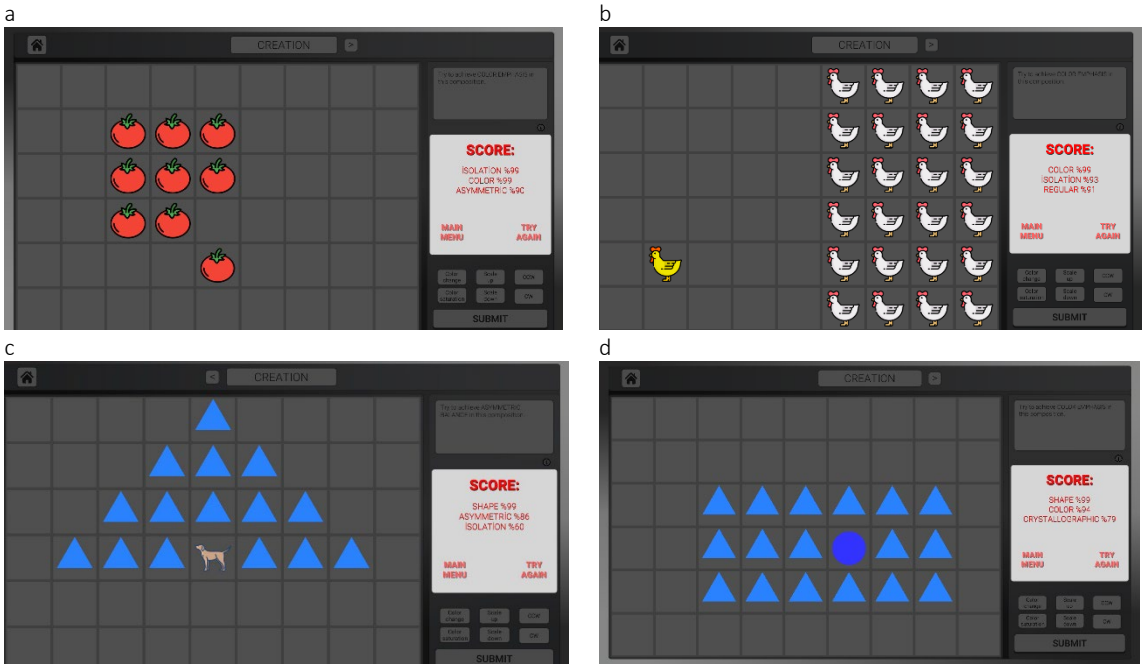

Figure 6 Emphasis (Isolation, color and shape) works by (a) E. B. (b) A. Y. (c) G. A. (d) S. A.

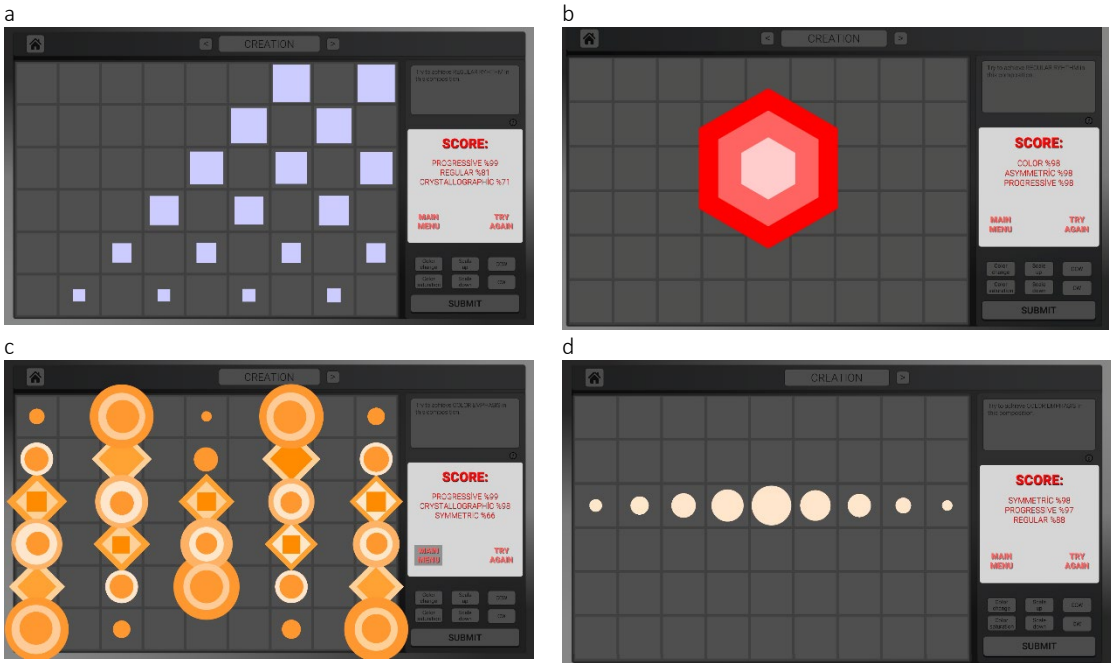

Figure 7 Progressive rhythm works by (a) B. S. Ö. (b) N. Y. (c) Z. B. (d) E. B. K.

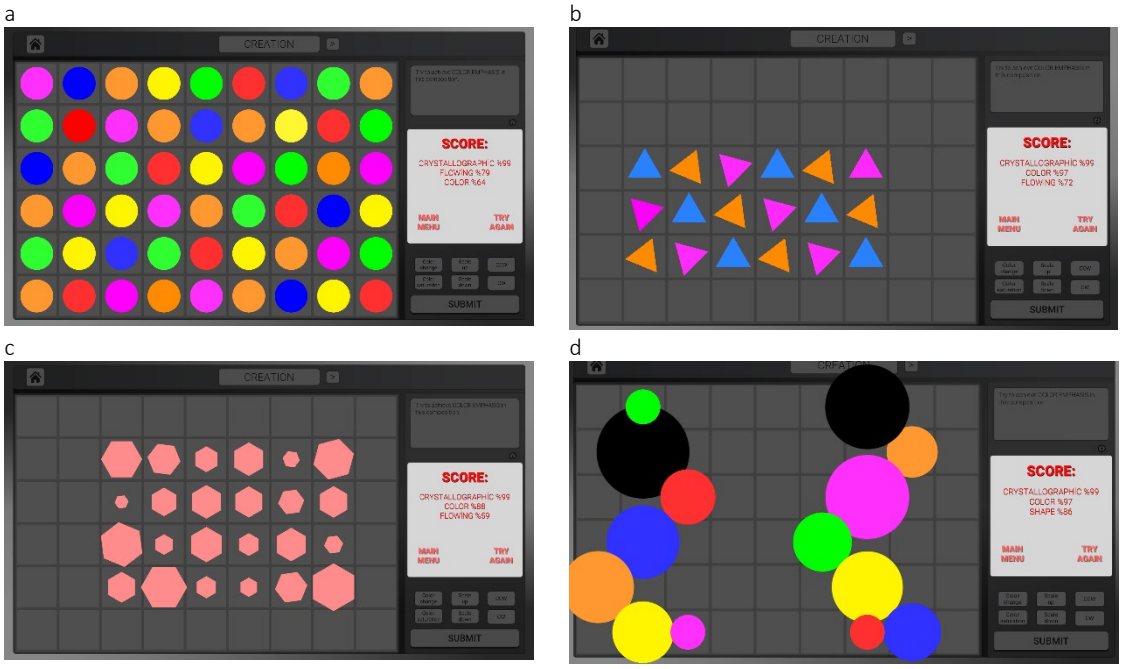

Figure 8 Crystallographic balance works by (a) S. A. (b) E. D. (c) D. A. (d) Y. S. M.

3.6. Data Analysis and Results

Upon examining the metrics, it becomes apparent that, on average, students remained engaged in the game for approximately one hour, with reported minimum and maximum playing times of 33 and 85 minutes, respectively. This data furnishes us with a reliable estimate of the game's duration, accommodating variances in play styles and strategies. Such insights are instrumental in planning game sessions efficiently, enabling us to gauge the time required for players to create a composition while maintaining immersion without becoming overly prolonged. Notably, 79% of participants completed the game with only one play, while the remainder participated two or more times. This suggests that the majority of students can feasibly accomplish all tasks within a single session without waning interest. Given the game's goal achievement nature, a high frequency of logins may not necessarily directly correlate with strong engagement in the game.

When examining the first five questions of the CEGE-Q, specifically addressing 'enjoyment' and 'frustration' scales, the distribution of ratings is illustrated in Figure 9. Questions 1 and 4 exhibit a significant alignment, with half of the participants expressing enjoyment through higher Likert values, while 25% selected values in the middle range, and the remaining 25% opted for lower values. Similarly, for Question 2, only 19% of students (24 out of 126) agreed that they experienced frustration at the conclusion. Our analysis indicates that students who enjoyed the game were more likely to engage deeply with the material, suggesting a positive correlation between enjoyment and educational quality.

The remaining items of the CEGE-Q, focusing on aspects related to video-game and puppetry, can be synthesized as follows: in the context of the 'puppetry: control' scale group, students expressed that they could remember the inputs provided by the controllers (Q-8, mean: 5.2); alongside an affirmation of clear visibility of necessary on-screen elements during gameplay (Q-9, mean: 4.96), and a recall of the actions performed in the game (Q-38, mean: 5.02). Question 14, associated with the 'puppetry: facilitators' category, revealed a consensus regarding the game's graphical simplicity (mean: 5.17). For Question 29, which belongs to 'video-game: environment' scale, students conveyed that the graphical elements of the game were consistent with the scenario depicted (mean: 5.17). Lastly, the question about 'video-game: game-play' (Q-33) scale showed that most participants understood the rules of the game, with an average score of 6.

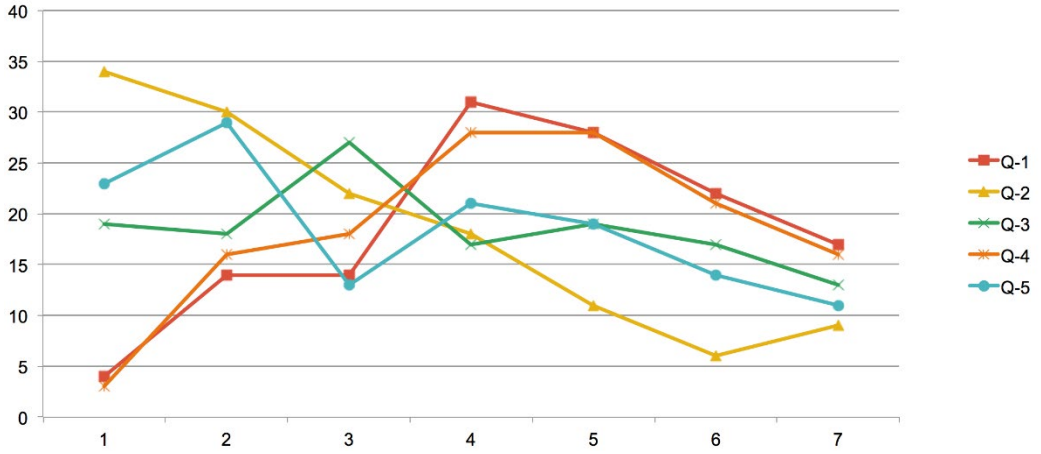

Figure 9 Distribution of the scores for first five questions

The open-ended game-specific questions provide valuable insights into participants' experiences. Regarding the query labeled S1, addressing the supportive elements of preceding game sections, a mere 9 out of 126 respondents noted minimal or no contribution. Conversely, the majority expressed strong affirmation, citing an array of concrete examples and commending the visually stimulating elements. They emphasized the educational component as being helpful, descriptive, informative, and conducive to a better understanding of the concepts. Additionally, some participants appreciated the convenience of accessing information within the game interface without exiting. Some players mentioned they revisited instructions and consulted learning materials before designing, underscoring the reinforcing effect of prior knowledge on successful game completion.

In regards to the Question: S2, the AI component in the game received highly positive evaluations from a significant majority of participants (78%). They found this aspect to be both accurate and effectively functional, as well as entertaining, adding an enjoyable dimension to the game. While for some, liking the AI did not provide enough motivation to sustain prolonged engagement, for the majority, it sparked greater ambition to generate new compositions and continuously strive for improvement. Several respondents expressed excitement and pleasure in awaiting the AI-generated results. Feedback often aligned with expectations, reinforcing feelings of success upon achieving desired outcomes. Conversely, instances of surprise arose when the AI produced unanticipated results, prompting participants to reconsider their approach. They also

learned from their 'mistakes' when the result possibilities appeared on the screen. Some comments referred to the capabilities of AI, including attempts to test it and observe how its responses changed when the pattern changed. Overall, the AI integration not only enhanced enjoyment but also fostered innovative thinking and experimentation. During the experiment, only 11 students were undecided, and 18 expressed negativity toward the inclusion of AI. Their reasons were largely linked to AI's inaccurate classification and shortcomes in explaining the rationale behind its choices. The errors of AI could stem from the algorithm's inability to fully grasp complex design nuances. The impact of these inaccuracies includes potential student frustration and misguidance. Future improvements may involve refining the training data and incorporating more sophisticated AI techniques to enhance accuracy. A few students found the feedback of AI model overly predictable, describing it as 'boring' in that regard.

Questioning the educational purpose of the game (S3) yielded highly positive results from participants, with 110 students affirming its efficiency. Many acknowledged that the game facilitated learning, understanding, and retention, particularly in enhancing their VDPs especially "*by applying*." Some students compared it to a self-assessment tool, describing it as a way to "*test myself*." Some answers highlighted the active engagement and participation fostered by the game:

"I can't say that I learned it in this way, but it helped me improve my creativity in this field."

"Yes. It is a good practice to learn well."

"Yes it made me use them whilst thinking about them not just passively use them.

"Yes, I think practical training is always more teachable."

"Yes it improved. It was a kind of brain training. It was fun trying to find a way with different alternatives within certain limits."

Some responses indicated the potential for the game to assume a supportive role in the basic design course, portraying it as an assistant tool:

"Yes, it supported. It enabled me to make memorable and reinforce what I had learned in depth in the basic designs of the previous semester."

"Yes, we had previously created such compositions from papers in the basic design homework. This game has become much more practical with artificial intelligence."

The critical feedback regarding S3 was also informative. 9 students expressed uncertainty, and 11 held negative views about the educational purpose of the game. One participant remarked that the game seemed inadequate for architecture students, particularly those focused on visual design, adding, "*I believe it would be more beneficial for other disciplines to grasp basic visual design concepts*." Two other students found the game unnecessary and overly simplistic for similar reasons. Additionally, one student stated that relying solely on a 2D grid to learn these principles would not be sufficient. Recognizing the limitations of a solely 2D platform, we aim to incorporate 3D design exercises in future versions. We also plan to enhance the game's complexity and add features that challenge students more effectively.

We also surveyed students about their likes and dislikes regarding the game (S4). The findings are summarized in Table 2, categorizing responses based on game design components. The largest number of negative comments revolve around technical issues, particularly bugs related to object interactions and responsiveness. These bugs significantly impact the gameplay experience and require attention for user satisfaction. Students expressed a desire for more intuitive and user-friendly controls, as well as additional keys for common actions. Future updates will focus on enhancing the control scheme to make the game more accessible.

Table 2 Coding Analysis of the S4 Data Obtained from the Participants

concepts of game design	number of students	(a) negative comments
bug	18	new object sticks to another object/ overlapping/ lack of layering
bug	16	not responding immediately/ slow/ crush/ freezing LAG
bug & mechanics	16	not easily place shape on the grid/ can not move objects freely
controls	8	need easier commands
graphics	8	few shapes (not variety in shape)
controls	6	adding simple control keys of copy, paste and undo
UI	5	accidentally clicking 'Deleting all' button (too close to the 'add a new object' button)
controls	4	being fully control of the game; controller was not sufficient
graphics	4	color variation; using a color spectrum and select among
bug	3	not detecting the objects clicked on, but select one another
bug	3	wait for AI responses/ results of AI
graphics	3	grid limitation
UI	3	better visual display and interface
level design	3	saving option, the game only works once every time
level design	3	trying again the same composition after the results come back
bug	2	difficulties in downloading
game mechanics	2	getting difficulty in changing size, color, direction etc.
controls	1	move an objects by a click instead of carrying it
graphics	1	size limitation
game mechanics	1	not remembering the last color setting of shape
game mechanics	1	incapable of selecting multiple objects for change
UI	1	understanding the selection (like a frame appearing)
concepts of game design	**number of students**	**(b) positive comments**
story and narrative	10	the idea behind the game (the aim; its logic; visual thinking)
story and narrative	10	sufficient examples and the pre-game information and quiz part
game mechanics	9	simple and understandable (commands and movements)
game mechanics	7	color or Size or orientation change
graphics	7	having options, different features
story and narrative	6	AI part
UI	6	Interface easy, plain
graphics	4	funny icons and shapes
story and narrative	4	like the idea of creating something on your own
game mechanics	2	creating compositions by using simple geometric shapes
graphics	2	grid system and layout

Feedback on graphics highlights concerns such as the limited variety of shapes, constraints in color options, and restrictions on size. Enhancing graphic quality and providing more customization options will be prioritized to make the game more visually appealing and creative. Various issues related to game mechanics were mentioned, including difficulty in changing object properties (size, color, direction), inability to remember settings, and challenges in selecting multiple objects for modification. Addressing these concerns in future versions will streamline the gameplay experience and make it more efficient for users. Several students highlighted problems with accidental actions (such as unintentionally deleting objects) due to the current UI design. This indicates that the UI may not be intuitive or responsive enough. Refining the UI will help prevent these issues and

improve overall usability. Finally, incorporating features like progress saving in level design can make the gameplay experience more engaging.

In terms of positive feedback, players have expressed appreciation for several aspects of the game. They value the underlying concept, as well as the provision of adequate examples and pre-game information. The AI aspect has also been recognized as a noteworthy component. Players emphasize the simplicity and clarity of the game mechanics, alongside the ability to create compositions using simple geometric shapes. The graphics have been well-received, attributed to the presence of appealing icons and shapes. The inclusion of a grid system and layout was also positively remarked upon for effectively managing visual clarity and organization. Additionally, the user interface is commended for its ease of use, facilitating overall accessibility and navigation within the game.

Regarding S5, which asked users about anything they wished to perform in the game but were unable to due to its design constraints, we observed some similar responses to those in S4. However, there were also distinctive comments, which offered innovative and suggestive insights. Primarily, participants expressed dissatisfaction with the 'limited space' of the grid, both in terms of being unable to work within a larger area and not being able to place objects at any point within the frame. This limitation hindered their ability to create desired compositions and restricted their design freedom. One participant noted, *"I couldn't work completely free because the shapes were placed at the exact central points. I could have gone through a more disorganized layout."* Some participants had remarkable requests within the game, including the following ideas:

"I wish I could move from 2D drawing to 3D."

"… maybe, I wish I make more curvy designs"

"I would liked to create new objects (shapes) with myself"

"Yes. There was nothing we could add as a background."

All of these refer to the students' expectation for more freedom within the game, akin to that found in 2D/3D design software. This entails shapes being able to perform more actions than just rotating and resizing; as one student articulated: *"I would like to be able to change more properties of shapes, such as stretching one side of a square to make it a trapezoid."* They seek greater ease in manipulating forms, including the ability to move them freely, duplicate them, and even array them, similar to functionalities available in many digital drawing tools they are accustomed to, such as AutoCAD. A comment pertained to the desire for more precise control over objects: *"When we want to enlarge objects, we can change their size by entering numbers instead of pressing constantly because I had a hard time getting them to the same size."* Implementing more advanced shape modification capabilities, and bringing the game interface closer to the current CAD tools in the future reconstruction of this game can attract more users and continue accustomed design-making behavior.

The final question (S6), inviting participants to write about any other issues they would like to mention regarding game development and potential improvements, also yielded fruitful comments. Students suggested adding different levels and increasing the game's difficulty, as well as expanding the quiz session. One student proposed the inclusion of a time limit as a challenge and pressure for the user, which could enhance gameplay. Another student suggested adding music: *"maybe the game can include some specific music, for every single stage."* Finally, there were requests for more architectural information and additional building features, and the implementation of design patterns in 3D format.

4. Conclusion

Within the field of architecture education, there exists a promising space for game developers and researchers to introduce novel approaches by integrating elements of serious games and game-

based learning. This study introduces a new digital game, currently in the testing phase, targeting first-year architecture students. It aims at a reinforcement of their basic design knowledge through creation of simple 2D compositions embodying specific visual design principles. The compositions crafted within the game are then assessed by an AI model capable of predicting the underlying design principles. This AI model draws from a separate body of research, having been trained on thousands of labeled art objects, photographs, and architectural views. By leveraging this technology, students are offered self-learning capabilities, enabling them to critique their work autonomously without the immediate presence of an instructor.

After elaborating the game's planning and production stages, this paper proceeded with a testing phase employing a series of user experience methodologies. The overall findings, derived from 126 first-year architecture students, indicate a strong positive response towards various aspects of the game, ranging from AI integration to usability. They particularly appreciated the underlying concept of utilizing Digital Game-Based Learning (DGBL) in architectural education, focusing on basic design principles. Detailed feedback was collected through a game-specific survey, which highlighted issues such as bugs and limitations in game mechanics, graphics, and user interface (UI). Addressing these concerns is essential for improving satisfaction and retention rates. In achieving self-directed learning, we can highlight that the AI component was found motivating by students for sustaining prolonged engagement. They generated compositions, took feedback, and re-generated new ones to get accurate predictions. They also learned from their mistakes by reflecting on the AI's responses. This interactive nature of the game promoted a deeper, experiential learning process. Moreover, the game allowed students to explore multiple patterns quickly, free from class settings and course requirements. Aligned with constructivist learning theory, the game facilitated understanding and direct experiences, particularly enhancing students' knowledge of visual design principles (VDPs) by "applying" them in practice. Students appreciated this hands-on participation, not just passively learning design principles but actively using them. Additionally, students suggested adding features to increase the challenge, such as time limits and varying difficulty levels. Implementing a scoring system as a reward mechanism, based on AI results, could enhance the game experience. These suggestions relate to the game's motivational potential and could be included into future versions. Depending on Self-Determination Theory, we could measure student motivation through a new experimental setting in further research, gaining further insights into their willingness to engage in gameplay.

In the agenda for further studies to develop and refine this game, several enhancements are planned. One proposed mechanism involves enabling students to capture and upload photos corresponding to requested design principles, which would then be evaluated by AI. Additionally, various interactive game modes may be incorporated to enhance enjoyment during educational sessions. The potential for a mobile app version is also promising, offering opportunities to integrate augmented reality for real-time manipulation of scenes. This would introduce new control mechanisms, such as touchscreens instead of mouse input, potentially improving usability. In response to student feedback, the AI component could be expanded beyond mere 'label' provision to actively generate revised compositions based on identified principles. While implementing this generative aspect will require additional technical work, visual representations such as heatmaps could be consulted to elucidate how AI detects principles within images, indicating the specific features influencing its predictions.

The game-related experiments in this research could benefit from enhancements. Integrating behavioral and game metrics with synchronized physiological sensor data could provide a more comprehensive understanding of the player experience. It's important to consider tracking login patterns to identify any recurring trends, such as semester-based patterns, which could offer valuable insights into user engagement over time.

The game still requires conducting experience testing across various institutions and for diverse skill level students to gather broader feedback and identify potential improvements. Additionally

performing longitudinal studies to evaluate game's impact on students learning through the proceeding years of education will be a feedback for educational basis.

The game can be adapted and evaluated in various educational and research context. The game is devised to incorporate into different course curriculums as a supplementary tool, also compare learning outcomes with traditional methods. The game inherits a capacity for cross-disciplinary applications, such as in visual arts, engineering and computer science, to assess it effectiveness in different learning environments.

The game developed in this research is planned to be available through an open-access platform, allowing other educators and researchers to use it. This will facilitate wider adoption and potential improvements by the community. In conclusion, while educational games in architecture face numerous challenges in achieving high-quality, stable products in the market, the underlying motive and ultimate goal aspire to cultivate a more engaged, interactive, and enjoyable learning environment within architecture schools.

References

Ahmed, M., Rahim, T., & Nasar, Z. (2023). *Role of AI-Supported Serious Simulation Games in Urban Planning Education*. Paper presented at 16th International Conference on Developments in eSystems Engineering (DeSE).

Arntson, A. E. (2011). *Graphic Design Basics*. Cengage Learning.

Babacan Çörekci, T. (2023). Game-Based Learning in Interior Architecture Education. *Design and Technology Education: An International Journal*, *28*(1), 55–78.

Bakan, U., & Bakan, U. (2018). Game-based learning studies in education journals: A systematic review of recent trends. *Actualidades Pedagógicas*, *72*, 119-145. https://doi.org/10.19052/ap.5245.

Baldwin, M. (2005). *Game Design Document Outline* (24). Baldwin Consultant.http://baldwinconsulting.org/.

Barron, J. L. (2015). *Comparison of a video game based learning environment and a traditional learning environment* [Doctoral dissertation]. Duquesne University.

Bernhaupt, R. (2015). User Experience Evaluation Methods in the Games Development Life Cycle. In R. Bernhaupt (Ed.), *Game User Experience Evaluation* (pp. 1–11). Springer.

Bertozzi, G., Paciarotti, C., & Schiraldi, M. M. (2024). Implementing serious games through a pedagogical lens in engineering education: an experimental study. *European Journal of Engineering Education,* 1-27. https://doi.org/10.1080/03043797.2024.2348007.

Boucharenc, C. G. (2006). Research on Basic Design Education: An International Survey. *International Journal of Technology and Design Education*, *16*, 1–30.

Calvillo-Gámez, E. H., Cairns, P., & Cox, A. L. (2015). Assessing the Core Elements of the Gaming Experience. In R. Bernhaupt (Ed.), *Game User Experience Evaluation* (pp. 37–62). Springer.

Chen, C. H., & Chang, C. L. (2024). Effectiveness of AI-assisted game-based learning on science learning outcomes, intrinsic motivation, cognitive load, and learning behavior. *Education and Information Technologies*, 1-22. https://doi.org/10.1007/s10639-024-12553-x.

Chuang, T.-Y., & Chen, W.-F. (2007). Effect of Computer-Based Video Games on Children: An Experimental Study. *IEEE International Workshop on Digital Game and Intelligent Toy Enhanced Learning (DIGITEL)*, 114–118. https://doi.org/10.1109/DIGITEL.2007.24.

Coleman, T. E., & Money, A. G. (2020). Student-centred digital game–based learning: A conceptual framework and survey of the state of the art. *Higher Education*, *79*(3), 415–457. https://doi.org/10.1007/s10734-019-00417-0.

Coşkun, E., & Çağdaş, G. (2022). Temel tasarım stüdyosu: Bilgisayar oyunu tabanlı yaklaşımı anlamak ve tasarlamak. *JCoDe: Journal of Computational Design*, *3*(2), 59-86. https://doi.org/10.53710/jcode.1167799.

Dalmau, D. S.-C. (2004). *Core Techniques and Algorithms in Game Programming*. New Riders Publishing.

Demir, G., Cekmis, A., Yeşilkaynak, V. B., & Unal, G. (2021). Detecting visual design principles in art and architecture through deep convolutional neural networks. *Automation in Construction*, *130*, 103826. https://doi.org/10.1016/j.autcon.2021.103826.

Elsamahy, E. M. (2017). An Investigation into using Digital Games-Based Learning in Architecture Education. *Architecture and Planning Journal (APJ)*, *23*(3), 3. https://doi.org/10.54729/2789-8547.1099.

Fan, X., & Li, J. (2023). Artificial intelligence-driven interactive learning methods for enhancing art and design education in higher institutions. *Applied Artificial Intelligence*, *37*(1), 2225907. https://doi.org/10.1080/08839514.2023.2225907.

Farivarsadri, G. (2001). A Critical view on pedagogical dimension of introductory design in architectural education. *Architectural Education Exchange*, 1–12.

Fichner-Rathus, L. (2011). *Foundations of art and design: An enhanced media edition*. Cengage Learning.

Goli, A., Teymournia, F., Naemabadi, M., & Garmaroodi, A. A. (2022). Architectural design game: A serious game approach to promote teaching and learning using multimodal interfaces. *Education and Information Technologies*, *27*(8), 11467–11498. https://doi.org/10.1007/s10639-022-11062-z.

Gros, B. (2007). Digital Games in Education: The Design of Games-Based Learning Environments. *Journal of Research on Technology in Education*, *40*(1), 23–38.https://doi.org/10.1080/15391523.2007.10782494.

Gungor, B. S., & Yorgancioglu, D. (2019). Analysis of the Creativity Development and Assessment of Architectural Design Education: A Case Study of Basic Design Studio. *IOP Conference Series: Materials Science and Engineering*, *603*(2), 022016. https://doi.org/10.1088/1757-899X/603/2/022016.

Hammedi, S., Essalmi, F., Jemni, M., & Qaffas, A. A. (2020). *An investigation of AI in games: educational intelligent games vs non-educational games*. Paper presented at *2020 International Multi-Conference on: "Organization of Knowledge and Advanced Technologies"(OCTA)*.

Harikrishnan, H., Halim, N. D. A., Harun, J., & Arjunan, S. (2019). Exploring the digital game-based elements in mathematics education: A meta-analysis review. *Universal Journal of Educational Research*, *7*(9A), 106-116. https://doi.org/10.13189/ujer.2019.071613.

Hartmann, A., & Gommer, L. (2021). To play or not to play: on the motivational effects of games in engineering education. *European Journal of Engineering Education,* *46*(3), 319-343. https://doi.org/10.1080/03043797.2019.1690430.

Javid, A. (2014). Creativity in Architecture Design Education: Design as Puzzle Solving. *The International Journal of Design Education*, *8*(2), 11–21. ProQuest Central. https://doi.org/10.18848/2325-128X/CGP/v08i02/38463.

Kang, J., Liu, M., & Qu, W. (2017). Using gameplay data to examine learning behavior patterns in a serious game. *Computers in Human Behavior*, *72*, 757–770. https://doi.org/10.1016/j.chb.2016.09.062.

Karakaya, M. (2023). *Game-Based Learning in Architecture Education: Consolidating Visual Design Principles in Freshmen* [M.Sc.]. Istanbul Technical University.

Kiili, K. (2005). Digital game-based learning: Towards an experiential gaming model. *The Internet and Higher Education*, *8*(1), 13-24. https://doi.org/10.1016/j.iheduc.2004.12.001.

Kolb, D. A. (2015). *Experiential Learning: Experience as the Source of Learning and Development.* Pearson Education.

Landa, R. (2010). *Graphic design solutions*. Cengage Learning.

Lauer, D. A., & Pentak, S. (2011). *Design Basics*. Cengage Learning.

Le, T. L., & Kim, S. A. (2023). Game-based platform for daylight analysis using deep learning. In *Proceedings of the International Conference on Education and Research in Computer Aided Architectural Design in Europe* (Vol. 2, pp. 481-490). Education and research in Computer Aided Architectural Design in Europe.

Li, B., Bonk, C. J., Wang, C., & Kou, X. (2024). Reconceptualizing self-directed learning in the era of generative AI: An exploratory analysis of language learning. *IEEE Transactions on Learning Technologies*, *17*, 1515-1529. https://doi.org/10.1109/TLT.2024.3386098.

Makaklı, E. S., & Özker, S. (2016). *Basic design in architectural education in Turkey*. *26*, 1–7. http://dx.doi.org/10.1051/shsconf/20162601053.

McLaren, B. M., & Nguyen, H. A. (2023). Digital learning games in Artificial Intelligence in Education (AIED): A review. *Handbook of Artificial Intelligence in Education*, 440-484. https://doi.org/10.4337/9781800375413.00032.

Nadeem, M., Oroszlanyova, M., & Farag, W. (2023). Effect of digital game-based learning on student engagement and motivation. *Computers*, *12*(9), 177. https://doi.org/10.3390/computers12090177.

Öksüz, M., & Cordan, Ö. (2022). Using Video Games for Design Education: An Example of Developing Earthquake Scenarios for Home Environments. *Journal of Design Studio*, *4*(2), 65–73. https://doi.org/10.46474/jds.1155669.

Örnek, M. A. (2013). Exploring the potential uses of computer games in landscape architecture education. *A|Z ITU JOURNAL OF THE FACULTY OF ARCHITECTUREITU A|Z*, *10*(2), 161–177.

Örnekoğlu‐Selçuk, M., Emmanouil, M., Hasirci, D., Grizioti, M., & Van Langenhove, L. (2024). Preparing Future Designers for their Role in Co‐Design: Student Insights on Learning Co‐Design. *International Journal of Art & Design Education, 43*(2), 241‐257. https://doi.org/10.1111/jade.12500.

Paciarotti, C., Bertozzi, G., & Sillaots, M. (2021). A new approach to Gamification in engineering education: the Learner-Designer Approach to Serious Games. *European Journal of Engineering Education, 46*(6), 1092-1116. https://doi.org/10.1080/03043797.2021.1997922.

Paszke, A., Gross, S., Massa, F., Lerer, A., Bradbury, J., Chanan, G., Killeen, T., Lin, Z., Gimelshein, N., Antiga, L., Desmaison, A., Kopf, A., Yang, E., DeVito, Z., Raison, M., Tejani, A., Chilamkurthy, S., Steiner, B., Fang, L., … Chintala, S. (2019). PyTorch: An Imperative Style, High-Performance Deep Learning Library. In H. Wallach, H. Larochelle, A. Beygelzimer, F. d'Alché-Buc, E. Fox, & R. Garnett (Eds.), *Advances in Neural Information Processing Systems* (Vol. *32*). Curran Associates, Inc. https://proceedings.neurips.cc/paper_files/paper/2019/file/bdbca288fee7f92f2bfa9f7012727740-Paper.pdf.

Pavlik, J. V., & Pavlik, O. M. (2024). Art Education and Generative AI: An Exploratory Study in Constructivist Learning and Visualization Automation for the Classroom. *Creative Education*, *15*(04), 601-616. https://doi.org/10.4236/ce.2024.154037.

Perlaza Rodríguez, J. M., Fonseca, F.C., & Díaz Márquez, Á.M. (2024). Gamified Architectural Design: Advancing Education with Extended Reality and AI Insights. In D. Bienvenido-Huertas, M. L. de la Hoz-Torres & A. J. Aguilar Aguilera (Eds.) *Teaching Innovation in Architecture and Building Engineering: Challenges of the 21st century* (pp. 17-45). Springer. https://doi.org/10.1007/978-3-031-59644-5.

Puhalla, D. (2011). *Design elements, form & space: A graphic style manual for understanding structure and design*. Rockport Publishers.

Redondo, E., Fonseca, D., Sánchez-Sepúlveda, M., Zapata, H., Navarro, I., Gimenez, L., & Pérez, M. A. (2020). EDUGAME4CITY. A Gamification for Architecture Students. Viability Study Applied to Urban Design. In P. Zaphiris & A. Ioannou (Eds.), *Learning and Collaboration Technologies. Human and Technology Ecosystems* (Vol. *12206*, pp. 296–314). Springer International Publishing.

Romero, M., Lameras, P., & Arnab, S. (2024). Affordances for AI-Enhanced Digital Game-Based Learning. In A. Urmeneta & M. Romero (Eds.), *Creative Applications of Artificial Intelligence in Education* (pp. 117-129). Palgrave Macmillan. https://doi.org/10.1007/978-3-031-55272-4.

Salem, Ö. G., & Dündar, M. (2019). Re-thinking Basic Design Course in Architectural Education in Turkey. *Intercultural Understanding*, *9*, 7–14.

Shaheen, A., & Fotaris, P. (2023). *Exploring Reflective Learning in Digital Game-Based Learning: A User Research Study*. Paper presented at 17th European Conference on Games Based Learning, Enschede, Netherlands. https://doi.org/10.34190/ecgbl.17.1.1640.

Sun, L., Kangas, M., & Ruokamo, H. (2023). Game-based features in intelligent game-based learning environments: A systematic literature review. *Interactive Learning Environments*, 1-17. https://doi.org/10.1080/10494820.2023.2179638.

Şahbaz, E., & Özköse, A. (2018). Experiencing historical buildings through digital computer games. *Internatio nal Journal of Architectural Computing*, *16*(1), 22-33.https://doi.org/10.1177/1478077117749.

Takatalo, J., Häkkinen, J., & Nyman, G. (2015). Understanding Presence, Involvement, and Flow in Digital Games. In R. Bernhaupt (Ed.), *Game User Experience Evaluation* (pp. 87–112). Springer.

Taşçi, B. G. (2016). Utilization of Digital Games in Built Environment Education. *Universal Journal of Educational Research*, *4*(3), 632–637. https://doi.org/10.13189/ujer.2016.040323.

Toh, W., & Kirschner, D. (2020). Self-directed learning in video games, affordances and pedagogical implications for teaching and learning. *Computers & Education*, *154*, 103912. https://doi.org/10.1016/j.compedu.2020.103912.

Uluçay, N. Ö. (2023). Basic design course through art-based research in interior architecture education. *Journal of Design for Resilience in Architecture and Planning*, *4*(1), 136–147. https://doi.org/10.47818/DRArch.2023.v4i1088.

Utian, D. (2015). *Digital games for architecture and spatial design: Investigating game design and facilitation of learning* [MPhil (HE), THE UNIVERSITY OF NEW SOUTH WALES]. https://doi.org/10.26190/unsworks/18145.

Westera, W. (2015). Games are motivating, aren´t they? Disputing the arguments for digital game-based learning. *International Journal of Serious Games*, *2*(2), 3–17. https://doi.org/10.17083/ijsg.v2i2.58.

Zhonggen, Y. (2019). A Meta-Analysis of Use of Serious Games in Education over a Decade. *International Journal of Computer Games Technology*, *2019*, 4797032. https://doi.org/10.1155/2019/4797032.

Appendix-1:

Core Elements of the Gaming Experience Questionnaire (CEGE-Q):

1. I enjoyed playing the game
2. I was frustrated at the end of the game
3. I was frustrated whilst playing the game
4. I liked the game
5. I would play this game again
6. I was in control of the game
7. The controllers responded as I expected
8. I remember the actions the controllers performed
9. I was able to see in the screen everything I needed during the game
10. * The point of view of the game that I had spoiled my gaming
11. I knew what I was supposed to do to win the game
12. * There was time when I was doing nothing in the game
13. I liked the way the game look
14. The graphics of the game were plain
15. * I do not like this type of game
16. I like to spend a lot of time playing this game
17. * I got bored playing this time
18. * I usually do not choose this type of game
19. * I did not have a strategy to win the game
20. The game kept constantly motivating me to keep playing
21. I felt what was happening in the game was my own doing
22. I challenged myself even if the game did not require it
23. I played with my own rules
24. * I felt guilty for the actions in the game
25. I knew how to manipulate the game to move forward
26. The graphics were appropriate for the type of game
27. The sound effects of the game were appropriate
28. * I did not like the music of the game
29. The graphics of the game were related to the scenario
30. The graphics and sound effects of the game were related
31. The sound of the game affected the way I was playing
32. * The game was unfair
33. I understood the rules of the game
34. The game was challenging
35. The game was difficult
36. The scenario of the game was interesting
37. * I did not like the scenario of the game
38. I knew all the actions that could be performed in the game

* Denotes items that are negatively worded.

Reliability of CEGE-Q:

The Cronbach alpha for the whole questionnaire is 0.794 and for the CEGE scale is 0.803.

Resume

Asli Cekmis is an Assist. Prof. Dr. in the Department of Architecture at Istanbul Technical University (ITU). She teaches in the graduate programs of Architectural Design Computing, and Game & Interaction Technologies. Her research focuses on soft computing methods and AI applications in building design. She also teaches undergraduate courses, including 'Basic Design and Visual Arts,' to first-year students in the ITU Faculty of Architecture.

Mert Karakaya earned his bachelor's degree in Mechatronics Engineering from Sabancı University. He then pursued and completed a master's degree in Game & Interaction Technologies at Istanbul Technical University (ITU). His research interests include game-based learning, game design, and the application of games to real-world topics.

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Computational earthquake management: An educational perspective

Serdar Aşut*

Abstract

This article presents an educational undertaking to integrate earthquake management subjects into the curriculum, specifically in a master' s-level design studio course within an architecture faculty. The course explores the employment of challenge-based learning (CBL) and self-directed learning (SDL) principles, emphasizing computation for earthquake resilience and recovery. It is taught with a teaching team with diverse expertise, and it is formulated as an interdisciplinary learning environment that leads to the development of projects that explore know-how beyond the typical disciplinary boundaries of the students' backgrounds. The article suggests that employing the principles of CBL and SDL, emphasizing computational thinking as a transversal competence, and introducing digital technologies into the course content and teaching methods can lead to an effective interdisciplinary learning environment that improves students' motivation and agency. They can allow the students to take the initiative in extending their disciplinary knowledge and encourage their self-positioning as problem solvers. The projects formulated and developed by the students address all four phases of earthquake management through computational methods and digital technologies. Accordingly, it is suggested that computational earthquake management can be studied as an interdisciplinary research field that can address all phases of earthquake management, influencing both educational and professional domains. This article presents this course's pedagogical approach, learning methods, and outcomes. It is concluded with an evaluation of this experience, highlighting directions towards future research. It is suggested that it can give insights into the effective integration of this subject into education and influence future research and professional explorations at the intersection of computation and earthquake management within interdisciplinary learning environments.

Keywords: architecture and built environment education, challenge-based learning, self-directed learning, interdisciplinary learning, computation, earthquake management

1. Introduction

Earthquake management is among the most significant subjects relevant to the built environment. It addresses several domains, including technical, technological, societal, and economic, to name a few. All professional actors who practice within the design and production of built environments, such as architects, planners, designers, or engineers, must have a fundamental understanding of this subject. Moreover, society needs experts who can develop effective solutions to this natural phenomenon, which otherwise can cause deadly disasters. Therefore, it is necessary to develop curricula in the related study programs to support students in developing the needed fundamentals and expertise to build more resilient environments. This article presents the theoretical background, methodology, and outcomes of an educational undertaking that aims to address this need after the devastating February 2023 earthquakes in Türkiye. It focuses explicitly on earthquake resilience and recovery by addressing computational thinking and digital technologies within masters-level education at an architecture faculty. Presenting this original educational perspective can contribute to the existing literature on integrating the earthquake management theme into architecture and built environment education through interdisciplinary learning environments.

*(Corresponding author) Dr. and Researcher, Delft University of Technology, Netherlands, s.asut@tudelft.nl
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1.1. The Need for Interdisciplinary Learning Environments

The primary motivation of the course design was to cover all phases of earthquake management instead of focusing on only one phase, which is the common practice in educational settings. This motivation necessitates creating an interdisciplinary learning environment, as the needed know-how and skills in different phases are significantly diverse, and they can be harvested only through collaboration between various disciplines. Therefore, the course design aimed to explore how an interdisciplinary learning environment can be created to allow and encourage the students to extend their know-how and skills beyond their previous studies.

Page | 230

Interdisciplinarity refers to integrating methods, knowledge and skills, theories, perspectives, and different disciplinary knowledge bodies to realize innovative solutions and advancement in uncharted problem areas (Castán Broto et al., 2009; Klaassen, 2018; Lam et al., 2012; Menken et al., 2016). Klaassen (2018) points out that pedagogical approaches that challenge students to demonstrate interdisciplinary understanding by integrating multiple sources of knowledge, methods, and perspectives from two or more disciplines to realize a problem solution or a learning outcome are limited. Van den Beemt et al. (2020) highlight the need for sound pedagogy to develop interdisciplinary skills, knowledge, and values and teaming experiences that provide students with authentic ways of engaging in interdisciplinary practice. Similarly, Moirano et al. (2020) emphasize the importance of interdisciplinary collaboration for innovation and the need for supporting pedagogical strategies.

To develop an effective pedagogical approach for creating the needed interdisciplinary learning environment, the course design presented in this article followed two hypotheses. The first hypothesis is that specific educational approaches, such as challenge-based learning (CBL) and self-directed learning (SDL), can support the creation of the needed interdisciplinary setting. The second one is that computational thinking, as a transversal competence, can encourage students to initiate projects with interdisciplinary content by enabling them to understand and apply the know-how and skills of other disciplines.

The need to integrate earthquake management into architecture education is widely discussed. However, more research is needed for a more thorough outlook and effective and sustainable results, especially to address the interdisciplinarity dimension discussed in this article. According to Laboy and Onnis-Hayden (2019), new pedagogies for design education should make evident how traditional curricular approaches are opened up to new questions and forms of input because, while interdisciplinary collaboration can begin to break down the silos in design education (architecture, engineering, urban planning, etc.) its shortcomings become more evident when well-intentioned efforts rely on self-contained modes of research, which are then brought together. Potur & Metin (2021) evaluate architects' role in disaster management and argue that while the 1999 Marmara Earthquake spurred initial improvements in architectural education and practices, these advancements have not been sustained over the past 20 years, emphasizing the need for multidimensional approaches in education and professional practice. In this line, Özdoğan and Güney (2016) emphasize the need to integrate comprehensive disaster-related education into architecture curricula to improve disaster preparedness and resilience, especially in countries that are geographically and climatically vulnerable, like Türkiye. In addition to the course contents and teaching methods, thorough explorations of effective pedagogical approaches are needed to achieve useful results. For example, Akdağ and Beyhan (2024) state that shifting earthquake education from traditional, instructor-centered methods to student-centered, experiential learning with modern technologies would enhance the quality of learning and better align with current learning habits.

The review research of Theodoropoulos (2006) shows that most architecture schools address the concepts central to seismic design across the curriculum in various courses. They mostly address subjects related to seismic design principles (Morales-Beltran et al., 2020; Morales-Beltran & Yildiz, 2020) and earthquake-resistant structural design systems (Karadag & Canakcioglu, 2023; Soyluk &

Harmankaya, 2012). Additionally, architecture schools have an extensive tradition of teaching post-earthquake or emergency shelter design (Krishnan & Liao, 2019; Mahmoud et al., 2019). Hence, the prominent interest in architecture schools focuses on the earthquake management cycle's response or recovery phases. As an alternative and original approach, the course presented in this article aimed to address all four phases of earthquake management and allow the students to explore diverse subjects, know-how, and skills needed in this broad spectrum. This objective requires an interdisciplinary learning environment that can be formulated on two levels. The first level involves a teaching team composed of experts from diverse areas of expertise who deliver lectures, workshops, and tutoring in their field. The second one considers the student teams as interdisciplinary despite having the same background. The course design presented in this article combined these two levels through a pedagogy that is new to its context and the literature.

1.2. The Influence of Digital Transformation on Earthquake Management Education

Digital transformation influences educational and professional domains in most fields, including earthquake management. Thus, computational competences and digital skills can play a significant role in developing the course contents and teaching methods on this subject. As relevant to this, Charleson (2018) argues that architecture schools should incorporate seismic design content into their curriculum, using rule-of-thumb software to enhance students' understanding and skills. Similarly, Solak (2022) states that engineering-based structural analysis programs used for earthquake-resistant building design should be integrated into the curriculum of architectural education, and the use of digital technologies within earthquake-resistant design courses is expected to enhance students' knowledge and learning. Also, Morales-Beltran and Yildiz (2020) emphasize the lack of research on teaching methods on seismic knowledge in architecture education, and they mention the possible influence of computational-aided structural design in the teaching and learning process.

The course presented in this article addresses digital transformation on two levels. On the first level, it employs computational thinking as a transversal competence, which supports achieving the targeted interdisciplinary learning environment. On the second level, the course introduces many subjects within digital technologies, provides learning activities to improve students' digital skills, and asks the students to apply these skills in their projects, exploring innovative ways of using them. In this sense, it introduces a new framework, so-called "computational earthquake management," which also points out directions for future explorations in research and professional fields. However, this article explicitly focuses on the educational setting and its implications for pedagogical perspectives.

1.3. Methods

Following the described needs, motivation, and hypotheses, this article presents the general course setup (section 2.1) and the specific theme and content implemented in the relevant semester (section 2.2). It is followed by a description of its pedagogical approach (section 2.2), referring to the literature on CBL and SDL, which are suggested as the enablers of an interdisciplinary learning environment.

The concept of earthquake management and its four phases are explained (section 3.1) as they constitute the course content. Then, how computation and digital competences can be integrated into earthquake management education is discussed (section 3.2), in line with the objectives of an interdisciplinary learning environment. An overview of the student projects is presented and analyzed (section 4) to understand how they have responded to the course setup and to what extent the interdisciplinary learning environment is achieved, as reflected in the project scopes.

By observing students' study behaviors during the course and analyzing the course evaluation surveys, the article concludes with evidence that employing CBL and SDL as pedagogical approaches and employing computational thinking as a transversal competence in education, an interdisciplinary learning environment can successfully be created, increasing students' motivation. The observations also include suggestions for more robust future implementation of such learning

environments. Moreover, it proposes computational earthquake management as a novel holistic framework that needs further research.

2. The Educational Context

2.1. Course Setup

Page | 232

The course is offered as an elective in the first quarter of the second year of the Building Technology track of the Master of Science (MSc) degree in Architecture, Urbanism, and Building Sciences at Delft University of Technology (TU Delft). It takes ten weeks (a full quarter) and consists of 15 study credits based on the European Credit Transfer System (ECTS). This corresponds to a workload of 420 hours, including contact hours (e.g., lectures, studios, and workshops) and self-study times. The students do not follow any concurrent course during this quarter. After completing this course, they start their MSc graduation theses. It is an interdisciplinary studio course that integrates computational methods and digital technologies into structural and material design within building technologies. It addresses various scales within the built environment, ranging from urban to building products, by paying attention to environmental, social, cultural, and ethical aspects. The course is called CORE, an acronym for "COmputational REpertoire for Architectural Design and Engineering". One of its goals is to bridge the know-how between architecture and (building) engineering disciplines.

The course aims to help students develop computational competences, integrating computational thinking and computer programming skills, toward designing and producing built environments. Herein, computational thinking refers to a cognitive approach to formulating problems and developing solutions. Programming is introduced as a practical skill to implement computational thinking within complex problems. Thus, the course includes a "programming crash course" module, which introduces Python programming language in eight sessions in the first two weeks. Each session includes a four-hour practical workshop. The students are further guided on their programming work through weekly studio sessions until the end of the course.

During the first two to three weeks, several lectures and relevant debates are organized to help students understand the theme's various dimensions and develop a personal reflection. Their contents are tailored based on the theme, which alters every year. After these sessions, the students identify a research question and develop a design brief. Accordingly, they build teams and work on their projects, receiving tutor feedback. During project development, they receive formative (ungraded) feedback in studio meetings, workshops, and presentations. The only summative (graded) feedback is given upon submitting and presenting the finalized project.

In the 2023-2024 academic year, 46 students enrolled in the course. They hold bachelor's degrees in architecture from different universities in 14 countries. This results in an extensively diverse group in terms of their prior experience. In their second quarter, they followed another course on computational design, which gave them a fundamental understanding of computational thinking and practical skills in visual programming using the Grasshopper (GH) software. Later, some followed other electives and deepened their knowledge of this subject. In this MSc program, no other courses explicitly teach programming with Python. Some students start this course with some experience in Python programming based on their individual ventures, whereas others start it with no experience. Moreover, also concerning altering course themes, there is extensive diversity in the students' prior experiences.

2.2. Course Theme and Content

The course explores a different theme every year, addressing significant societal topics. Following the devastating February 2023 earthquakes in Türkiye, the theme was defined as "Computation for Earthquake Resilience and Recovery" for the 2023-2024 academic year. This response aimed to contribute to worldwide endeavors to solve this crucial challenge through an

academic perspective and reflect on our roles as architects, designers, planners, and engineers in light of it.

Following a thorough evaluation of the scientific and professional needs of the Architecture, Engineering, and Construction (AEC) industry, the scope of the theme was defined to address all phases of earthquake management, including mitigation, preparedness, response, and recovery. Even though it increases the complexity of the challenge, the scope could be complete only when all of these phases are covered and the needs associated with each are studied. Therefore, the course theme aimed to introduce the students to the challenges of all four phases and to raise awareness of their professional roles in recovering the built environments from earthquake damage and ensuring their future resilience.

Concerning the course objectives, the solutions to the problems identified in all phases were meant to be solved using computational methods and digital technologies. This could mean the advanced utilization of existing methods, tools, and technologies or the creation of new ones to develop the solutions. Eventually, both the scope of the theme and the approach to explore it required a high level of divergence, which could only be undertaken with an interdisciplinary approach. The fact that the course was taught by the involvement of three scientific chairs (Design Informatics, Structural Design & Mechanics, and Design of Construction) made it possible to appoint staff from different disciplines and form a teaching team with diverse expertise. Moreover, several guest tutors contributed to the content through (online or in-campus) lectures and workshops, significantly improving the course's interdisciplinary nature.

In the first three weeks, several sessions were organized as lectures or workshops to elaborate on several subjects concerning the theme and approach. They covered subjects such as the aftermath of the February 2023 earthquakes, urban and disaster resilience, humanitarian engineering, geographic information systems and machine learning for disaster management, seismic performance of structural and non-structural building elements, material-related problems in earthquakes, energy dissipation in buildings, seismic fragility, performance-based earthquake engineering, seismic simulation, finite element analysis, earthquake-resistant architectural design, facade design and retrofitting, low-damage technologies, earthquake early warning systems, robotics for search and rescue operations, emergency shelter design, participatory reconstruction, layout optimization, and community empowerment through digital technologies. The core teaching team and the guest lecturers elaborated on these subjects in 27 sessions through lectures and workshops. Additionally, a field trip was organized to observe an existing retrofitting solution on a historical building affected by an earthquake and to implement hands-on structural design experiments on a shake table.

The total workload of these planned activities could exceed the maximum allowed contact hours. Therefore, the students were allowed to select the course activities they wanted to participate in within the allowed limit. They were informed about the content of each activity through the course book and enrolled in the ones they were interested in at the beginning of the course. Similarly, each programming crash-course session was offered as a free-to-choose activity, allowing the students to tailor their schedules and decide on the activities they wanted to follow based on their prior experience and interests. This method was suggested to keep the workload per student within the allowed limits and further enhance the group's diversity of know-how and approaches.

During the first two weeks, a few brainstorming sessions were organized where students discussed the possible problems and formulated methodologies to solve them in the moderation of the tutors. An interactive online mind map was kept active throughout this process, allowing the students to read and edit their ideas at any time. Through these sessions, each student focused on a specific problem that was collectively developed. Moreover, they found their teammates who shared similar interests with them. This method was proposed to let the students identify their own interests and define the project they want to work on. Moreover, it helped the team formation by

making it a more informed decision. Accordingly, they identified their research and design objectives, methodology, deliverables, and learning resources through the guidance of the tutors. Over ten weeks, they developed projects through teamwork that addressed different phases within computational earthquake management.

2.3. Pedagogical Approach

Page | 234

The studio employs primarily two pedagogical approaches: challenge-based learning (CBL) and self-directed learning (SDL). According to Malmqvist et al. (2015), CBL is a multidisciplinary learning experience that takes place through the identification, analysis, and design of a solution to a socio-technical problem, aiming to find a collaboratively developed solution, which is environmentally, socially and economically sustainable. Gallagher and Savage (2020) state that CBL fosters student transversal competencies, knowledge of socio-technical problems, and collaboration with industry and community actors. Doulougeri et al. (2024) emphasize that CBL centers learning around open-ended global socio-technical challenges, often involving external stakeholders in self-directed and collaborative learning.

In this course, the principles of CBL were implemented by formulating the course scope as a response to a recent major earthquake. This challenge was evident at the faculty, observable through several initiatives of the different student groups and other stakeholders seeking ways to support the earthquake region by different means. Thus, the students readily perceived the course theme as an authentic and actual subject, reflected by the high enrolment numbers. Also, involving people who brought in observations and experiences directly from the region and shared them with the students through lectures or discussions further improved the authenticity of the challenge.

Loeng (2020) describes SDL as a process by which individuals take the initiative in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes, and emphasizes that when teachers are involved in SDL, they should be facilitators of learning, not transmitters. Avsec and Jagiełło-Kowalczyk (2021) explore the interactions between design thinking and SDL in architecture students, and they conclude that design thinking can provide metacognitive insights such as interpersonal skills, creativity, and digital skills that can support SDL. Thus, one may state that architecture students must typically be competent in SDL, as design thinking is a fundamental cognitive procedure in architecture education.

In this course, the implementation of the principles of SDL is evident on several levels. First, the flexibility offered to the students to customize their schedule and course activities allows them to diagnose and act on their learning needs and styles. Allowing them to identify their project objectives, methodology, and deliverables further strengthens this approach. Based on the needs of each project, the students had to identify the learning resources, reaching out to people and institutions who could provide them with the needed expertise, information, or data. In the meantime, the tutors facilitate the environment needed to explore various open-ended questions, acting as students' collaborators instead of traditional instructors.

A search was implemented on Web of Science (WOS) and Scopus databases to understand how CBL and SDL are explored in architecture (and related fields) education. It aimed to identify the articles which have "Challenge-Based Learning", "Self-Directed Learning", "Architecture / Architectural Education", "Design Education", "Planning / City Planning / Urbanism / Urban Planning Education" and "Engineering Education" terms in titles, keywords, and abstracts. Table 1 presents the number of articles found with each search query. Accordingly, it can be argued that the scientific literature that explores CBL and SDL, specifically within architecture, planning, and design education (which are commonly considered closely related study programs), is very limited. Meanwhile, research on CBL and SDL within engineering education is fairly extensive. More research is needed to develop pedagogical approaches to integrate CBL and SDL in architecture (and related study programs) education and to evaluate their effectiveness.

Table 1 The Number of Articles in WOS and Scopus on CBL and SDL

Search Query	WOS	Scopus
"Challenge-Based Learning"	304	519
("Challenge-Based Learning") AND ("Architecture Education" OR Architectural Education")	1	1
("Challenge-Based Learning") AND ("Design Education")	2	4
("Challenge Based Learning") AND ("Planning / City Planning / Urbanism / Urban Planning Education")	1	1
("Challenge-Based Learning") AND ("Engineering Education")	47	187
"Self-Directed Learning"	4738	6769
("Self-Directed Learning") AND ("Architecture Education" OR Architectural Education")	3	6
("Self-Directed Learning") AND ("Design Education")	9	17
("Self-Directed Learning") AND ("Planning / City Planning / Urbanism / Urban Planning Education")	0	0
("Self-Directed Learning") AND ("Engineering Education")	62	345

3. Interdisciplinary Learning on Computational Earthquake Management

3.1. Disaster Management Phases

United Nations Office for Disaster Risk Reduction (UNDRR) defines a disaster as a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts. According to the same resource, disaster management refers to the organization, planning, and application of measures preparing for, responding to, and recovering from disasters (UNDRR, 2017).

According to Percy et al. (2011), disaster management conventionally considers four distinct phases: mitigation, preparedness, response, and recovery. They define these four phases as follows:

1. Mitigation: The activities or perceptions relating to reducing the risks of disasters.
2. Preparedness: Considering, rehearsing, and preparing what to do in the event of a disaster, for example, by conducting drills, exercises, and simulations.
3. Response: The activities and experiences of tackling immediate danger when a disaster occurs.
4. Recovery: Activities and experiences associated with longer-term relief once immediate risk to life has passed.

Similarly, Edrissi et al. (2013) define these phases as follows:

1. Mitigation includes strategic measures taken to reduce or eliminate the disaster impacts.
2. Preparedness aims to lessen or avoid disaster consequences by preparing the community for hazards.
3. Response includes acting according to emergency plans to preserve lives, properties, the environment, and the community's social, economic, and political structures.
4. Recovery involves long-term actions that will restore normalcy to the affected areas.

Preparedness and mitigation are pre-disaster activities, while response and recovery are considered as during (disaster) and post-disaster activities, respectively, although there is increasing recognition that these activities considerably overlap (Nyimbili & Erden, 2017). These

four phases form a cyclic cycle rather than a linear process, and success within one phase depends on the proper administration of all phases. Therefore, the course scope aimed to cover all four phases, encouraging the students to understand the importance of each and see the relationships between them.

3.2. Computation and Earthquake Management Education

Page | 236

One of the primary objectives of the course was to help students develop competences in computation. There are vast definitions and discussions on what the term computation refers to. Additionally, the term may gain different meanings in different contexts. Knight and Vardouli (2015) interpret the term broadly as the use of formal, mathematical systems, theories, and methods, as well as tools and technologies developed on the basis of such systems, and they state that computation may include, but is not limited to, the use of digital computers. Therefore, the term may contain two related processes: computational thinking as a cognitive skill and using computer systems as a practical skill.

According to Aho (2012), computational thinking refers to the thought processes involved in formulating problems so their solutions can be represented as computational steps and algorithms. Wing (2006) argues that, it relates to thinking at multiple levels of abstraction, and it is a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use.

Computational thinking is a transversal competence. Sá and Serpa (2018) define transversal competences as a set of competences that can be applied in any professional situation or task, regardless of where they were attained. Cruz et al. (2019) emphasize the importance of integrating transversal competences in education curricula to prepare students for the labour market. Similarly, Belchior-Rocha et al. (2022) argue that the acquisition of transversal competences, especially in a labour market that is affected by social, economic, technological and political changes, is increasingly essential. Granado-Alcón et al. (2020) highlight that transversal competences allow students to engage constructively and responsibly with today's world. Moreover, transversal competences can encourage and support individuals' self-positioning as a problem solver within or outside any disciplinary context.

Even though computational thinking does not necessarily require the use of computers, formulating and solving complex problems necessitates the use of contemporary computer applications and digital technologies. Therefore, the ideal educational curricula, which aims to address a complex socio-technical problem like earthquake management, need to intertwine computational thinking with expertise in computer programming. The scope and methodology of the course which is discussed in this article is developed following this argument. It is suggested that its outcomes can provide insights into how computation can support earthquake management, contributing to both educational and professional contexts.

Even though there is a wide range of applications in which distinct digital technologies are used to solve specific challenges within disaster management, the definition of a holistic framework is scarce. One of the existing definitions is presented by Van Hentenryck (2013), who views computational disaster management as a system that integrates various layers such as; (i) the geospatial modeling layer mapping of a region; (ii) the sensing and monitoring layer collecting information via sensors, social media analyses, crowdsourcing, and hyperspectral imaging; (iii) the data layer managing information; (iv) the behavioral layer synthesizing individual and group behaviors during emergencies; (v) the simulation and forecasting layer generating potential scenarios; (vi) the optimization layer providing decision support; and (vii) the visualization layer offering unprecedented awareness via 3D and information visualizations. Also, Eslamian and Maleki (2021) explore computational methods to address the complexity of disaster management, and they propose a conceptual design framework that integrates a computation core involving simulation modeling algorithms, optimization algorithms, cost-benefit analysis, and verification.

In this course, each project utilized a specific approach for defining the research and design problems and developing solutions. The emphasis on computational thinking facilitated a cognitive approach by which students formulated problems and solutions through procedural steps, algorithms, and abstractions on multiple levels. This approach was further supported by using computer programming methods and digital technologies. Eventually, each project delivered a tool, toolset, or workflow that can practically be used to solve complex problems. Moreover, these methods and technologies enhanced integrated problem-solving, which supported the needed interdisciplinary learning environment. The course's emphasis on computational competences, the presentation of various digital technologies, and the introduction of practical computer programming skills led to 17 distinct projects. They were distributed over various subjects within earthquake management, eventually covering all four phases. Due to the interdisciplinary explorations the students pursued, they brought together know-how from different fields.

4. Results: An Overview and Analysis of the Projects

The course resulted in 17 projects, each studied in a team of 2 to 4 students. Each project is distinct in its problem statement, which students identified through the guidance of the tutors. The project subjects are as follows:

1- Large-scale seismic risk assessment of aged hydraulic structures: It aims to develop a computational tool that can identify the risk level of dams and visualize the potential flood hazards around them. The computational model uses data related to dam type, construction material, construction year, soil type, and water level to define the risk factor of a dam. It also visualizes the effects of a possible flood caused by failure after an earthquake to help predict the damage in the dam's surrounding region. The project utilizes Python, Rhino, Grasshopper, and SOFiSTiK for mapping, structural modeling, analysis, and simulation.

2- Enhancing seismic resilience in mid-rise buildings with visco-elastic dampers in Antakya: It aims to provide rapid feedback on the effects of seismic bracing in the early design stages of architectural structures. It uses a machine learning algorithm to calculate and simulate the seismic behavior of dampers, providing input to the architect by generating optimized bracing configurations. The project utilizes Python, Rhino, Grasshopper, and Karamba3D for programming, numerical simulation, and visualization.

3- Shear wall generator for housing typologies in Antakya: It aims to develop a computational tool that can provide optimum shear wall placement based on the spatial layout of the building. The tool specifically considers the common housing typologies in Antakya, ensuring seismic performance in the early architectural design phase. The project utilizes Python, Rhino, and Grasshopper for static analysis, optimization, and visualization.

4- Architectural guide for site-specific designs of new earthquake-resistant buildings and structures: It aims to develop an Interactive analysis tool that allows architects to visually and qualitatively understand how their building design will respond to earthquakes. It provides feedback to illustrate potentially problematic building qualities based on the user's inputs. The project utilizes Python, Rhino, Grasshopper, and Karamba3D for structural modeling, analysis, and visualization.

5- Holistic site-specific hazard assessment: It aims to improve accessibility to probabilistic seismic hazard assessment by providing a site-specific prediction of primary impact direction. It outputs a tool that provides hazard assessment and predictive models based on the location and directionality concept using data from publicly available databases. The project utilizes Python, Rhino, and Grasshopper for data extraction and processing, statistical modeling, and visualization.

6- Active stabilization systems for critical infrastructures: It aims to provide a retrofitting solution for the power transmission towers to sustain power after the earthquake. It includes devices mounted on the tower arms, equipped with sensors that detect seismic forces, and actuators that

apply customized forces to the cables. The project utilizes Python, Rhino, Grasshopper, and Alpaca4D for earthquake simulations, seismic data analysis, and decision-making.

7- A tool for finding the shortest route for rescue after the earthquake: It aims to develop a computational tool that can identify the safe areas and routes to guide the rescue teams in transferring people from assembly hubs to shelter locations after the earthquake. The project uses QGIS and QuickOSM to obtain geospatial data. It suggests using LiDAR Drones and Ground Penetrating Radars to assess the conditions of the possible transfer routes. It uses a program made in Python to process the data and the DIJKSTRA algorithm to find the optimum transfer route. The project outputs a visual user interface that can be used by the search and rescue teams and decision-makers.

Page | 238

8- An information-driven framework to increase efficiency in site-specific shelter decision-making process: It aims to facilitate the timely deployment of appropriate shelters to areas in need. The project includes an analysis of the existing shelter types to better match the needs and supply, considering structural integrity, comfort, and cultural relevance. The project uses Pandas, Rasterio, and Matplotlib libraries in Python to obtain and visualize geospatial data. It utilizes data related to shelter designs derived from the documentation of the IFRC (International Federation of Red Cross) and the UNHCR (United Nations Refugee Agency). The project outputs an interactive interface on a browser to help the decision-making process.

9- Rapid estimation of disaster consequences: It aims to reduce the time needed for damage assessment immediately after the earthquake. It develops a simulation tool to forecast risk zones based on a database of building types and real-time seismic data. The project utilizes Python, Rhino, Grasshopper, and Karamba3D for data processing, structural modeling and analysis, and visualization. It outputs a map that visualizes the vulnerability assessment.

10- Active mass damper activation tool and analysis on structural seismic vulnerability: It aims to explore the potential benefits of Active Mass Damper (AMD) systems to reduce earthquake damage to buildings. The project uses QGIS to gather geospatial data, SAP2000 to perform structural analysis, and a program made in Python to integrate the automated workflow. The project output is a digital platform that integrates several software and outputs feedback towards AMD integration in a building and information on its post-earthquake condition.

11- Enhancing earthquake preparedness through building vulnerability assessment: It aims to develop a framework for building vulnerability analysis in seismic scenarios. It uses data related to building dimensions and construction materials to implement statistical analysis for assessing building vulnerability. It uses Alpaca4d, Grasshopper, and a Python program using the Pandas library for statistical analysis and machine learning for structural performance predictions. It outputs a visual interface that assesses vulnerability and identifies safe areas to help decision-makers make informed decisions.

12- Custom emergency shelter based on Japanese wood joints: It aims to support self-help for communities that need emergency shelters. The project outputs an interactive environment that can be used by people to design a custom shelter based on needs and preferences. The system optimizes the design for structural performance, provides solutions for the digital fabrication of the shelter components, and gives instructions for DIY assembly. The project utilizes Python, Rhino, and Grasshopper, and it outputs a web-based interactive interface that can be used by citizens who need shelters.

13- Identifying collapsed buildings and assessing vulnerable types with satellite image segmentation: It aims to develop and train a deep learning model to perform image segmentation and object classification on satellite images after the earthquake. The model identifies the collapsed buildings and correlates between damage and building typologies to support decision-making processes by providing quick feedback on damage assessment on the buildings after the earthquake.

14- A decision support system for search & rescue resource allocation in response to an earthquake: It aims to develop a decision support system for more efficient management of search and rescue resources. It estimates possible injuries based on building size, construction type, function, and occupancy. The project develops a Python-based application that implements fragility assessment based on available geospatial data and statistical predictive models and provides feedback for search and rescue resource allocation.

15- Earthquake damage detection with drones: It aims to develop a workflow for using consumer drones to asses damages to buildings after an earthquake. The project develops a machine learning model to analyze the drone footage and identify the buildings' safety factors based on the detected damage to structural components. It utilizes a Python-based application that uses images and videos collected by consumer drones to generate 3D models, detect the damages on the buildings, and determine the effect of the damages on structural integrity.

16- A tool for designing with reusable reinforced concrete elements: It aims to develop a workflow to support the reuse of reinforced concrete beams rescued from earthquake demolition waste in new buildings. The workflow includes strategies for harvesting and assessing the usable elements in the demolition waste. It uses a program developed in Python and integrated in Rhino and Grasshopper to suggest new design variations that use the available beams.

17- Identifying suitable locations for material hubs: It aims to develop a system that provides optimal routes after a disaster and identifies suitable locations for emergency hubs for temporary housing. The project develops a computational tool that generates networks that are updated in real-time to help identify safety routes after the earthquake. The project utilizes OpenStreetMap and Python programming for real-time mapping and providing feedback to support logistical operations in the earthquake region.

Table 2 presents the distribution of the projects in the different phases of earthquake management (as evaluated by the author). The complex nature of the projects sometimes makes it challenging to identify the specific phase the project addresses. Moreover, some projects address more than one phase, aligning with the arguments of Nyimbili and Erden (2017). Therefore, this identification can be subjective to some extent. The first column of the table refers to the project number listed above. The other four columns refer to the phases. The primary phase a project addresses is identified with A, and the secondary phase is identified with B.

Page | 240

Table 2 The Distribution of the Projects on Earthquake Management Phases

	Mitigation	Preparedness	Response	Recovery
1	A	B		
2	A			B
3	B			A
4	B			A
5	B			A
6	A			B
7			A	
8		B	A	
9		B	A	
10	A			B
11		A		
12			A	
13			A	
14		B	A	
15				A
16				A
17		B	A	

Figure 1 illustrates the distribution of the projects among the four phases through stacked columns. The blue color indicates primary (A), and the orange color indicates secondary (B) link between a project and a phase, similar to Table 2. As seen in this figure, the distribution of the projects among the four phases is fairly even. In total, six projects address preparedness, seven address mitigation and response, and eight address the recovery phase. This distribution confirms that the scope of the projects covers the broad spectrum of earthquake management instead of focusing on only one phase. An important aspect is that only the blue color is represented in the response phase. This aspect can be explained by the fact that the students holding bachelor's education in architecture are more trained to work on this phase (as explained with references earlier), so they can relate to this phase more easily than the others. Still, the fairly even distribution among the phases supports the hypotheses. Suggestions to improve this distribution are discussed in the conclusion section.

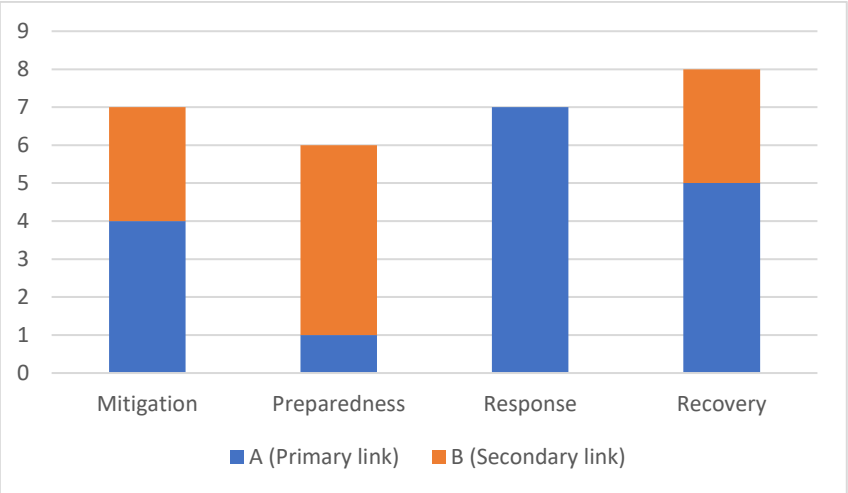

Figure 1 The distribution of the projects among the four phases through stacked columns

Another takeaway from this analysis is that computation and digital technologies can help us define a holistic framework for earthquake management by providing tools and methods to address solutions in all phases. Therefore, it confirms the abovementioned arguments of Van Hentenryck

(2013) and Eslamian and Maleki (2021). More research is needed to define this proposed framework as a professional domain, which is outside the scope of this article.

For a better understanding of the interdisciplinary scope of the projects, Table 3 presents an overview of which scientific discipline each project addresses. The relevant scientific disciplines are retrieved from The Dutch Research Council's classification of research fields (NWO, 2024) and listed in the table's first column. The following columns refer to the projects listed above with project numbers. The disciplines that a project addresses are marked with an X in the cells of the corresponding columns and rows. The bottom row indicates how many disciplines each project addresses. The right side column indicates how many projects address each discipline.

Table 3 The Distribution of the Scientific Disciplines the Projects Address

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	
Software, algorithms, control systems	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	*17*
Artificial intelligence, expert systems		X	X	X	X	X	X		X	X		X	X	X	X		X	*13*
Civil engineering	X	X	X	X	X	X	X		X	X	X	X			X	X		*13*
Information systems, databases	X				X		X	X	X		X		X	X	X	X	X	*11*
Urban studies	X				X		X	X			X		X	X			X	*8*
User interfaces, multimedia	X							X			X	X		X		X		*6*
Architecture		X	X	X								X				X		*5*
Geotechnics	X			X	X	X	X											*5*
Computer graphics		X								X		X						*3*
Design sciences			X									X				X		*3*
Mechanical engineering		X				X				X								*3*
Materials technology							X									X		*2*
	6	*6*	*5*	*5*	*6*	*5*	*7*	*4*	*4*	*5*	*5*	*7*	*4*	*5*	*4*	*7*	*4*	

This analysis may be somewhat subjective, similar to the abovementioned analysis regarding the relationships between the projects and the earthquake management phases. The complex nature of the projects makes it difficult to identify the related disciplines precisely, and the methods and know-how of disciplines often overlap. This analysis sought strong integration of distinct know-how and methods of a discipline to be considered addressed. Eventually, it demonstrates that each project integrates know-how and methods from multiple disciplines. Software, algorithms, and control systems discipline is strongly relevant to all projects, as computational thinking and programming are introduced as core competences to be gained in this course. It is followed by artificial intelligence and expert systems, which strongly correspond to the course's learning objectives and are beneficial for developing state-of-the-art solutions to complex problems. Civil engineering is another prominent discipline, as earthquake-related subjects are traditionally studied in this field, especially within earthquake-resistant structural design. The fact that information systems and databases are also highly addressed highlights the profound need for data, especially in the mitigation and preparedness phases. The low number of projects directly addressing architecture (in its typical understanding) confirms that students have widely explored new areas of expertise beyond their previous studies.

As seen in this overview, the scope of most projects is beyond what would typically be expected from a student with a bachelor's degree in architecture to work on. The course's pedagogical approach that employed the principles of CBL and SDL must have encouraged the students to go beyond the disciplinary boundaries of their field and explore other domains. The interdisciplinary nature of the course setup and the tutor team is seen as an encouraging factor towards this exploration. Moreover, the fact that computational workflows enable, encourage, and require the integration of know-how from other fields empowers the students to develop their work in an

interdisciplinary manner. In this case, the interdisciplinary setup relies on something other than a situation where the students in a team come from different disciplines. Instead, they reach out to different domains while sharing similar backgrounds in this setup, which can hypothetically be called a *discipline-fluid* learning environment.

Page | 242

5. Conclusions

This article presented an educational intervention to provide an original perspective for integrating earthquake management into architecture and built environment education through an interdisciplinary learning environment. Through a course that serves as a context for observational research, it evaluated the study behaviors and outcomes, confirming that an educational perspective that employs CBL, SDL, and computational thinking enables interdisciplinary learning. Analyzing the project contents demonstrated how this perspective encourages the students to extend their disciplinary boundaries and integrate know-how and skills from different disciplines to develop solutions that relate to all phases of earthquake management. This educational perspective can provide insights into the effective integration of earthquake management into architecture and built environment curricula and stimulate future research in this direction. It is also suggested that this case serves as a basis for future research on a holistic framework for computational earthquake management, potentially leading to professional implications.

Integrating the principles of CBL strongly improves students' motivation. This can be achieved by focusing on authentic case studies and involving stakeholders who can bring insights from actual experiences into education. The principles of SDL further improve motivation, allowing the students to identify what and how they want to learn. It supports students' self-positioning and encourages them to explore the expertise they want to develop. Moreover, creating space for flexibility in learning is necessary to explore open-ended questions. This can be done by allowing the students to customize the learning activities they want to participate in throughout the course instead of planning a fixed program that is compulsory for all students to attend. Also, by allowing customization, the workload becomes more manageable for the students while all subjects can still be integrated into the course as the students bring all learning experiences into the course and share them with others through collaborative work. In addition, employing computational thinking as a transversal competence in curricula complements interdisciplinarity and gives students the fundamental skills to master state-of-the-art digital technologies.

The course evaluation survey confirms the observations and reveals helpful student feedback that supports the two hypotheses defined at the beginning. Also, it points out directions for improvement toward a more robust interdisciplinary learning environment. The students evaluated the course considerably high (on average, 4.8 out of 5.0) in terms of the learning experience, indicating that they learned a lot throughout the course. One of the main takeaways is that their evaluation was relatively low (on average, 3.5 out of 5.0) regarding how the previous semesters have prepared them for this course. Thus, exploring ways to integrate this specific teaching methodology with the courses from earlier semesters is necessary.

According to the survey results, the main aspects that are evaluated as the best are the degree of challenge (86%), teaching methods (86%), academic level (76%), and lectures (76%). This evaluation confirms that the students highly welcome the CBL and SDL approaches and the interdisciplinary learning environment. Clarity about what is expected (62%) and connection to prior knowledge and skills (29%) emerge as the most prominent aspects that need improvement. This evaluation confirms the need for better integration between the semesters. Moreover, a more precise definition of the expected results seems requested. Here, the challenge in front of the teacher must be sustaining the freedom in the process while helping the students feel more secure by defining the possible results concerning the particularities of each project.

According to students' qualitative feedback, the most important point for improvement is the need for more specific instructions, tasks, restrictions, and clear evaluation criteria. This feedback

underlines the tutors' role as guides and facilitators. Also, a student pointed out the possible benefits of working in teams that involve students from different disciplines. This would require a different course setup that welcomes students of other disciplines to enroll, an aspect certainly worth exploring.

Also, the most common positive feedback include the following:

- The possibility of using the project outcomes to help actual disaster areas motivated the students to go further than usual and explore new challenges. It resulted in many students going out of the box to learn something new and broaden their perspectives.
- The assignment's freedom is a good feature.
- The diversity and broad spectrum of the lectures and their multi-faceted content are beneficial in defining the scope of the projects.
- Learning programming while applying it in a case provides an effective learning experience.
- The diversity and broad spectrum of the lectures are beneficial in defining the scope of the projects.

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References

Aho, A. V. (2012). Computation and Computational Thinking. *The Computer Journal*, *55*(7), 832-835. https://doi.org/10.1093/comjnl/bxs074

Akdağ, F., & Beyhan, F. (2024). Bir Deprem Ülkesinde Mimarlık Eğitim Sürecinin İrdelenmesi. *Online Journal of Art and Design*, *12*(1), 88-103.

Avsec, S., & Jagiełło-Kowalczyk, M. (2021). Investigating Possibilities of Developing Self-Directed Learning in Architecture Students Using Design Thinking. *Sustainability*, *13*(8). https://doi.org/10.3390/su13084369

Belchior-Rocha, H., Casquilho-Martins, I., & Simões, E. (2022). Transversal Competencies for Employability: From Higher Education to the Labour Market. *Education Sciences*, *12*(4). https://doi.org/10.3390/educsci12040255

Castán Broto, V., Gislason, M., & Ehlers, M.-H. (2009). Practising interdisciplinarity in the interplay between disciplines: experiences of established researchers. *Environmental Science & Policy*, *12*(7), 922-933. https://doi.org/10.1016/j.envsci.2009.04.005

Charleson, A. (2018). Earthquake Engineering Education in Schools of Architecture: Developments during the Last Ten Years Including Rule-of-Thumb Software. *Journal of Architectural Engineering*, *24*(3). https://doi.org/10.1061/(asce)ae.1943-5568.0000324

Cruz, M. L., Saunders-Smits, G. N., & Groen, P. (2019). Evaluation of competency methods in engineering education: a systematic review. *European Journal of Engineering Education*, *45*(5), 729-757. https://doi.org/10.1080/03043797.2019.1671810

Doulougeri, K., Vermunt, J. D., Bombaerts, G., & Bots, M. (2024). Challenge-based learning implementation in engineering education: A systematic literature review. *Journal of Engineering Education*. https://doi.org/10.1002/jee.20588

Edrissi, A., Poorzahedy, H., Nassiri, H., & Nourinejad, M. (2013). A multi-agent optimization formulation of earthquake disaster prevention and management. *European Journal of Operational Research*, *229*(1), 261-275. https://doi.org/10.1016/j.ejor.2013.03.008

Eslamian, S., & Maleki, M. (2021). Disaster Resilience and Computational Methods for Urban Infrastructures. In *Handbook of disaster risk reduction for resilience: New frameworks for building resilience to disasters* (pp. 279-298). Springer.

Gallagher, S. E., & Savage, T. (2020). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*, *28*(6), 1135-1157. https://doi.org/10.1080/13562517.2020.1863354

Granado-Alcón, M. d. C., Gómez-Baya, D., Herrera-Gutiérrez, E., Vélez-Toral, M., Alonso-Martín, P., & Martínez-Frutos, M. T. (2020). Project-Based Learning and the Acquisition of Competencies and Knowledge Transfer in Higher Education. *Sustainability*, *12*(23). https://doi.org/10.3390/su122310062

Karadag, O., & Canakcioglu, N. G. (2023). Teaching earthquake-resistant structural systems in architecture department: a hands-on learning experience. *Architectural Science Review*, *67*(4), 332-344. https://doi.org/10.1080/00038628.2023.2288967

Page | 244

Klaassen, R. G. (2018). Interdisciplinary education: a case study. *European Journal of Engineering Education*, *43*(6), 842-859. https://doi.org/10.1080/03043797.2018.1442417

Knight, T., & Vardouli, T. (2015). Computational making. *Design Studies*, *41*, 1-7. https://doi.org/10.1016/j.destud.2015.09.003

Krishnan, S., & Liao, Y. (2019). Integrating shelter design and disaster education in architectural curriculum. ASEE Annual Conference and Exposition, Conference Proceedings, Tampa, Florida.

Laboy, M., & Onnis-Hayden, A. (2019). Bridging the Gap between Architecture and Engineering: a Transdisciplinary Model for a Resilient Built Environment. *Building Technology Educator's Society*, *2019*(1), 38.

Lam, J. C. K., Walker, R. M., & Hills, P. (2012). Interdisciplinarity in Sustainability Studies: A Review. *Sustainable Development*, *22*(3), 158-176. https://doi.org/10.1002/sd.533

Loeng, S. (2020). Self-Directed Learning: A Core Concept in Adult Education. *Education Research International*, *2020*, 1-12. https://doi.org/10.1155/2020/3816132

Mahmoud, Z. A., Ahmad, Y., & Alias, A. (2019). Relevance to Post-disaster Recovery in Undergraduate Architectural Education: A Case of Southern Turkish Universities. *Pertanika Journal of Social Sciences & Humanities*, *27*(1).

Malmqvist, J., Rådberg, K. K., & Lundqvist, U. (2015). Comparative analysis of challenge-based learning experiences. Proceedings of the 11th International CDIO Conference, Chengdu University of Information Technology, Chengdu, Sichuan, PR China.

Menken, S., Keestra, M., Rutting, L., Post, G., Keestra, M., Roo, M., Blad, S., & Greef, L. (2016). *An Introduction to Interdisciplinary Research*. https://doi.org/10.5117/9789462981843

Moirano, R., Sánchez, M. A., & Štěpánek, L. (2020). Creative interdisciplinary collaboration: A systematic literature review. *Thinking Skills and Creativity*, *35*. https://doi.org/10.1016/j.tsc.2019.100626

Morales-Beltran, M., Charleson, A., & Aydin, E. E. (2020). Sawtooth Method for Teaching Seismic Design Principles to Architecture Students. *Journal of Architectural Engineering*, *26*(1). https://doi.org/10.1061/(asce)ae.1943-5568.0000387

Morales-Beltran, M., & Yildiz, B. (2020). Integrating configuration-based seismic design principles into architectural education: teaching strategies for lecture courses. *Architectural Engineering and Design Management*, *16*(4), 310-328. https://doi.org/10.1080/17452007.2020.1738995

NWO. (2024). *NWO research fields*. Retrieved 10.08.2024 from https://www.nwo.nl/en/nwo-research-fields

Nyimbili, P. H., & Erden, T. (2017). Spatial decision support systems (SDSS) and software applications for earthquake disaster management with special reference to Turkey. *Natural Hazards*, *90*(3), 1485-1507. https://doi.org/10.1007/s11069-017-3089-7

Özdoğan, F., & Güney, D. (2016). The importance of architecture education for disaster mitigation. *WIT Transactions on Ecology and the Environment*, *204*, 373-384.

Percy, C., Chen, Y. F., Bibi, A., Coles-Jordan, D., Dodson, E., Evans, T., Klingberg, D., & van der Bruggen, M. (2011). The contribution of human psychology to disaster management: mitigation, advance preparedness, response and recovery. In C. A. Brebbia (Ed.), *Disaster Management and Human Health Risk II* (pp. 195-208). WIT Press. https://doi.org/10.2495/dman110181

Potur, A. A., & Metin, H. (2021). The Place of Earthquake in Architectural Education and the Educational Dimension of the Earthquake: An Evaluation of the Global Agenda and Turkey Context. *MEGARON / Yıldız Technical University, Faculty of Architecture E-Journal*, *16*(2), 223-254. https://doi.org/10.14744/megaron.2020.94210

Sá, M., & Serpa, S. (2018). Transversal Competences: Their Importance and Learning Processes by Higher Education Students. *Education Sciences*, *8*(3). https://doi.org/10.3390/educsci8030126

Solak, A. (2022). The Place and Importance of Earthquake Resistant Building Design in Civil Engineering and Architectural Education. *European Journal of Science and Technology*. https://doi.org/10.31590/ejosat.1091518

Soyluk, A., & Harmankaya, Z. Y. (2012). Examination of Earthquake Resistant Design in the Education of Architecture. *Procedia - Social and Behavioral Sciences*, *51*, 1080-1086. https://doi.org/10.1016/j.sbspro.2012.08.291

Theodoropoulos, C. (2006). *Seismic design education in schools of architecture* 113th Annual ASEE Conference and Exposition, Chicago, Illinois.

UNDRR. (2017). *Sendai Framework Terminology on Disaster Risk Reduction*. Retrieved 18-05-2024 from https://www.undrr.org/drr-glossary/terminology

Van den Beemt, A., MacLeod, M., Van der Veen, J., Van de Ven, A., van Baalen, S., Klaassen, R., & Boon, M. (2020). Interdisciplinary engineering education: A review of vision, teaching, and support. *Journal of Engineering Education*, *109*(3), 508-555. https://doi.org/10.1002/jee.20347

Van Hentenryck, P. (2013). Computational disaster management. IJCAI '13: Proceedings of the Twenty-Third international joint conference on Artificial Intelligence, Beijing, China.

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33-35. https://doi.org/10.1145/1118178.1118215

Resume

Serdar Aşut is an educator and researcher at the Faculty of Architecture and the Built Environment of TU Delft. He is an architect and holds a PhD in Architectural Design Computing. His works explore topics at the intersection of digital technologies and the built environment, including computational methods, creative robotics, digital fabrication, and architecture and design education.

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Monastery heritage as a tool for reconciliation pre-post earthquake: The case of Saint Simeon Monastery

Bilge Kalkan*
Kağan Günçe**

Abstract

Preserving heritage ensures it is passed to future generations, cultural heritage is crucial in shaping community's identity through this journey. Religious heritage has huge importance in continuation and give sense of belonging within religious communities. Monastery heritage has a crucial role in safeguarding the rich past and traditions of monastic communities, with a focus on their religious and societal significance. Antioch is a city, a home of coexistence. Beside the city's rich culture, the city is known as central point promoting reconciliation through three main monotheistic religions. The city has faced several earthquakes in history, it was completely destroyed and later rebuilt again. Unfortunately, recently an earthquake occurred and destroyed not only the historical religious buildings but the greatness of coexistence. Reconciliation is the key of healing after the disaster by fostering unity, comprehension and collaboration. Saint Simeon Monastery in Antioch is a significant example of resilience, rebirth, and reconciliation, as evidenced by the references to its response to challenges in its history. Preservation of the monastery should include physical and psychological strategies so that the place can welcome everyone, heal, and coexist with its values and characteristics post-challenge. The research aims to create a framework to increase cultural awareness within the community about the importance of Saint Simeon Monastery as religious heritage site. This will promote to build the bridge of reconciliation post-earthquake. Method of the study includes both quantitative and qualitative research to examine the significance of Saint Simeon Monastery's religious history brings communities together in Antioch after the earthquake.

Keywords: coexistence, cultural heritage, earthquake, historical religious buildings, reconciliation

1. Introduction

Like Heritage refers to items, buildings, objects, rituals, or culture that have historical or cultural significance and are handed down from one generation to another. Rather of being destroyed, these structures should be preserved since they provide as tangible record of the lifestyle and culture of the people who lived in or near them (Mısırlısoy & Günçe, 2016). Cultural heritage has a crucial role in shaping the identity of a community, promoting a strong feeling of pride and belonging among its inhabitants (Nijkamp, 2012). Religious heritage encompasses holy writings, rituals, architecture, and art, serving as a means to safeguard beliefs, values, and traditions, assuring their transmission to future generations (Olsen, 2006). The heritage of monasteries is very valued as it helps to preserve the history and traditions of monastic communities (Gilchrist, 2020). It provides a deeper understanding of their religious and social functions, as well as their cultural and intellectual contributions to society.

Antioch, also known as Antakya, is a city that has a significant cultural heritage and plays a pivotal role in fostering harmony among the three major monotheistic faiths. Antioch a significant city which serves as a central location and preservation of cultural inheritance. The city's coexistence of Islam, Christianity, and Judaism enhances its cultural fabric and promoting mutual understanding between the religions to promote interfaith. Earthquake of 7.7 magnitude that occurred in 2023

*(Corresponding author) Res. Assist. and PhD Candidate, Eastern Mediterranean University, North Cyprus, bilgekaalkan@gmail.com **Prof. Dr., Eastern Mediterranean University, North Cyprus, kagan.gunce@emu.edu.tr
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was a historic moment that highlighted the necessity of research to examine the steps to rebuild the bridge of reconciliation.

Earthquakes as natural disaster has a big impact on cultural heritage not only physical structures but it also has impact on communities. Earthquakes cause people to lose their houses, so people have to shift somewhere else to maintain their daily basic needs. Beside of these needs, they could not fulfill the needs of cultural and social demands. In this case monasteries with their power can act to build or serve as reconciliation. It can bring people together to share values and appreciate their cultural significance.

Reconciliation is the process of repairing relationships, solving conflicts and restoring divisions within society. It promotes understanding, forgiving in reconstructing relationships between individuals, communities, organizations or nations. It includes political, social and emotional factors in facing any conflict of type of a disaster. Restoring cultural heritage places can ensure the revival of communities (Mısırlısoy & Günçe, 2023). Cultural heritage in that region is one of the most important structures of reconciliation, as it is the common heritage of the common past.

Research aims to create a comprehensive framework of comportment to sensitize cultural significance in the region among communities. Saint Simeon Monastery is recognized by its authority to gather people together even it is abandoned. As a part of religious heritage in Antioch and tool for reconciliation, Saint Simeon Monastery can act as a hub of coexistence post-earthquake. Earthquakes occurs suddenly and brings people together, Saint Simeon Monastery can serve as healing sanctuary. The primary objective is to promote communities to be back to city strategically by superior of monastery.

The research reviews the role of monastery in means of reconciliation after earthquake. Comparing monasteries in Antioch region and investigating cultural, religious and monastic heritage. The limitation of the study is theoretical and obstacles related to post earthquake reconciliation among specific religions and cultural context.

2. Literature Review

Heritage consists of items that can be passed down from one generation to another, items that can be safeguarded and inherited, items that hold historical or cultural importance to the community (Feilden & Jo Kilehto, 2003). According to UNESCO heritage is categorized in three sections which are cultural, natural and mixed heritage (UNESCO, 2021). It is an inheritance that belongs to all of humanity and gives each region its own unique qualities. Additionally, cultural heritage serves as a repository of human existence (Jokilehto, 2006). Assets of cultural heritage are tangible and intangible that a group or society inherits from earlier periods (Figure 1). Tangible assets include ancient ruins, monuments, buildings with significant values. Intangible cultural heritage includes music, art, languages and more (UNESCO, 2021).

Figure 1 Types of Cultural Heritage (Adapted from UNESCO, 2021)

UNESCO defines 'tangible cultural heritage' as physical objects, such as creative creations and historical buildings, that are preserved and transmitted over generations. This preservation is

crucial for understanding and appreciating humanity's history, and divided into movable and immovable cultural assets (UNESCO, 2003). Intangible Cultural Heritage refers to cultural practices, expressions, knowledge, and skills passed down through generations, considered part of a community's identity. The 2003 UNESCO Convention defines it as practices, representations, and artifacts. In built heritage, it includes hidden values, such as associations with historical figures, personal memories, or ethical principles, deeply intertwined with the heritage's significance (Petronela, 2016). Cultural heritage is significant due to various causes and values, including historical, architectural, aesthetic, unique, and archaeological aspects. Intangible qualities include emotional, symbolic, and spiritual significance (Jokilehto, 2006).

Religious heritage consists of customs, beliefs, rituals, texts, artefacts, and historical buildings shared by religious groups for future generations. It includes symbols by religious buildings such as monasteries, synagogues, churches, mosques, and temples as material and for immaterial religious heritage includes spiritual rites, ceremonies, and practices that connects beliefs to the historical roots (Mekonnen et al., 2022). Traditions hold great significance as symbols and clothes links faith and continuation. Religious heritage impacts culture and society on literature, unity in diversity, art and ethical frameworks (UNESCO, 2003). Shapes everyday life preserves historical sites and items promotes interfaith in communities. Religious heritage is complex and interconnected aspect of human civilization that impacts cultural identity, social connections and spiritual practices. It supports the preservation of cultural identity in the context of globalization (Mekonnen et al., 2022). It is important in rebuilding relationships between the communities and fosters sense of belonging.

Religious buildings including churches, monasteries, cathedrals are not only significant by cultural and as religious landmarks, are also centers for knowledge preservation and dissemination (UNESCO, 2003). They provide important role in promoting societal and cultural advancement. Monasteries as religious heritage buildings are the places of spiritual retreat and religious practice.

2.1. Philosophy of Monastery Heriatge

The monastery heritage refers to the historical and cultural importance of monasteries, which are holy buildings where monks or nuns reside, worship, and participate in religious ceremonies. The monasteries have had a significant impact on cultural identities, practices, and beliefs throughout the course of history (Harvey, 2012). These cultural artefacts include profound spiritual doctrines, innovative accomplishments, impressive architectural wonders, and enduring traditions, establishing them as a worldwide phenomenon that beyond both national boundaries and religious associations (Baker & Chitty, 2013).

Monasteries have a profound cultural past that encompasses many generations of spiritual activities, ceremonies, and rituals. They function as temples of worship, hubs of education, and reservoirs of learning and enlightenment. In addition, monasteries contain significant artworks and relics that provide insights into the religious tales, symbolism, and aesthetic sensitivities of different civilizations (Williams, 2008). In addition, they participate in social services and charitable endeavors, such as operating educational institutions, medical facilities, and orphanages (Brewer et al., 2015).

Preserving monastic heritage requires cooperation among several entities, each fulfilling a crucial role in upholding the cultural, historical, and spiritual importance of these locations. Monasteries have shown to be resilient by successfully adjusting and attracting people who are seeking solace, contemplation, and spiritual enlightenment, even if their initial educational purposes have changed throughout time (Smith, 2016).

Monasteries have played a crucial role in important historical events, displaying their significance beyond religious activities in social and political changes. Their unusual architecture, which displays a range of styles from several locales and historical eras, is well recognized and celebrated (Jenkins & Forsyth , 2009).

Architecturally, monasteries harmoniously integrate functional spaces with spiritual and communal aspects, placing emphasis on communal living, prayer, and deep reflection inside a confined environment. These artefacts may be found throughout many civilizations and religious traditions, and they include a wide array of designs tailored to meet the special requirements of their respective societies. Typical characteristics of these structures include of enclosed sections, central courtyards, places of worship such as churches or primary prayer halls, covered walkways, living quarters, dining halls, libraries, rooms for studying, tall structures housing bells, and accommodations for visitors (Crawford, 2009).

Monasteries embody the seamless fusion of architecture and the surrounding with natural environment, resulting in sacred locations that evoke deep respect and tranquilly. Their architectural prowess is often augmented by their flawless integration into the surroundings, promoting contemplation and admiration of the beauty of nature. Monastic gardens, characterized by their luxuriant foliage and vivid hues, provide a serene and calm ambiance that harmonizes with the spiritual principles upheld in these hallowed sites. The monastery grounds provide expansive places that are conducive to contemplation, reflection, and social meetings. These settings give breathtaking views of the close environment (McNeill, 2017). Monasteries exemplify cultural and religious profundity via their architectural structures, with some ones using sustainable design methodologies to attain a state of ecological balance. Contemporary monasteries are progressively embracing eco-friendly architectural styles that seamlessly integrate with the surrounding environment (Jackson, 2020).

UNESCO identifies World Heritage Sites based on their global worth, cultural importance, human ingenuity, and cultural heritage. Monasteries, being tangible cultural treasures, are acknowledged as World Heritage Sites in order to guarantee their conservation for future generations. In order to be eligible, a monastery must satisfy certain requirements, such as being an exceptional example of human artistic brilliance, offering distinctive evidence of a cultural heritage or civilization, representing a noteworthy period in human history, or having direct connections to significant events or traditions (UNESCO, 2019). Monasteries are regarded as exemplary works of architectural and creative ingenuity, demonstrating the talents and inventiveness of the people and communities responsible for their construction. Additionally, they provide as evidence of religious, spiritual, and community customs, showcasing distinct architectural designs, artistic customs, and cultural rituals (ICOMOS, 2018).

The monastery's cultural heritage is endangered by acts of vandalism, the encroachment of urban development, lack of care and maintenance, the impact of tourism, extremist ideologies, and the potential risks posed by natural catastrophes. Efforts to save this cultural heritage include the collaboration of several entities, including local law enforcement, historical preservation groups, monastic communities, government cultural agencies, heritage foundations, international religious freedom organizations, and disaster management agencies (Brelsford et al., 2014).

Table 1 Threats to Monastery Heritage and Safeguarding Measures

Threat Name	Impact Explanation	Safeguarding Organization
Vandalism and Desecration	Vandalism refers to the deliberate act of damaging or altering monastic buildings, religious symbols, or artefacts, resulting in the loss of their spiritual and cultural significance.	UNESCO, ICOMOS, WMF, EAA, CHwB, Local heritage preservation agencies
Urbanization and Development	The process of urban growth poses a significant danger to monastic sites as it might lead to their destruction, change, or invasion, so disturbing their historical and spiritual significance.	UNESCO, ICOMOS, WMF, GHF, NTHP, Local heritage preservation agencies
Neglect and Lack of Funding	Inadequate funding may lead to the decay of monastery structures and artefacts, hence reducing their historical and cultural importance.	UNESCO, ICOMOS, WMF, GHF, NTHP, Local heritage preservation agencies, Europa Nostra, The Getty Foundation

Tourism Pressure	The presence of a large number of visitors may exert physical strain on the infrastructure of monasteries, resulting in deterioration and disruption of the serene atmosphere.	UNESCO, ICOMOS, WMF, EAA, GSTC, Local and National Heritage Agencies
Ideological Extremism	Radical ideologies might potentially cause deliberate devastation or compelled cessation of monasteries, leading to the extinction of cultural variety and spiritual customs.	UNESCO, ICOMOS, ICCROM, Blue Shield International, GHF, ICC
Natural Disasters	Monastic buildings and artefacts are at substantial danger of damage and destruction from natural calamities such as earthquakes, floods, or wildfires.	UNESCO, ICOMOS, ICCROM, WMF, GCI, Blue Shield International, GHF

Disasters occurs quick and tragic beyond to handle and react. These events can be natural occurrences like earthquakes, floods, and tropical storms, or it can be human generated disasters such as industrial misfortunes and technical accidents. By this cultural heritage sites are under danger, these can be threat as tangible or intangible that can damage physical and non-physical impacts. UNESCO is an international organization that safeguards cultural heritage sites during crises. Cultural heritage should be protected from these events by all-encompassing approach that includes disaster preparedness assessment of possible disaster and coordinated emergency actions.

Earthquake causes movements on tectonic plate, this makes buildings to move, relocate, collapse. It has potential to damage historical buildings, monuments, and archaeological sites. Similar to physical aspects, intangible cultural heritage has impacts caused by earthquakes to such as destroying cultural unity and memory. This highlights the difficulty and courage of communities bonding together and protecting their identity. Reconciliation appears here to bring people together, strengthening, restoring relationships and healing as a whole. It brings mutual understanding and collaboration, promotes peace, positive development, instead of spreading hostility.

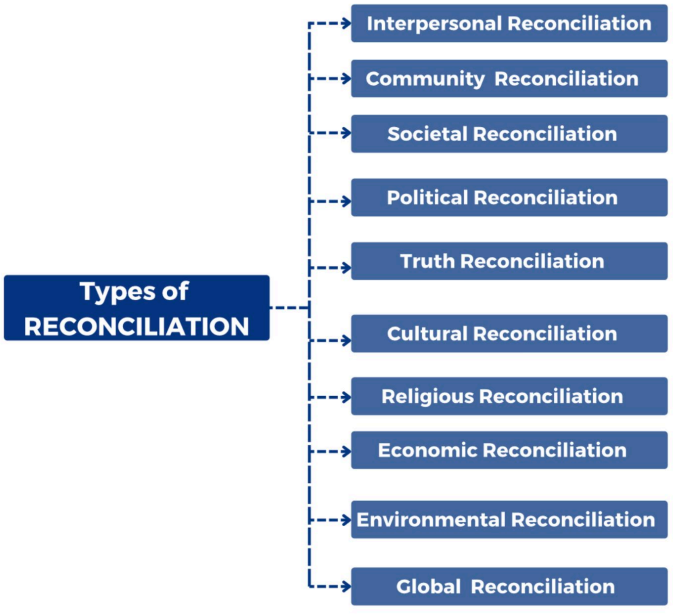


Figure 2 Reconciliation types (Developed according to Radzik & Murphy, 2015)

Reconciliation is complex, can be grouped within its types according to situations. In each specific environment, reconciliation becomes evident by embracing the unique characteristics inherent (Gale & Potter, 2002). Reconciliation is the process of examining the tolerance to certain aspects of forming human connection and societal frameworks (Meierhenrich, 2008). Reconciliation in post disaster recovery can be seen in various types (Figure 2).

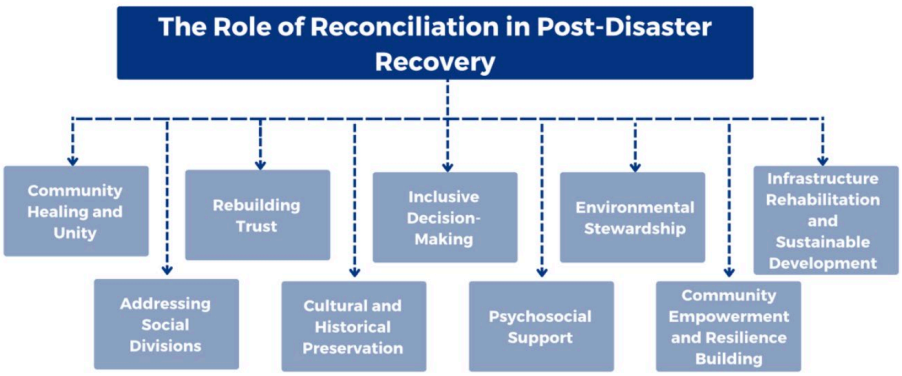


Figure 3 The role of reconciliation in post-disaster recovery

Reconciliation has crucial role in rebuilding emotional, social and cultural facets of community healing in post disaster recovery (Figure 3). It includes a systematic framework for community healing that allows remaining communities to openly discuss their situations and find comfort on a shared path to healing. Reconciliation efforts aim to restore trust, preserve cultural heritage, and support embracing resolution (Mısırlısoy & Günçe, 2023). Cultural heritage sites are significant in facilitating the process of reconciliation (Viejo-Rose, 2016). Attaining harmony between our pasts is an additional objective, but it requires sincere trust from every community involved (Scham & Yahya, 2003). Facilitating the empowerment of communities and fostering their ability to withstand and recover from challenges are essential elements of the reconciliation process, since they empower people to actively participate in their own healing and restoration.

2.2. Monastery Heritage and Reconciliation Relationship

Promoting reconciliation by integrating cultural, spiritual and social facets is the tradition of monasteries. This is not only architectural importance but to foster understanding and recovery. In this case preserving monastery heritage post-disaster can be separated by two strategies, physical and psychological (Figure 4). By this way it can be possible to categorize to follow which strategies to apply in different situations.

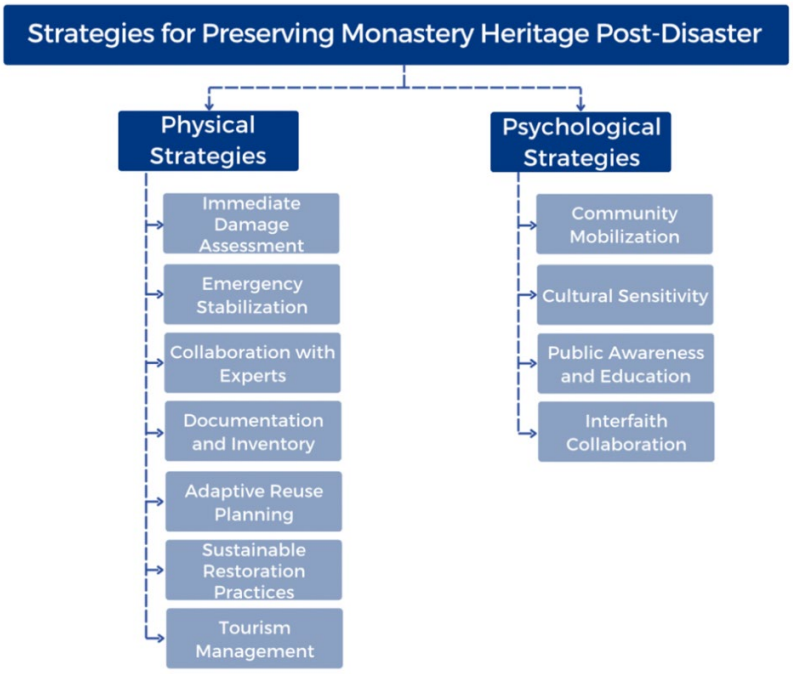


Figure 4 Grouping of preservation strategies in post-disaster

Post-earthquake monasteries foster and strength peace, promotes healing and preserving cultural heritage. It is promoting well-being and advocating the healing and bonding communities

(Radzik & Murphy, 2015). By promoting awareness, monasteries offer resilient peace, sustain cultural history, aiding sense of identity and belonging.

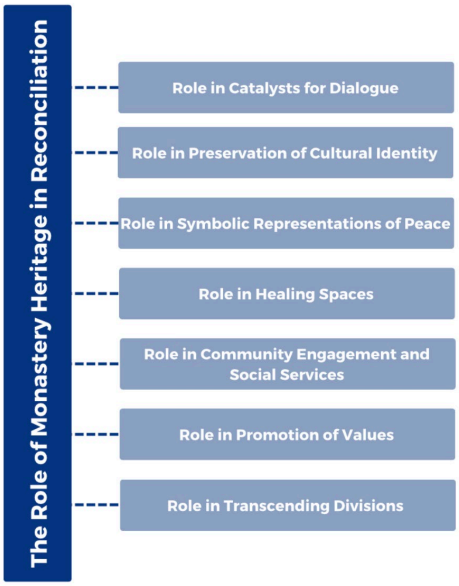


Figure 5 The role of monastery heritage in reconciliation

As means of fostering healing and unity between societies specifically in cases of social divisions, conflicts and disasters monasteries had played crucial role in history. Communities which are affected by earthquake survives with continuation of their identity, they ensure this continuation by safeguarding cultural heritage. Monasteries provide their continued existence over time by protecting their identity with religious artifacts, literature and artistic treasures (Figure 5). Providing peaceful environments, rituals, and cultural significance, monasteries are the icons of tranquility. Through the practice of mindfulness, prayer, mediation, and ceremonies passed over the years, monasteries promote inner healing, cutting chaos from the outside and protecting peace. Monasteries commitment in overall wellbeing shown by involving in humanitarian efforts, healthcare and educational initiatives. They adapt current situation to function as during crises and environmental disasters.

Figure 6 Monasteries as symbols of healing

In times of crisis monasteries are providing peaceful, calm and psychological support environments (Figure 6). They create good relationships with their communities and efficiently

strategize humanitarian efforts. Heritage of monastery should be protected by organized approach that merges both psychological and physical plan. Should respond with quick damage evaluation and collaboration with professionals. Economy is being achieved by the active role of participating. Protecting cultural environments provide sustainable tourism.

3. Methods and Materials

Resources and materials widely shaped the approach of this research and gave result of objective and sub-aims. Materials that form this study are literature review sources, survey and on-site observation by photography. An extensive observation was made in Antioch which is now known as Antakya as mentioned above. On site observation has made it possible to see the situation of the city is beyond imagination. Pictures have been taken as a live proof of barely no one is left in the city and reconciliation is no longer there. Online databases and libraries are sources of literature review. To gain wide range of understanding, research contains multi choice questionary survey answered by local people, religious communities and academicians. Questions were organized according to the findings of literature review and answers shaped the result of the research.

Methodology of the research is mixed method that involves two components of quantitative research and qualitative research. Method includes compairation between two monasteries in the region. Literature review as first component of qualitative research, purposes to provide a theoretical foundation on why and how preservation post-earthquake is important. As second component case study, comparative analysis occurs according to cultural and architectural values and UNESCO World heritage list criteria's (UNESCO, 2005). Provided theoretical perceptions are proven physically by the support of photographs. Quantitative research consists of selection of case study, survey design, data collection and analysis. The research observes post-earthquake condition of the city by the result of survey responders. Views possible strategies as monasteries being bridge of reconciliation post-earthquake.

4. Review of the Case

The city of Antioch is an exceptionally refined and prestigious location. This city is encompassed by two fortifications, the larger of which is exceptionally tall and remarkably wide, constructed with immense stones, and adorned with four hundred and fifty towers. The entirety of this city is aesthetically pleasing. To the east, the area is enclosed by four mountains, while to the west, a river named Farfar (Orontes) flows alongside the city walls. The city below was remarkable and meticulously designed, embellished with a variety of magnificent structures, including numerous churches and three hundred and sixty monasteries (Todt, 2004). The organization's head was a metropolitan who oversaw a total of one hundred and fifty-three bishops. Antioch, the city in question, holds significant influence as it was founded by a total of seventy-five monarchs, with King Antiochus being the most prominent among them, hence the name Antioch (Todt, 2004).

Antioch, ancient city of Turkey is significant by its unique cultural religious and architectural history, shaped by ears of Hellenistic, Roman, and Byzantine. Fabric of the city is a testament shows city has accepted variety of cultures. Context of the city and symbol of coexistence between different religions that can be observed by seeing Habibi Neccar Mosque located near by Church of St. Peter (Figure 7), everyday routines are defined by spiritual institutions.

Figure 7 Identity of religious coexistence in Antioch (Diker & Erkan, 2017)

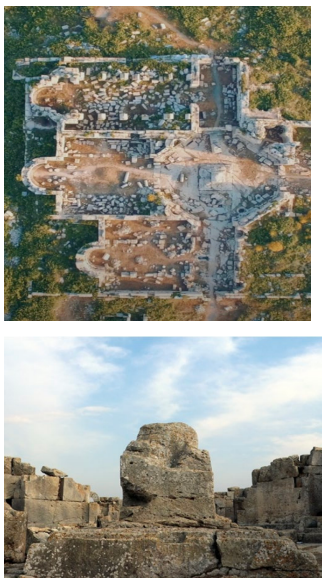
Shared values of historical heritage of the city promotes tolerance and mutual respect. The mentioned number of monasteries in Antioch were refunded and reconstructed in the history. This number shows the city's significance in the early Christian World. These monasteries were not the places of worship only, they were the centers of education and community services. Important example, Saint Simeon monastery is a living representation of religious and cultural heritage displays city's ability and preserve historical monuments. Antioch with its integrative nature is evident in pieces of architectural structures and archaeological landmarks. Monasteries of Saint Simeon and Saint Barlaam are spiritual atmosphere of Antioch was impacted by Christian monasticism. Additionally, to these aspects, vanished monasteries enhance religious traditions and historical identity of the city. Reading the past of the city is possible through cultural mosaics by multi faith history.

One of the significant historical monuments of Antioch is the Monastery of Saint Barlaam. During the 3rd century BCE, a Doric temple stood at this location. In the 4th century, St. Barlaam arrived at this location, dismantled the statue of Zeus, and formed a community of monks. In the 6th century, a church was constructed in the southeastern corner of the monastery (Figure 8). Saint Barlaam monastery has faced many difficulties, like natural disasters and political disruptions. An earthquake in 526 demolished the monastery (Hatay Büyükşehir Belediyesi, 2021). The monastery is refounded and reconstructed by Georgian monks between 950 and 1050, remained operational until 1268 before being deserted (Todt, 2004). Its architectural style is Byzantine style and includes church, chapel and monastic cells. Monastery is left with remaining's of architectural features, murals, mosaics and structural features displays artistry of the era. Considering these economical limitations, being left to its destiny resulted the abandonment of the monastery. Unfortunately, the absence of documentation for Saint Barlaam monastery results in a dearth of information.

Figure 8 Saint Barlaam Monastery, Antioch (Hatay Büyükşehir Belediyesi, 2021)

Saint Simeon Stylist the Younger, who influenced a religious movement, laid the foundation for the Monastery of Saint Simeon. He followed Saint Simeon Stylist the Elder way of living. He became a significant spiritual figure in Antioch during the Byzantine Empire. He entered monastic life at an early age. To be closer to God and focus on prayer, he isolated himself from the city and started to live on a 15-meter pillar for this spiritual dedication on a mountain in Antioch (Torrey & Simeon 1899). He spent 65 years of his life on this 132x160-metre pillar. His dedication has earned him respect and fame over the years. People would visit him and bring food. His popularity grew worldwide, and his lifestyle shaped the lives of many. He was accepted as a holy man. Pilgrims used to travel and visit him for blessings, they also believed he could cure the sick and heal them (Figure 9). Between 476 and 490 AD, the pillar served as the focal point for the construction of the monastery, enabling monks to live together and learn from him. Emperor Zeno, who ruled the Empire, supported the construction, and architects, builders, and monks collaborated to create a suitable living space. Monastery has become religious center for Orthodox Christianity. The central pillar, a cross-form with four wings, shaped its unique architectural style. In the 6th century, the monastery suffered considerable damage from several earthquakes in 526, 529, and 588 AD. In the 7th century, Arab conquests resulted in the dissolution of monasteries, leaving them without the support and maintenance they needed. In addition to this issue, seismic events occurred continuously. In the 10th century, during the Byzantine Reconquest, monasteries were undergoing reconstruction efforts by Emperor Basil II. Emperor Basil II transformed the monastery into a fortress with strong walls and towers, preparing it for further attacks. Seismic events that occurred in the 11th century damaged the monastery even more, making it abandoned during this century. Up until the 16th century, some parts of the monastery remained in use. Excavations uncovered the historical and architectural significance of the monastery in modern times.

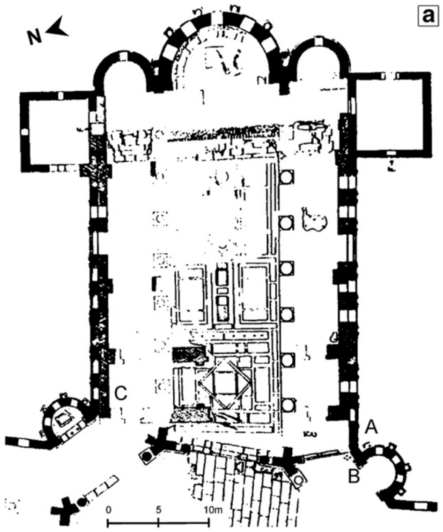
Drawing of Saint Simeon Stylist the Younger Living on Pillar



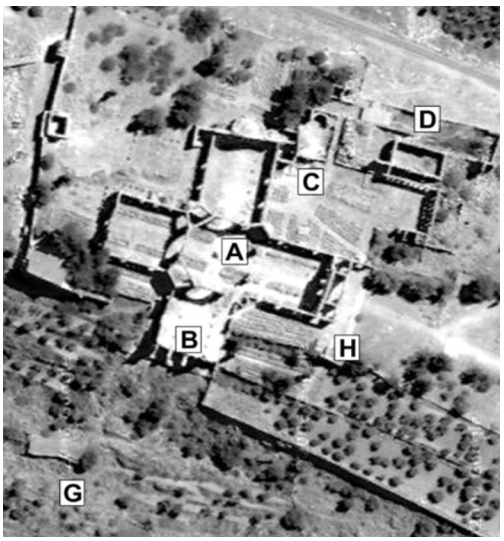
Pillar of Saint Simeon Monastery

Figure 9 Saint Simeon Monastery, Antioch (Lendering, 2024; Contributors to Wikimedia projects, 2016)

The octagonal courtyard and surrounding area creates a focal point for the monastery. This courtyard was also designed to create space for pilgrims and monks to come together and pray. Three wings of the cross shaped main church of the monastery is approximately 25 meters and eastern wing is longer with three apses in the end of the wing (Figure 10). These wings are built to serve as basilica and create environment for worship. Chapels and baptisteries are additional structures within the monastery. Chapels serve as worship spaces, while baptisteries serve as separate buildings for baptisms. The monks and nuns stayed in dormitories, and guesthouses were constructed for visitors.



Plan drawing of Saint Simeon Monastery

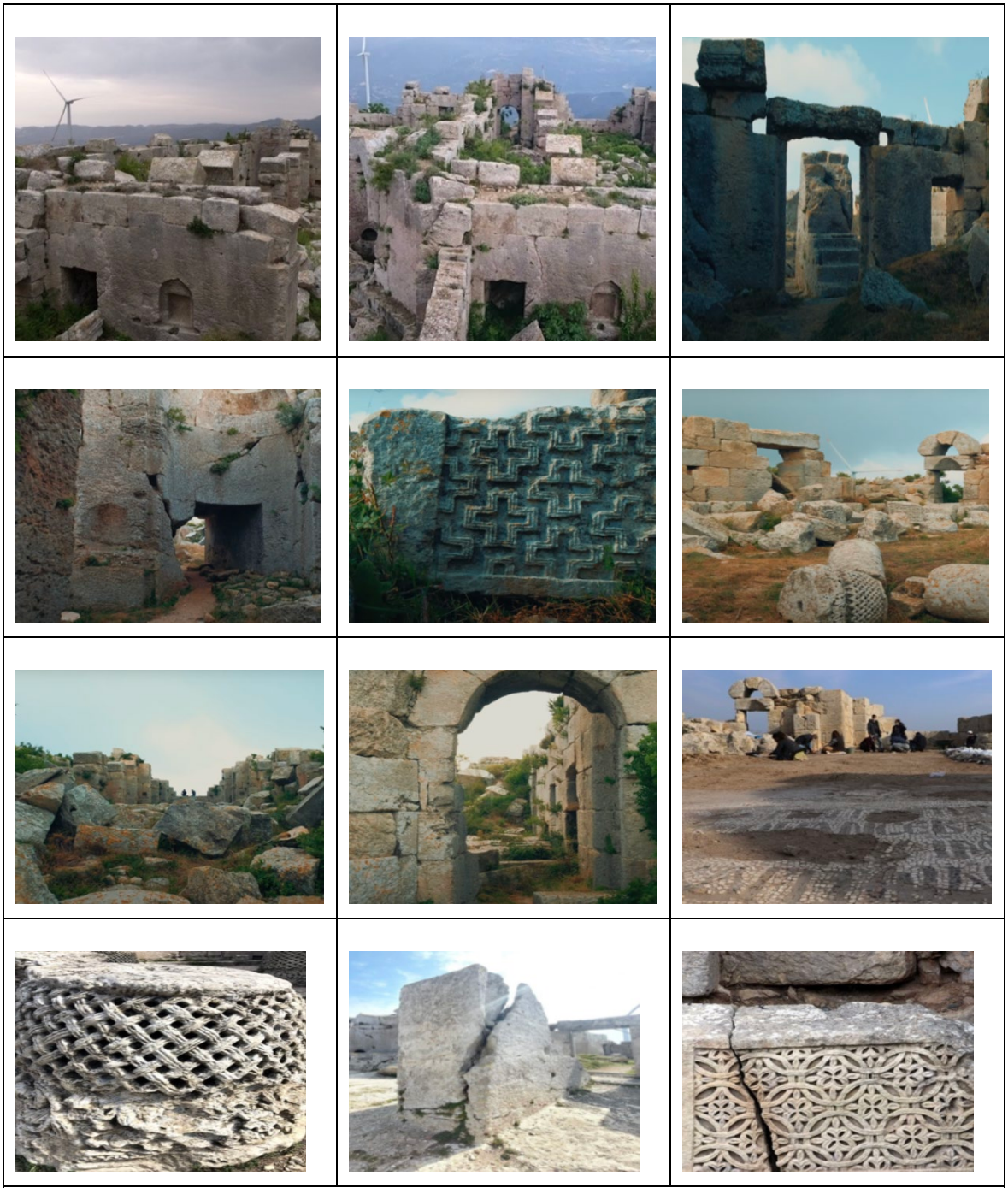


Top View of Saint Simeon Monastery

Figure 10 Architectural layout of the Monastery of Saint Simeon (Karakhanian et al., 2008)

The main church is represented by A, the western wing with a loggia is represented by B, the main church chapel is represented by C, the Convent is represented by D, the Baptistery is represented by E, the Baptistery chapel is represented by F, a bastion or water reservoir is represented by G, and the entrance to the lower terrace is represented by H.

Architectural features of Byzantine style on structures, columns, openings and mosaics on the floor represents the cultural background and importance of monastery heritage (Figure 11). Historical events leaded to changes to additional modifications and fortifications. These features of the monastery are also crucial in representing both practical and symbolic aspects of Byzantine architecture. Mosaics are aesthetically adding color to interiors, they frequently illustrate religious scenes and creating visual environments. Arches are representing the typical Byzantine architecture, beside supporting heavy load by distributing weight equally, they create sense of openness and height in the space. The structural design of the monastery supports the daily routines of monastic life with wide open spaces which provides spiritual atmosphere. Overall, the features are reflecting architectural sophistication and the significance as cultural, religious and historical site.



Architectural Features of the Monastery

Figure 11 Architectural features of the Saint Simeon Monastery (Hatay. com, 2021)

Additionally, to its fascinating architectural features, monastery located on top of the mountain has magnificent view of nature. This location gives lots of opportunities in promoting peace and healing. Being isolated is ideal for mediation, pray and contemplation as it provides quiet environment. Connecting with nature facilitates healing, fosters a deeper connection, and fosters the experience of a spiritual bond. The height makes it possible to observe surrounding areas. The location of being on top of the mountain symbolizes being closer to God and heaven, this makes it significant as religious tradition.

Saint Simeon monastery has faced several earthquakes in the past; it has been rebuilt many times, as mentioned previously. The most recent earthquake, which occurred on February 6, 2023, did not cause any damage to the monastery. However, prior to this, political issues led to its abandonment, and subsequent repairs were not carried out. Local people are publishing news, creating awareness of significant features of cultural heritage. They are striving to gain the government's attention. Even though it remains abandoned, local people, religious communities, and tourists are visiting the monastery constantly. Primary schools are organizing trips to sites to teach heritage to new generations (Figure 12).

Tourist Attraction to the Monastery

Educational School Visit to the Monastery

Figure 12 Attraction on Saint Simeon Monastery (Motley Turkey, 2016; Turkish Archaeological News,2016)

Both of the monasteries hold architectural and cultural significance but Saint Simeon Monastery clearly has more historically significance. Saint Simeon Monastery sustains its importance by its visitors from different groups. This is a live representation of reconciliation by its neglectance is not decreasing its value. Saint Simeon Monastery is not in the list of World Heritage but when considering UNESCO criteria, it is tangible and immovable cultural heritage, representing unique evidence of cultural tradition and stands as illustrating example of significant point in human history.

5. Evaluations and Findings of the Case

Numerous evaluations and observations have filled the research gap with findings from the study on valuable cultural heritage. This research has produced highly valuable findings that revealed important perceptions and awareness. The study has never been executed before, so it fills a significant gap.

As means of historical resilience, fostering the shared identities and cultural bridge religious heritage becomes an important tool in both before and after earthquake. After the earthquake it becomes tangible as for healing, unity, interfaith cooperation, preserves cultural traditions and it serves as an educational resource. Religious heritage builds the coexistence by guiding communities

to reconciliation in post disaster recovery. Its multifaceted aspects makes it a powerful tool in leading communities towards reconciliation.

Table 2 Role of Religious Heritage as a Reconciliation Tool Pre and Post Earthquake

Aspect	Pre-Earthquake	Post-Earthquake
Sense Cultural Bridge and Shared Identity	Serves as a cultural bridge, fostering shared identity.	Shared identity becomes a tool for unity and collaboration in rebuilding.
Historical Continuity and Resilience	Embodies historical continuity, symbolizing resilience.	Historical continuity inspires resilience, aiding in the recovery process.
Symbol of Hope and Healing	Acts as a beacon of hope and inspiration.	Becomes a tangible symbol of hope and healing for communities.
Interfaith Dialogue and Cooperation	Promotes interfaith understanding and cooperation.	Facilitates collaboration among diverse religious groups for recovery.
Cultural Preservation and Reconstruction	Preserves cultural traditions and architectural treasures.	Preservation and reconstruction contribute to cultural revitalization.
Educational Resource for Understanding	Serves as an educational resource for cultural and spiritual values.	Becomes a tool for understanding, dispelling misconceptions, and unity.

Religious heritage is not only connecting communities to their past but also leads them forward by offering solace, hope and heal to rebuild. Religious heritage represents the soul of resilience and reconciliation facing challenges. Saint Simeon Monastery can serve as a powerful tool for reconciliation by its cultural, religious and historical significance. To understand this, it is important to delve into both its tangible, immovable heritage and their connection of intangible, living cultural aspects.

To observe the situation of the site and to cover people's awareness through rebuilding the bridge of reconciliation under the role of monastic heritage, it has been reflected with survey questions that answered by local people, religious communities and academicians. With a %54 percentage of respond they were aware of religious and cultural heritage in Antioch. Study revealed with greater amount people visited Saint Simeon Monastery before earthquake. Half of the participants reviewed religious heritage is important in promoting peace, smaller amount of group was not aware and others answered as it is not important. Half of the people thinks monasteries are important in cultural heritage of Antioch. The question of earthquakes impact on sense of identity and bonding of community through damage on monasteries, greater amount of responders were agreed only an amount of 17% were not sure. People are highly aware of coexistence of different religious communities in Antioch. After this relationship demolished by earthquake question were asked on re-functioning monasteries can be part of three monotheistic religions to come together and heal together, more than half of the responders agreed. Recent earthquake occurred on 6th February, 2023 with magnitude of 7.7 had a big impact on religious heritage as means of physical structures and more than that the communities are damaged (Figure 13).

Earthquake Damage on Habibi Neccar Mosque

Earthquake Damage on Greek Orthodox Church

Figure 13 Damage on religious heritage (Arkeofili, 2023; Gazete Oksijen, 2023)

By the result of highly agreement of responders on question of conserving religious heritage sites can benefit as to repair relationships, recover and heal. At the same time these places are where they have tourist attraction constantly and this will feed economic growth. City got greatly damaged by the earthquake. On the site observation it has been dedicated that, residential buildings, commercial buildings, schools got collapsed. Single-storey buildings were not having damage and this is where the only people left in the city are living. There are only few people living in the city because they had to shift out of the city where they could provide their daily needs. People who could not find a place to live are living in the tents which the government provided but their health is highly affected from the asbestos dust that comes out from demolishing process of the buildings (Figure 14).

Overall Situation of the City

Demolished School in Antioch

People are Living in the Tents

Asbestos Dust

Figure 14 Post-earthquake situation of Antioch (Pictures taken by Kalkan, 2024)

With the perception of local people that stayed in the city, academicians and religious communities' answers on survey questions shaped the findings of the research. 29% of the respondents, who are part of the local population group, did not recognize the heritage. When asked about the impact of religious heritage conservation on community healing, 63% of respondents cited fostering pride and identity, promoting tourism and economic opportunities, and organizing cultural events and gatherings.

Survey question on conserving and re-functioning damaged monasteries can significantly contribute bonding relationships of communities and healing together which is an act of reconciliation. 57% of people agreed with this solution. As a final result greater amounts of responder's thoughts are on monasteries are promoting peace and they can continue to sustain their culture by coming together. With a great amount of 70% of the responders answered on the active involvement in efforts to rebuild reconciliation and protect cultural heritage in Antioch.

As general review of survey results, responders are aware of earthquake did not only destroy physically but also demolished the relationship of communities. Heritage sites are important by means of cultural and religious heritage. Monastery of Saint Simeon can be transformed into a place where everyone can come as a whole, appreciate their significance.

Research findings gave the result of people are already doing the act of reconciliation already without notice. There was an event of Easter celebration in front of collapsed Antioch Greek Orthodox Church and different communities had attended (Figure 15). Also, a collaborative effort had shown in Christmas celebration in Antioch. Even though they are people with different beliefs they want to come together under the umbrella of common shared values of heritage and cover their wounds.

The Easter Celebration Conducted in Front of the Antioch Greek Orthodox Church Post-Earthquake

Christmas Celebration in Antioch Post-Earthquake

Figure 15 Christmas and easter celebrations in Antioch (BBC NEWS TÜRKÇE, 2023)

All the religious representatives of three Abrahamic religions came together and visited city's religious and historical sites on the date of 19 April 2023 (Açık et al., 2023). The aim of this visit was to give hope to people during this challenging time. In the speeches each of them gave they were mentioning that collaboration is important, this unity can heal the pain caused by the earthquake. They were giving information of historical significance, cultural richness and coexistence of Antioch to make local people aware. They were sharing prayers even if they were having different faiths, this represents the collective hope, resilience and reconciliation. While these were happening in religious communities, organizations started to publish platforms with names of Yeniden Antakya Platformu Derneği Kültürü Korumak ve İyileştirmek (Rebuild Antakya Platform for Preserving and Improving Culture), Korumaradyoda (Cultural Heritage and Preservation), Hatay Ortak Meselemiz

(Hatay, Our Common Issue), and Hatay Yeniden Ayakta Platformu (Hatay Rebuilds Platform) these are the actions of reconciliation (Figure 16).

Rebuild Antakya Platform Association	Preservation Radio	Hatay is Our Common Issue	Hatay Standing Again

Figure 16 Platform building awareness of Antioch

While the types of reconciliation mentioned in Figure 2 may be more than one suitable for this case but 'community reconciliation' is the most accurate type. It is the type of forgiveness that matters the most, it is all about bringing the communities together and fostering unity, healing and rebuilding the relationship within. This is the aim of utilizing religious heritage such as Saint Simeon Monastery as a tool for reconciliation among the communities affected by the earthquake in Antioch. By focusing on community reconciliation, looking into how religious heritage can help to bring people together, it can be possible to understand each other and make the relationship stronger.

Survey resulted the answer on further steps on to sustain permanent existence and usefulness of restored monasteries as; with 74% of responds on it is by creating partnerships with local companies, developing educational programs for youth and community members, establishing ongoing dialogue platforms for interfaith cooperation. In the post-earthquake rehabilitation Saint Simeon Monastery can play an important role by implementing to practice with plan that incorporates activities for community and social growth and it will significantly develop economy by this cultural heritage can sustain. This can be the call to people who forced to shift elsewhere because of the bad living conditions. This will be the approach to build the bridge of reconciliation. Saint Simeon Monastery is a living testament as tangible and intangible cultural heritage. Also, the result of the survey question on involvement in the efforts to build peace and protect cultural assets is that 70% of highly rated respondents said they would definitely participate, seven people with the amount of 20% were interested but depending on the condition (Figure 17). These responses demonstrate a great willingness to participate in the reconciliation process.

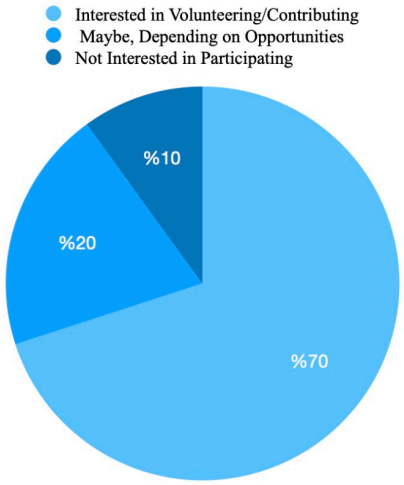


Figure 17 Reveal diverse levels of willingness among participants to actively engage in efforts aimed at building reconciliation and safeguarding cultural assets in Antioch

Result of Survey Questions

The analysis of the survey results makes it clear that earthquakes are not only damaging the buildings themselves, but also disrupting the relationship between the buildings and communities. It shatters the reconciliation bridge between Saint Simeon Monastery and its sacred assets. The general result of the responses has shown there is a need for this place; such a holy place should be restorated to be in use. The awareness of the importance of cultural and religious heritage is significantly higher than that of those who are not familiar with it. Communities aspire to transform the Monastery of Saint Simeon into a place where everyone can come together as one. The results show a shared desire to protect and repair religious and cultural heritage linked to the monastery, demonstrating how important it is as a communal resource.

- Local people: More than half of the local residents were aware of the heritage, while less than half were not, indicating a persistent lack of knowledge. Saint Simeon Monastery, with educational efforts and community involvement, can effectively address and reduce the knowledge gap.
- Religious communities: Calling religious groups emotional participants can reflect how they percieve their answers to the survey. This brings out how deeply they feel connected to religious historical sites. It is important to recognise and understand this emotion in order to create programs that can connect with beliefs and feelings. Including this emotion and cultural aspects together in the preservation can get more people involved in the community.
- Academicians: This is a well-informed group where opinions come from experts who know a lot about Saint Simeon Monastery's cultural, religious, and unique heritage. Scholarly perspectives contribute to their perceptions, enhancing academic knowledge. Engagement with scholars plays a crucial role in approaches to conserving cultural assets.

These findings provide a comprehensive understanding of participants' viewpoints and emotions at Saint Simeon Monastery, as well as the wider context of Antioch's cultural and religious heritage. In order to create a strong link between the past and present, it is essential to implement an integrated heritage approach for the Saint Simeon Monastery. This approach involves finding both the concrete aspects, such as the physical characteristics, and the intangible aspects that make the monastery distinct. Both the tangible and intangible aspects of the Saint Simeon Monastery should be considered to create a significant framework, and the findings can enable to understand their deep connections.

Tangible Heritage

- UNESCO Criteria: Architectural and artistic values represents the details of different eras, its healing location with the view of on top of everything, woven with spiritual value, collective soul of the community that exceed extents tangible architectural magnificence. Saint Simeon Monastery is not in the list of UNESCO's World Heritage List, it should meet at least one of the criteria which consists of (i) to (x) criteria (UNESCO, 2004). Saint Simeon Monastery aligns with Criterion (i), Criterion (iii), Criterion (iv) and Criterion (vi). Criterion (i), represent a masterpiece of human creative genius. Criterion (iii), bear a unique or at least exceptional testimony to a cultural tradition or to a civilization. Criterion (iv), be an outstanding example of a type of building, architectural or technological ensemble, or landscape that illustrates a significant stage in human history. Criterion (vi), be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance.
- Architectural and Artistic Value: The architectural elements of Byzantine style found on structures, columns, entrances, and floor mosaics symbolize the cultural significance and historical legacy of the monastery (Figure 11). Historical events resulted in subsequent alterations and reinforcements. The practical and symbolic components of Byzantine

architecture are effectively represented by these features of the monastery. Mosaics serve to enhance the aesthetic appeal of rooms by adding vibrant colors. They often depict religious motifs and contribute to the creation of visually captivating spaces. Arches in Byzantine architecture serve the dual purpose of evenly distributing weight and creating a sense of openness and height in the space. The monastery's structural design facilitates the daily operations of monastic life by incorporating expansive areas that provide a conducive spiritual ambiance. Overall, the features exhibit architectural refinement and hold cultural, religious, and historical importance.

- Historical Significance: The beauty of Saint Simeon Monastery is more than its architecture, it is a living testament to the historical significance of Antioch. The narratives give the site a sense of shared spiritual background. Its prayers and visitors are drawn for not only its architectural featured but also the connection with the sacred history carved in its Stones. The history still shapes the culture of the area, it connects the past to the present and welcomes everyone to be a part of the lasting memory.

Saint Simeon Monastery is s significant monument with architectural, artistic and historical values. It serves as a place where Saint Simeon's ultimate burial occurs. The monastery's Byzantine architecture, as shown by the Pillar of Saint Simeon, draws researchers and enthusiasts from across the globe. The spiritual importance of this place is well established in the region's history, interweaving a collective spiritual narrative within its stones. Although the monastery is not included in UNESCO's World Heritage List, it has inherent qualities that meet UNESCO's standards for acknowledgment, demonstrating global significance, cultural significance, and historical genuineness. The eventual acknowledgment would enhance the monastery's significance in the worldwide account of human history and spirituality.

Intangible Heritage

- Spiritual Values: The spiritual meanings of the Saint Simeon Monastery is deeply interwoven into the invisible work of art that goes beyond its physical beauty. The traditions, spiritual practices and beliefs connected with the monastery are not only monastery rituals, it shows what community symbolizes as a whole. It is a powerful force that brings people together, shapes the community’s identity and have been passed down from generations. The echos of prayers, sacred chants and quiet reflection creates monastery’s intangible aura. It is a source of spiritual richness that brings the community together in a shared journey.
- Community Behaviors and Beliefs: Beyond its physical presence, the monastery is where everyone in the community shares beliefs and acts in the same way. It is a lively hub where people do spiritual activities together and this gives sense of unity and purpose. Shared faith shapes the behavior in a way that is more than walls of the monastery and into the daily lives. It is influences on guiding the daily actions, community unity, ethical decisions, cultural traditions and social support. How people in the community acts and believe is connected. Shared beliefs and behaviors are keeping Saint Simeon Monastery alive. The heritage of the monastery is not only tangible.

Integration of Tangible and Intangible Heritage

- Model of Behavior - Integrated Heritage Approach: To build a powerful connection between the past and present, there should be an integrated heritage method for Saint Simeon Monastery. This method entails both identifying the physical (tangible) and the traditions and beliefs (intangible) that define the monastery's uniqueness. Guided towers and educational programs in the monastery help visitors not only understand the architecture, but also the cultural and spiritual values that keep the monastery alive. Combining and considering these elements allows for a full appreciation of the monastery

heritage's richness. This method promotes not only preserving the heritage but also dynamically engaging with the present legacy.

- Cultural Events and Celebrations: There are many cultural events and celebrations that Saint Simeon Monastery hosts to bring communities together. These events are not only displaying the physical richness of the monastery but also its rich history, art, and spiritual practices. Organizing activities, art shows, music performances, and traditional rituals can strengthen the bonds between community members and honor the shared heritage. The monastery gains vibrant cultural life from each activity and event, reflecting its meanings and keeping its significance alive. Additionally, this approach helps people feel proud and united, so they can keep monastery heritage alive by making it a part of their lives.

- Interfaith Dialogues: Saint Simeon Monastery acts as a place where people with different faiths, including the three Abrahamic religions of Christianity, Islam, and Judaism in Antioch, can come together and participate in interfaith dialogues. This post-earthquake conservation of religions is more than just religious differences; it helps to rebuild common understanding, perception, and collaboration within religious groups. By inspiring these interactions, different belief systems make the monastery serve as a bridge. This approach enriches the cultural diversity and promotes coexistence in Antioch. Collaboration can avoid social divisions, and shared values can foster respect and unite people. This is done through the interfaith dialogues at the monastery.

Healing Place and Gathering Hub

Saint Simeon Monastery, aside from being renowned for its healing properties, offers health and wellness activities. It blends ancient calm with modern wellness practices, and this creates a sanctuary for physical and spiritual restoration. Community engagement approaches encourage community members to contribute to the monastery's preservation, which fosters a sense of honor and ownership. These activities, including workshops and educational sessions, help locals view the monastery as a living part of their community, ensuring its relevance.

6. Conclusion

The recent earthquake in Antioch had a significant impact on religious heritage, causing physical structures and communities to be damaged. The survey results reveal that earthquakes not only damage the buildings but also disrupt reconciliation between the buildings and communities, shattering the relationship between the monastery and its sacred assets. However, conserving religious heritage sites can help repair relationships, recover, and heal. Religious heritage plays a crucial role in historical resilience and cultural bridges, both before and after earthquakes. It serves as a powerful tool for healing, unity, interfaith cooperation, preservation of cultural traditions, and educational resources. Saint Simeon Monastery can serve as a powerful tool for reconciliation due to its cultural, religious, and historical significance. Tourist attractions and economic growth are also contributing to the recovery process.

The visit by religious representatives from three Abrahamic religions to city's religious and historical sites give hope and promoted unity. In the visit representatives shared prayers and gave information about historical significance, cultural richness, and coexistence of Antioch. Representers were mentioning that the only way to recover from this disaster is to come together. Celebrating holy religious days in demolished religious buildings with rituals, ceremonies and traditions (Figure 15), platforms that are working on rebuilding relationships (Figure 16) and visits by religious representatives is a proof of possible reconciliation post-earthquake. By focusing on community reconciliation, religious heritage can help bring people together and strengthen relationships.

Religious representatives played an important role in encouraging local people to see the richness of Antioch's culture, they spread unity and thought it would give them the power to get through this challenge. They showed exemplary behavior and broadened the opinions of the locals,

so the answers to the survey questions were more conscious. The survey results indicate that the Saint Simeon Monastery, a living testament to both tangible and intangible cultural heritage, can be significantly improved by implementing post-earthquake rehabilitation plans that incorporate community and social growth activities. The survey also revealed that 70% of highly rated respondents would participate in the reconciliation process, demonstrating a willingness to participate in the process.

An integrated heritage approach identifies the tangible and intangible aspects of the monastery's uniqueness, promoting a full appreciation of its heritage as these aspects are reinforcing each other. Building itself serves as physical manifestation of intangible heritage that includes traditions, knowledge and rituals. Saint Simeon Monastery as building is enhanced by these practices, that makes it gain its significance from the intangible cultural heritage. History, art, and spiritual practices of the monastery embodies cultural expressions, historical narratives and social values. Activities, art shows, music performances, and traditional rituals provides the symbolic meaning and context that makes Saint Simeon Monastery valuable. These intangible aspects are crucial for the transmission of cultural values and knowledge from past to future. Without Saint Simeon Monastery, these practices cannot be performed, without these traditions the monastery is losing its cultural significance. It is crucial to understand this connection for a possible heritage conservation. Safeguarding the practices should be involved in preservation of the monastery. This study can be a base for further researches and it is open to research in different dimensions. It can form the basis for studies in different disciplines.

These mentioned cultural events and celebrations at the monastery brings communities together, showcasing the monastery's physical richness and rich history, art, and spiritual practices. Interfaith dialogues at the monastery help rebuild common understanding and collaboration within religious groups, fostering respect and unity. By repairing these relationships, communities will recover and heal, making it possible to rebuild the bridge of reconciliation.

References

Açık, D., Haktanıyan, E., & Avci, S. (2023), Depremden etkilenen Hatay'da 3 semavi dinin temsilcileri buluştu, Anadolu Ajansı, https://www.aa.com.tr/tr/asrin-felaketi/depremden-etkilenen-hatayda-3-semavi-dinin-temsilcileri-bulustu/2876686.

Arkeofili, 2023, Antakya'daki Depremde Habib-i Neccar Camisi Yıkıldı, https://arkeofili.com/antakyadaki-depremde-habib-i-neccar-camisi-yikildi/#google_vignette.

Baker, D., & Chitty, G. (2013). *Managing historic sites and buildings: reconciling presentation and preservation*. Routledge.

Brelsford, G. M., Fulmer, M. E., Harrison, M. A., & Xu, X. (2014). Religious coping and gratitude in emerging adulthood. *In Research in the Social Scientific Study of Religion*, *Volume 25* (pp. 32-52). Brill.

Brewer, G., Robinson, S., Sumra, A., Tatsi, E., & Gire, N. (2015). The influence of religious coping and religious social support on health behaviour, health status and health attitudes in a British Christian sample. *Journal of religion and health*, *54*, 2225-2234.

Contributors to Wikimedia projects, 2016, Monastery of Saint Simeon Stylites the Younger, Wikipedia, https://en.wikipedia.org/wiki/Monastery_of_Saint_Simeon_Stylites_the_Younger#:~:text=4%20References-,History,years%20of%20his%20long%20life.

Crawford, S. (2009). *Settlement and Social Differentiation*. A Companion to the Early Middle Ages: Britain and Ireland, c. 500–c. 1100, 432-445.

Diker, M., & Erkan, N. Ç. (2017). *Kent kimliğinde ibadet yapıları: Antakya örneği*.

Feilden, B., & Jo Kilehto, J. U. K. K. A. (2003). Management of World Heritage Sites. *HAFTSHAHR*, *1*(12, 13), 135-143.

Gale, W. G., & Potter, S. R. (2002). An economic evaluation of the economic growth and tax relief reconciliation act of 2001. *National Tax Journal*, *55*(1), 133-186.

Gazete Oksijen, (2023). Wall Street Journal yazdı: Antik Antakya 2 bin 400 yıl boyunca pek çok felaket atlattı, depremde yok oldu, https://gazeteoksijen.com/turkiye/wall-street-journal-yazdi-antik-antakya-2-bin-400-yil-boyunca-pek-cok-felaket-atlatti-depremde-yok-oldu-172124.

Gilchrist, R. (2020). *Sacred heritage: Monastic archaeology, identities, beliefs.* Cambridge University Press.

Harvey, P. (2012). *An introduction to Buddhism: Teachings, history and practices*. Cambridge University Press.

Jackson, M. (2020). The palm at the end of the mind: Relatedness, religiosity, and the real. Duke University Press.

Hatay Büyükşehir Belediyesi, (2021). Barlaam Manastırı, https://hatay.bel.tr/rehber/barlaam-manastiri.

Hatay. com, 2021, 4K ST. SİMEON MANASTIRI BELGESELİ, YouTube, https://www.youtube.com/watch?v=9fsTMktxSIk.

BBC NEWS TÜRKÇE, (2023). Antakya'da depremde yıkılan Rum Ortodoks Kilisesi önünde Paskalya Ayini, https://www.instagram.com/p/CrHLXwgoWrh/?img_index=1.

Jenkins, P., & Forsyth, L. (2009). *Architecture, participation and society*. Routledge.

Jokilehto, J. (2006). Considerations on authenticity and integrity in world heritage context. *City & time, 2*(1), 1.

Kalkan, B. (2024). Role of Religious Heritage as a Tool for Reconciliation Pre/Post Earthquake: The Case of Saint Simeon Monastery in Antioch, Turkey (Master's thesis, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ)).

Karakhanian, A. S., Trifonov, V. G., Ivanova, T. P., Avagyan, A., Rukieh, M., Minini, H., … & Bachmanov, D. M. (2008). Seismic deformation in the St. Simeon Monasteries (Qal'at Sim'an), *Northwestern Syria. Tectonophysics*, *453*(1-4), 122-147.

Lendering, J., 2024, Simeon de Styliet-De Pilaarheilige, Historiek, https://historiek.net/simeon-de-styliet-pilaarheilige/82370/.

McNeill, W. H. (2017). *The global condition: conquerors, catastrophes, and community*. Princeton University Press.

Meierhenrich, J. (2008). Varieties of reconciliation. *Law & Social Inquiry*, *33*(1), 195-231.

Mekonnen, H., Bires, Z., & Berhanu, K. (2022). Practices and challenges of cultural heritage conservation in historical and religious heritage sites: evidence from North Shoa Zone, Amhara Region, *Ethiopia. Heritage Science, 10*(1), 172.

Mısırlısoy, D., & Günçe, K. (2016). Adaptive reuse strategies for heritage buildings: *A holistic approach. Sustainable cities and society*, *26*, 91-98.

Mısırlısoy, D., & Günçe, K. (2023). Railways as Common Cultural Heritage: Cyprus Government Railway. *The Historic Environment: Policy & Practice, 14*(1), 112-128.

Motley Turkey, 2016, St. Simeon Monastery, https://www.motleyturkey.com/st-simeon-monastery/.

Nijkamp, P. (2012). Economic valuation of cultural heritage. The economics of uniqueness: Investing in historic city cores and cultural heritage assets for sustainable development, *75*, 75-103.

Olsen, D. H. (2006). *Management issues for religious heritage attractions. In Tourism, religion and spiritual journeys* (pp. 104-118). Routledge.

Petronela, T. (2016). The importance of the intangible cultural heritage in the economy. *Procedia Economics and Finance, 39*, 731-736.

Radzik, L., & Murphy, C. (2015). Reconciliation.

Scham, S. A., & Yahya, A. (2003). Heritage and reconciliation. *Journal of social archaeology, 3*(3), 399-416.

Smith, W. L. (2016). *Prayer in an American Cistercian monastery. In Monasticism in Modern Times* (pp. 124-142). Routledge.

Todt, K. P. (2004). Antioch in the Middle Byzantine period (969-1084): the reconstruction of the city as an administrative, economic, military and ecclesiastical center. Topoi. Orient-Occident, *5*(1), 171-190.

Torrey, C. C., & Simeon, S. (1899). The letters of Simeon the stylite. Journal of the American Oriental Society, *20*, 253-276.

Turkish Archaeological News, (2016). Monastery of St. Simeon near Antakya, https://turkisharchaeonews.net/site/monastery-st-simeon-near-antakya.

UNESCO, (2021). Definition of the cultural heritage | United Nations educational, scientific and cultural organization. (n.d.). UNESCO | *Building peace in the minds of men and women*. Retrieved from https://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/.

Viejo-Rose, D. (2016). *Reconstructing heritage in the aftermath of civil war: Re-visioning the nation and the implications of international involvement. In Political Culture, Soft Interventions and Nation Building* (pp. 7-30). Routledge.

Williams, P. (2008). *Mahayana Buddhism: the doctrinal foundations*. Routledge.

Resume

Bilge Kalkan is a Ph.D. candidate in Architectural Theory at Eastern Mediterranean University (EMU) while simultaneously working there as a research assistant. She has a Bachelor degree in the Architectural Program and a Master's (of Science) degree in the Architecture Program from EMU. She completed the Master's thesis titled 'Role of Religious Heritage as a Tool for Reconciliation Pre/Post-Earthquake: The Case of Saint Simeon Monastery in Antioch, Turkey' in 2024. Her research interests include architectural theory, cultural heritage and conservation.

Kağan Günçe is Professor of Architecture at Eastern Mediterranean University (EMU) in North Cyprus. He is a full-time professor in the Faculty of Architecture, EMU. He also serves as Vice-Chair of the Institute of Graduate Studies and Research at EMU. He has a Bachelor degree in Architectural Program, a Master (of Science) degree in Architecture Program and Ph.D. in Architectural Theory from EMU, Department of Architecture. He was the director of HERA-C (Housing Education, Research & Advisory Centre) and he was the head of the Interior Architecture Department at EMU. He was a long-time University senator and is currently the elected professor representative senator. His research interests include architectural theory, design, environmental psychology and conservation. He has articles, papers in many national and international journals & conferences, and international research projects in the mentioned fields. His academic work has received many citations in web of science platform.

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Urban parks in developing countries: Challenges and opportunities in Addis Ababa, Ethiopia

Bruktawit Getachew Kebede*
Devrim Yücel Besim**

Abstract

The scarcity of well-functioning green spaces in the rapidly growing urban centers of developing countries poses significant challenges, hindering the well-being and quality of life for urban populations. Urban parks, often referred to as the "lungs of the city," have the potential to alleviate these challenges, yet their benefits are not always evident. This study explores the challenges and opportunities faced by urban parks in developing countries through a comparative analysis of Janmeda Park and Entoto Park in Addis Ababa, Ethiopia. The research assesses key dimensions, including accessibility, sociability, comfort, image projection, and management/maintenance. These elements are vital for understanding how well urban parks serve their communities and contribute to urban development. While Janmeda Park, despite its historical importance, struggles with physical and operational challenges, Entoto Park's well-designed amenities, management, and safety provide a model for future park developments. The study offers recommendations to improve urban parks, such as enhancing accessibility, fostering sociability, ensuring user comfort and safety, strengthening image projection, integrating cultural and historical elements, and improving management and maintenance. It also highlights the importance of monitoring and evaluating park performance. These recommendations aim to guide urban planners and policymakers in enhancing urban parks, thereby supporting community well-being and promoting effective urban development. The insights provided are intended to inform better practices for urban park planning and management, contributing to more vibrant and functional green spaces in developing cities.

Keywords: developing countries, urbanization, urban parks

1. Introduction

Urbanization is a defining feature of the modern era, with a growing percentage of the global population residing in cities (United Nations, 2018). While urbanization brings about economic growth and opportunities, it also gives rise to challenges related to environmental degradation, congestion, and diminished green spaces (Glaeser et al., 2001). In this context, urban parks emerge as vital components in the urban landscape, providing relief from the pressures of urban living and contributing to the overall well-being of residents.

In developing countries, the significance of urban parks is particularly pronounced. As these nations undergo rapid urbanization, they often face issues of overcrowding, inadequate infrastructure, and limited access to basic amenities (World Bank 2018). Urban parks can serve as oases of tranquility and recreation, offering citizens a place to connect with nature, engage in physical activities, and foster a sense of community (Wolch et al., 2014). Furthermore, they can play a role in mitigating the negative impacts of urbanization, such as air and water pollution, by providing green areas that support ecological balance (Bolund & Hunhammar, 1999). Despite their potential benefits, urban parks in developing countries like Ethiopia are often hindered by a range of challenges, including limited resources, inadequate planning, and poor management (Roberts et al., 2012).

*(Corresponding author) M.Sc., Sapienza University of Rome, Italy, bruktawitk77@gmail.com
**Assoc. Prof. Dr., Cyprus International University, Cyprus, dbesim@ciu.edu.tr
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This study seeks to explore the challenges and opportunities of urban parks in developing countries through a comparative analysis of two emblematic cases in Addis Ababa, the capital of Ethiopia. By examining Janmeda Park and Entoto Park, this research aims to identify common challenges faced by urban parks in similar settings and provide insights that can inform strategies for enhancing their impact.

By understanding the challenges and opportunities presented by these cases, this research contributes to the broader discourse on urban park planning and management in developing countries. The lessons and recommendations derived from this study aim to guide policymakers, urban planners, and stakeholders in formulating more effective strategies for developing and enhancing urban parks that truly serve the needs of communities in developing countries.

1.1. Research Approach and Methodology

This study adopts a comparative case analysis approach to delve into the effectiveness of urban parks in developing countries. Janmeda Park and Entoto Park in Addis Ababa were selected due to their historical and functional significance (Figure 1). Janmeda, as the city's oldest park, contrasts with the newly developed Entoto Park, offering a rich comparison in terms of historical value and contemporary urban park design. Through an evaluation of these cases, it's intended to identify critical aspects that influence urban parks in developing countries. The analysis encompasses parameters such as, accessibility, sociability, comfort, image, Management and Maintenance.

Data collection involved site observations, document analysis, and semi-structured interviews with park managers and other relevant stakeholders. Site observations were systematically recorded, noting physical attributes, user behaviors, and environmental conditions. Document analysis included reviewing historical records, planning documents, and policy papers to understand the development context of each park.

These data sources were synthesized to provide a comprehensive understanding of each park's challenges and opportunities. A comparative analysis employing descriptive and qualitative methods, including photographs, illustrative figures, tables, and textual data, was applied to evaluate the findings across the five dimensions.

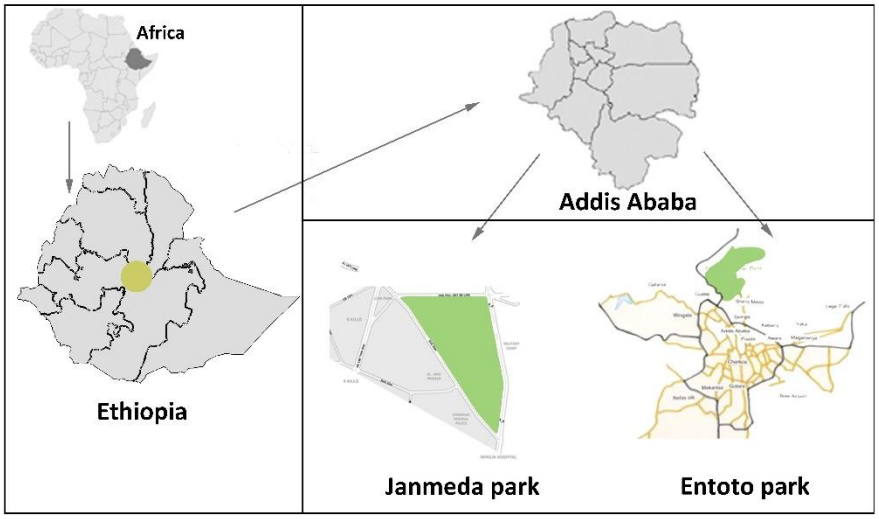

Figure 1 Geographic location of the selected cases for the study (Diagram by author)

In the following chapters, a detailed analyses of Janmeda Park and Entoto Park will be conducted, evaluating their performance within the parameters of the study. Through this examination, its aimed to identify common trends, challenges, and opportunities that illuminate the broader issues faced by urban parks in similar contexts, that can inform recommendations for enhancing the effectiveness of urban parks in developing countries, benefiting both local communities and the cities they inhabit.

2. Urban Parks in Developing Countries: Challenges and Opportunities

The unprecedented pace of urbanization in developing countries presents a pressing need for urban planners to address various social, environmental, and health-related challenges (United Nations, 2018). Urban parks, often referred to as "lungs of the city," have the potential to mitigate these challenges and provide numerous benefits to urban populations.

Urban parks offer respite from the concrete jungle, serving as essential components of the urban landscape. They play a pivotal role in improving air quality, reducing noise pollution, and providing spaces for physical activity and relaxation (Nowak & Dwyer, 2000). In developing countries, where access to nature may be limited for many residents, urban parks become vital spaces for recreation, cultural activities, and community engagement (Wolch et al., 2014).

Urban parks in developing countries confront a myriad of challenges that impact their effectiveness. These include issues related to, Rapid urbanization, population growth, inadequate planning, inadequate resources, urban poverty, and competing land uses (Roberts et al., 2012). In Addis Ababa, as in many other cities in the Global South, these challenges are pronounced. The pressures of urban growth often result in encroachments on parkland, making it difficult to preserve and expand green spaces (Akhtar, 2018).

This section delves key characteristics for evaluating urban parks and examines their relevance and role within the urban context, setting the foundation for the subsequent analysis.

2.1. Characteristics for Evaluating Urban Parks

Urbanization is rapidly reshaping developing countries, and as cities grow, so does the need for accessible and functional urban parks. In these settings, the need of urban parks extends beyond traditional considerations and touches upon issues of economic development, social equity, and environmental sustainability. In Ethiopia, a country undergoing rapid urbanization, understanding and enhancing the effectiveness of urban parks is of paramount importance to foster livable and resilient cities.

In evaluating the development of urban parks, various characteristics have been proposed to gauge their success, each emphasizing distinct aspects of their effectiveness. The Project for Public Spaces (PPS) has identified four key indicators: Uses and Activities, Access and Linkage, Comfort and Image, and Sociability (Project for Public Spaces, 2016). These indicators have been adopted for this study, though with some modifications to better align with the specific context and goals.

Modified Characteristics for This Study:

- *Accessibility:* This indicator combines the ideas of Access and Linkage from the PPS framework, focusing on how easily people can reach and navigate through the park.
- *Sociability:* This aspect merges the concepts of Uses and Activities with Sociability. It assesses how the park facilitates social interactions and the range of activities available to users.
- *Comfort:* This characteristic stands alone, reflecting the park's physical and environmental comfort levels, including amenities and overall user satisfaction.
- *Image Projection:* While PPS combines this with Comfort, this study separates it to specifically address how the park's design and aesthetics contribute to its public image and perception.
- *Management and Maintenance:* An additional characteristic introduced in this study, focusing on the effectiveness of park upkeep and operational management, which is crucial for the park's long-term success.

These modifications refine the evaluation framework to better address the specific needs and objectives of urban park development, ensuring a comprehensive assessment of their effectiveness.

2.1.1. Accessibility

Accessibility is a major component of effective urban parks. Kellett (2009) defines accessibility as "a people's ability to get to a certain green space." Moreover, it is the capacity to benefit from the activity that is conducted in the green space. Parks should be easily reachable by residents from diverse socio-economic backgrounds. According to Addas and Maghrabi (2020), urban parks within walking distance are more likely to be used. Urban parks should be designed to be responsive to potential users, the environment, and the needs of different groups of people. Despite this, Kellett (2009), recommends that a successful urban park should include a diverse range of activities rather than simply one. Equitable access will benefit the overall function, leisure, and safety of public spaces. In many developing countries, limited transportation options and spatial inequalities may hinder accessibility to green spaces (Roberts et al., 2012). Ensuring inclusivity is equally important, as parks should cater to the needs of all citizens, including people with disabilities (UN-Habitat, 2013). The accessibility of an urban park can be assessed by examining its connections to its surroundings, both visually and physically (City of Gold Coast, 2018).

2.1.2. Sociability

The social aspect of urban design refers to the relationships between space and society (Saikia, 2015). According to Whyte (1998), people wish to get away from the crowd and other people, but they really do the opposite. It's pretty clear that people naturally gravitate toward socially active and welcoming environments. However, many public settings nowadays appear to have been purposefully created to be watched but not touched. When an urban park is empty, it will be vandalized or used for undesirable functions. The relationship between individuals and their environment is best considered as a continuous mutual process in which people create spaces while simultaneously being influenced by those spaces. Empirical studies indicate that well-designed parks with spaces for gathering, events, and cultural activities encourage greater sociability (Carr et al., 1992). Furthermore, involving the local community in park planning and management can enhance community engagement and ownership (Lindhjem et al., 2014). This dimension may be assessed by the examination of the presence of various social groups, the establishment of social societies, and cohabitation at various times of the day (Project for Public Spaces, 2016).

2.1.3. Comfort

User comfort and safety are paramount to the effectiveness of urban parks. An inviting and secure environment encourages greater use. Factors such as shading, seating, cleanliness, lighting, and the presence of amenities like restrooms play a pivotal role in creating comfortable park experiences (Bedimo-Rung et al., 2005). Conversely, safety measures, such as visible security and surveillance, reduce the perception of risk and contribute to overall safety (Kuo et al., 1998). If the initiation of the urban park is to invite different types of users, then women, children, and the elderly need to feel welcome. Urban parks must be built to minimize the potential for crime and violence, as well as to provide public areas where people feel safe and secure.

2.1.4. Image Projection

The image projected by urban parks can influence their attractiveness and relevance to the community. It's associated with aesthetics and the uniqueness of urban parks (Project for Public Spaces, 2016). Aesthetics consider how the physical features of an urban park are laid out based on the aesthetic elements used. The presence of trees and bushes, flowers, grass, natural settings, and water features are all aesthetic aspects that impact the usage of urban parks (Ayala-Azcárraga et al., 2019). Other important design issues related to aesthetics include the size of an urban park, the layout, landscaping, and the balance between soft and hard landscape, topography, cleanness, uniqueness, and visually appealing aesthetic elements that trigger the human senses (Ismail 2017).

Uniqueness of urban park is characterized by incorporating physical, historic, cultural, and natural features of the site into the design of the urban park together to create a unique sense of place (Bolund & Hunhammar, 1999). Each urban park should celebrate the special features that

provide its unique identity and help the community engage and learn. Highlighting these elements fosters community pride and a sense of ownership (Lindsey & Maraj, 2017).

Urban parks, by their very nature, need extensive management and maintenance. The maintenance of urban parks is among the most critical factors influencing their use. It should be applied to both hard (non-green) and soft (green) structures. Maintenance of soft structures deals with landscaping and vegetation in order to guarantee that they do not overgrow, resulting in invisibility in the park and along routes. On the other hand, hard structure maintenance deals with recreation equipment and amenities to ensure a high-quality, safe, and user-friendly park (Kellett, 2009).

2.1.5. Maintenance and Management

Urban parks, by their very nature, need extensive management and maintenance. The maintenance of urban parks is among the most critical factors influencing their use. It should be applied to both hard (non-green) and soft (green) structures. Maintenance of soft structures deals with landscaping and vegetation in order to guarantee that they do not overgrow, resulting in invisibility in the park and along routes. On the other hand, hard structure maintenance deals with recreation equipment and amenities to ensure a high-quality, safe, and user-friendly park (Kellett, 2009).

Parks and their assets must be easy to manage and financially sustainable. In park design, an awareness of long-term financial sustainability is critical (City of Gold Coast, 2018). Actually, many of the most basic and significant features of parks are inexpensive to build and maintain. For instance, trees, paths, grass, and benches are simple park elements that can last for generations and have wide appeal. For the expensive facilities that are required, careful design and planning are needed in order to assure durability and low ongoing maintenance costs. The following are the main aspects of urban park management and maintenance (City of Gold Coast, 2018).

3. Urban Park Development in Addis Ababa and Analysis of Cases

Addis Ababa, the capital city of Ethiopia, is emblematic of many developing cities experiencing rapid urbanization, with a population of 5,005,524 people (Addis Ababa Population, 2021). With growing urbanization, the city is facing multiple problems related to its spatial and physical development (Tsegaye, 2007). These city problems are well revealed by the poor quality of its urban parks. Although the city's physical and social infrastructure has improved in quantity over the last few decades, it still needs considerable distribution and quality improvements. The government's urban investment initiatives, which combine environmental improvements with economic prospects have shown promising results. However, policies and strategies must be assessed, improved, or changed in context of their contribution to resolving the city's ongoing challenges.

3.1. The Evolution of Urban Parks in Addis Ababa

Urban parks in Addis Ababa have evolved significantly over time, reflecting broader changes in urban planning and societal needs. Historically, the development of open spaces in Addis Ababa began with the natural landscape used for various purposes during different eras of the monarchy. These spaces were used for festivals, religious ceremonies, political events, and markets. For instance, Emperor Menelik II's era saw the use of open spaces for public gatherings such as horse races at Janmeda. Religious ceremonies like Meskel (the finding of the true cross) and Timiket (Epiphany) were also celebrated in large open areas. Additionally, these spaces served as marketplaces where people gathered for trade.

As the city expanded and foreign planners introduced new concepts, the approach to urban park planning transformed. The natural open spaces became more systematically organized and segregated according to their functions. The city saw the emergence of local, district, and city-level urban parks, each serving different purposes based on their location and context. The evolution of

urban parks is summarized in Figure 2, which illustrates the timeline of development from functional open spaces to more structured urban parks.

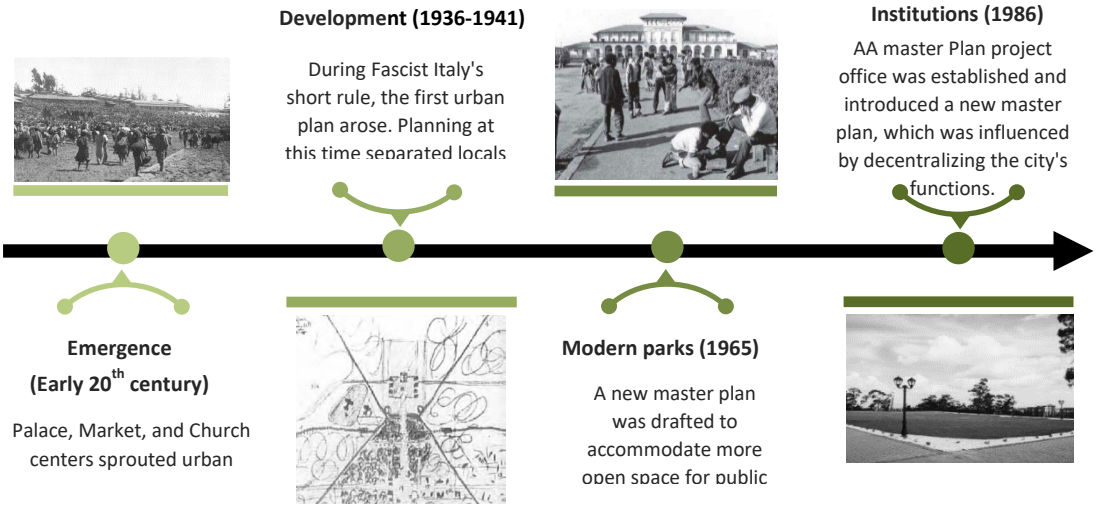

Figure 2 Historical development Addis Ababa's of urban park (Diagram by author)

3.2. Urban Parks Policies and Standards in Addis Ababa

There are three levels of government in Addis Ababa: one municipality, ten sub-cities, and 116 districts (or woredas). The city is the country's social, economic, and political center. Diverse urban park types may presently offer different services to a city, but their provision in terms of size, international standards, and demography doesn't seem to be satisfactory (Kassaye, 2017).

Therefore, additional in-depth investigation is necessary to identify the current state and constraints of these spaces. Generally, urban planning and design in Addis Ababa have not yet given proper attention to the importance of urban parks. Most of the parks in Addis Ababa were built in the 1970s, due to their long age they are deteriorated and no longer suit the interests of visitors reducing their capacity to perform their vital social, economic, and ecological functions. According to the 2003 master plan, around which the city is currently being developed, urban open spaces are classified as open spaces at the local, district, and city levels (Table 1).

Table 1 Classification of Urban Open Spaces in Addis Ababa (Table by Author)

	Local level	**District level**	**City level**
Picture and description	 These spaces are usually used by children for recreational activities in neighborhoods.	 Consist of street sides, parks & square. Most of this spaces are located in the center of the city.	 Are forest areas that are located on mountainous areas of the city which are being preserved.
Size	<0.3 hectare	0.3-10 hectare	> 10 hectares
Administrator	Woreda	Sub city	city

The structural plan is one of the plans that have been acknowledged under Proclamation No. 547/2008. Among the topics that the structural plan has to address, environmental issues have been recognized and recommendations have been set out. This environmental policy is the country's relevant policy regarding urban parks. Green infrastructure is one of the topics covered under environmental policy. The term "green infrastructure" is used to describe any kind of green space in Addis Ababa. It is a multifunctional open space network that includes parks, woods, gardens, green corridors, street greenery, open courtyards, and river banks.

Ethiopia has attempted to address environmental degradation in several ways since the 1992 Rio-Summit conference in Brazil. In 1995, the first and most important move was to add an article (Article 44) to the country's constitution, which states that Ethiopians have the right to live in a healthy environment (Birru, 2014).

Aside from that, a Greening and Beautification Office was set up. Following the aforementioned decisional action, a great effort was made on the master plan revision conducted in 2003, which is still the city the is currently being developed around. Among the surprising policies stated in this master plan was the allocation of 22,000 hectares (41%) of the city's 54,000 hectares for open space and greenery purposes, which, like the rest of the policies, is more on paper than in actual implementation.

The structural plan (2017-2027) outlines the expansion of current urban parks as well as the development of new parks. However, the structural plans do not provide a clear explanation of the purpose of these urban parks, the activities that should take place there, as well as their administration and upkeep; in general, the requirements stated in the structural plan are not precise.

3.3. Analysis of Cases

This study looked at the two city-wide parks in Addis Ababa - Janmeda and Entoto. Janmeda Park and Entoto Park stand as significant landmarks within Addis Ababa, embodying historical and cultural narratives that intertwine with the urban fabric. These two urban parks offer unique perspectives on how such spaces evolve over time, influence communities, and respond to changing needs.

3.3.1. Urban Case 1: Janmeda Park

Janmeda is a historic urban park established in the north east part of Addis Ababa, covering a total area of 2.5 hectares. Janmeda came to prominence during Emperor Minilik II time. It was one of the spots where the royal family and their entourage used to play horse racing and polo (Giorghis & Gérard, 2007). The Ethiopian nobility and foreign diplomats were also frequent visitors. Today, different city residents use urban parks for different reasons at different times of the year. In contrast to most of the city's parks, which demand a fee, this is a free public park.

3.3.1.1. Accessibility

Location: Janmeda Park is strategically located at the heart of Addis Ababa, within the city center. This prime location ensures its accessibility to a large urban population.

Entrances and Exits: The Park has multiple entrances, primarily along key city streets, ensuring convenient access for pedestrians. However, it is crucial to note that the park is encircled by high walls and fences, making it less visible from a distance.

Accessibility for All: Unfortunately, Janmeda Park lacks proper facilities to accommodate visitors with disabilities. There are no ramps, special pathways, or designated facilities that ensure inclusivity.

Traffic Flow: There is no controlled path within the park (Figure 3). Additionally, there are no walkways that connect the park with the adjacent areas. Vehicular traffic flow around the park can be challenging, especially during peak hours. The park's proximity to major roads often results in congestion, affecting accessibility.

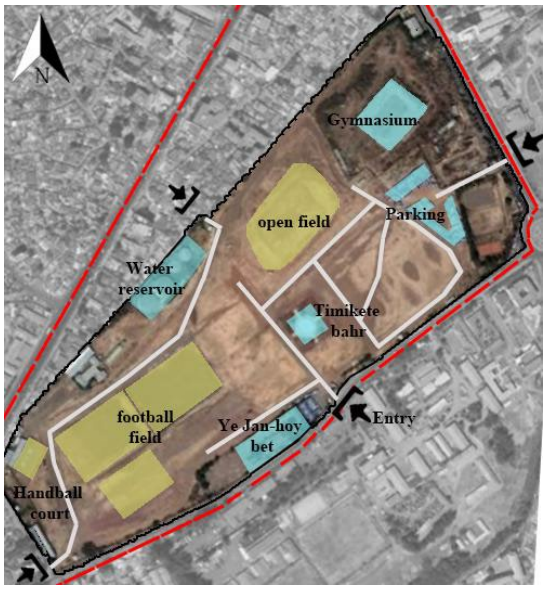

Figure 3 Map showing paths of Janmeda (Diagram by author)

3.3.1.2. Sociability

User Demographics: Visitors to Janmeda Park are primarily young adults and families. However, there is a noticeable absence of a balanced representation of different age groups, and limited diversity among users

Social Interaction: While the park attracts groups of visitors, social interaction among users is relatively limited. Visitors often define their own territories within the park, reducing opportunities for spontaneous socializing.

Events and Activities: Janmeda Park predominantly hosts sports activities, including football and athletics in line with some occasional social activities (Figure 4). While these events draw crowds, the activities are not well organized.

Figure 4 Frequent and occasional activities of Janmeda (Diagram by author)

3.3.1.3. Comfort

Safety and Security: The Park faces significant safety and security challenges. There is a lack of technological advancements in security measures, leading to concerns among visitors.

Shading and Seating: Janmeda Park lacks adequate shading structures, making it less comfortable during hot weather (Figure 5). Seating areas are minimal, and visitors often bring their own portable chairs.

Cleanliness: The Park's cleanliness is a concern. There are limited waste bins and a lack of proper waste management, resulting in littering.

Facilities: Janmeda Park lacks essential facilities such as restrooms and drinking fountains. This impacts visitor comfort negatively.

Figure 5 Image showing the lack of comfort in Janmeda Park (Diagram by author)

3.3.1.4. Image Projection

Aesthetics: The Park's visual appeal is modest at best. There are minimal landscaping efforts, and the park lacks artistic or architectural elements that could enhance its aesthetics.

Historic Integration: Janmeda Park has historical significance, but these elements are not effectively integrated into its facilities or design (Table 2). The historical aspects remain understated.

Uniqueness: The Park's uniqueness is limited, as it primarily focuses on sports activities, lacking the diversity found in more successful urban parks.

Table 2 Historical Elements of Janmeda (Table by Author)

Ye Jan-hoy Bet	**Starter's Rostrum**	**EOTC Baptism Field (Timikete bahr**	**Bodyguard Band Rehearsal Building**
			
Former museum, burned down due to neglect.	Abandoned structure built during Haile Selassie's reign.	Reserved for church ceremonies, open on special days	Historic building, now used as a residence

3.3.1.5. Management and Maintenance

Urban parks, by their very nature, need extensive management and maintenance. Like most urban parks in Addis Ababa, Janmeda is not well managed and maintained despite its importance throughout history. The hard (non-green) structures in the park are aged and deteriorated due to lack of attention, and also the soft (green) elements of the site are poorly managed. Few studies have examined the challenges and consequences of the multiplicity of ownership in Janmeda. The management of Janmeda has become problematic because of conflicting ownership. The ownership conflict is among the AA water and sewerage authority (which has built water tanks in the park), the Addis Ababa Sports Commission, the Ethiopian Orthodox Church (which has fenced a few square meters for the Timiket procession), and the BPCDAA.

None of these stakeholders have access to a venue or platform to debate how Janmeda should be handled. The several parties involved in the administration of the park do not seem to have a well-defined division of work. There has been a clear deterioration in both the park's physical and aesthetic qualities as a direct result of the struggle that has been going on for some time. According to the city's environmental policy, the BPCDAA is in charge of the establishment and administration of urban parks in the city. Janmeda, on the other hand, has become a name without a legal owner. The majority of the hard structures in the park were constructed in the 1950s, but since then, no repairs or maintenance have been performed, which has led to deterioration. The park is not well vegetated and guarded, which led to its ineffectiveness.

3.3.2. Case 2: Entoto Park

The park is located on the southern slopes of Mount Entoto between Addis Ababa's northern and southern limits (at 2,600 m) with a total area of 1,300 ha. (Haile & Getaneh, 1989). Entoto Mountain formerly served as an imperial residence and court for Emperor Minilik in the 1800s. Then it was maintained as a natural park for almost 100 years. Later in 2020, Ethiopia's prime minister formally designated part of it as an urban park and it's now a fully functional park providing visitors with a broad variety of exciting indoor and outdoor recreational options. The relevance of Entoto Park in bolstering the city's service economy and radically altering the city's appearance and experience cannot be overstated.

3.3.2.1. Accessibility

Location: Entoto Park is situated in a historically and naturally significant area, part of the Entoto Mountain range. While it's not as centrally located as Janmeda, its unique setting offers a different type of accessibility.

Entrances and Exits: The Park features well-defined and welcoming entrances that connects the various sections in the park by sub-roads (Figure 6). These entrances contribute to a positive first impression.

Accessibility for All: Similar to Janmeda Park, Entoto Park also falls short in providing facilities for visitors with disabilities. It lacks ramps, specialized pathways, or facilities for inclusivity.

Traffic Flow: As the park is car-free, visitors must walk or use bicycles within the park. The absence of vehicular traffic contributes to a safer and more tranquil environment.

Figure 6 Map showing entrances of Entoto Park with their linking services (Diagram by author)

3.3.2.2. Sociability

User Demographics: Entoto Park attracts a diverse range of visitors, including families, individuals, and tourists. It accommodates a broader spectrum of age groups and social backgrounds compared to Janmeda.

Social Interaction: The Park's layout, amenities, and open spaces encourage social interaction among visitors. It provides opportunities for diverse user groups to interact naturally.

Events and Activities: Entoto Park offers a wide variety of both indoor and outdoor activities, including a library, sports fields, dining options, and recreational facilities (Figure 7). This diversity of activities fosters social engagement.

Figure 7 Different activities in Entoto Park (Diagram by author)

3.3.2.3. Comfort

*Safety and Security***:** Entoto Park's design promotes user visibility, reducing vulnerable settings. This contributes to a safer environment.

Shading and Seating: The Park features shaded areas and well-maintained seating, enhancing visitor comfort. Restrooms, rest areas, and shops are available at regular intervals, improving convenience.

Cleanliness: Entoto Park maintains a higher standard of cleanliness compared to Janmeda. Adequate waste management and clean facilities contribute to a more pleasant experience.

Facilities: The Park is well-facilitated with essential amenities, providing a wide range of services to visitors, enhancing their overall experience.

3.3.2.4. Image Projection

Aesthetics: Entoto Park's design incorporates natural elements and crafted statues, enhancing its visual appeal. It blends with the historic and natural environment effectively.

Historic Integration: While the park doesn't celebrate its historical features as a central design element, it harmoniously coexists with its historical surroundings (Table 3).

Uniqueness: Entoto Park is unique in its size, diverse amenities, and the variety of activities it offers. This diversity contributes to its uniqueness within Addis Ababa.

Table 3 Historical Elements of Entoto Park (Table by Author)

Menelik's Palace	**Saint Raguel Church**	**Entoto Mariam Church**
		
Former royal residence, undergoing restoration.	Ethiopian Orthodox church with ornate paintings.	Ancient church and burial site of Emperor Menelik II.

3.3.2.5. Management and Maintenance

The management of the parks is held by the Addis Ababa city administration, and supportive services are managed by the contract owners of the facility. Common areas and activity areas are maintained by park staff, and security is maintained by the guards employed by the park and some federal police staff. Private services are managed and maintained entirely by themselves. This

makes them responsible. This responsibility gave the owner time to think about the quality of their service and customer care.

In the subsequent sections, discussion will center on the broader implications of these findings, extracting insights that can inform urban park policies and improvements in Addis Ababa and similar urban centers.

4. Discussion

Addis Ababa's open spaces were initially used for royal and religious purposes. As the city grew, parks were classified into local, district, and city levels based on size and administration. Local parks are under 0.3 hectares, managed by Woreda; district parks range from 0.3 to 10 hectares, managed by the Sub-City; and city parks exceed 10 hectares, managed by the city.

The city's 2017–2027 Environmental Policy and Structural Plan emphasize the need for improved parks but lack specific guidelines. The BPCDAA, responsible for park development and management, also lacks a clear policy and operational instructions.

Current existing parks suffer from poor management. Proposed Park areas are often repurposed, leading to safety concerns as social events spill into streets.

Management is fragmented among various agencies, with the BPCDAA facing institutional and administrative challenges. If trends continue, parks may be converted into built-up areas, leaving residents without adequate recreational options and worsening city-wide issues.

Case studies of Janmeda Park (old) and Entoto Park (new) reveal that many parks are outdated and fail to meet modern standards or community needs. There's a clear need for better standards and improved management.

In this chapter, a comprehensive discussion of the results obtained from the case analysis of Janmeda Park and Entoto Park in Addis Ababa will be undertaken. By comparing and contrasting these two cases, valuable insights are extracted that shed light on the broader implications for urban park development in developing countries. The comprehensive findings, are discussed in the context of five factors. It can be seen the general characteristics of selected cases in comparative approach in Table 3. The later Table (Table 4) shows the detailed comparative analysis of bored in five parameters.

Table 4 General Information on the Two Cases (Table by Author)

Aspects	Janmeda Park (Case 1)	Entoto Park (Case 2)
Scale	2.5 hectares	1,300 hectares
Site Context	City center	Historical & natural
Design Approach	Evolved over time	Economic renovation
Special Features	Sport arenas	Diverse activities
Spatial Relation	Unstructured paths	Gate-linked sections

Accessibility

Accessible urban parks are more likely to attract a diverse range of users. Janmeda Park, despite its central location within Addis Ababa, presents accessibility challenges. The absence of defined pathways and limited connectivity with neighboring buildings hinder its accessibility. This limitation highlights the importance of urban planning that seamlessly integrates parks into the surrounding urban fabric. In contrast, Entoto Park, although located farther from the city center, excels in terms of access and connectivity. Well-planned pathways, strategically positioned entrances, and interlinked sections create an environment that encourages inclusivity. The park's success in fostering sociability, despite its geographical distance, underscores the significance of thoughtful design and integration with transportation networks.

Sociability:

Urban parks are envisioned as vibrant spaces that facilitate social interaction among diverse user groups. However, both Janmeda Park and Entoto Park exhibit limitations in fostering meaningful sociability. In Janmeda Park, users tend to form territorial groups, hindering cross-interactions. This underscores the importance of park layouts and amenities that encourage communal gathering and interaction, allowing for the integration of various social backgrounds, ages, and genders. Entoto Park presents a more successful model in promoting sociability. Its variety of activities and clear pathways facilitate encounters among users with diverse interests. The strategic placement of seating areas, restrooms, and shops contributes to a comfortable environment for socializing. The comparison emphasizes the role of design and amenities in shaping user behavior and interaction patterns.

Comfort:

Comfort and safety are paramount to the success of urban parks. Janmeda Park faces challenges in this regard, with issues ranging from poor shading and seating to inadequate cleanliness. The absence of proper security measures and the presence of undesirable activities deter potential users from fully utilizing the park. These problems underscore the importance of regular maintenance and the implementation of safety features to create a welcoming environment. Janmeda Park's ineffective management, stemming from conflicting ownership and unclear division of responsibilities, negatively affects its physical condition and functionality.

In contrast, Entoto Park excels in providing a safe and comfortable space for visitors. Its well-maintained infrastructure, clear signage, and careful placement of seating areas contribute to an overall pleasant experience. The emphasis on safety through design demonstrates the potential of urban parks to serve as secure havens within the urban landscape.

Image Projection:

The image projected by urban parks plays a crucial role in attracting users and fostering a sense of pride in the community. Janmeda Park's historical significance is not effectively integrated into its design, leading to its underappreciation as a historical landmark. This illustrates the importance of highlighting and preserving historical elements within urban parks, contributing to their unique identity and cultural value.

In contrast, Entoto Park effectively integrates historical features, leveraging them to create a distinctive and memorable atmosphere. The incorporation of historic buildings and natural elements enhances the park's aesthetic appeal and cultural significance. This serves as a reminder of the potential of urban parks to serve as repositories of history and culture.

Management and Maintenance:

As the study indicates, the management and maintenance of Janmeda is very poor, like most urban parks in Addis Ababa, despite its importance throughout history. which is due to its conflicting ownership among the AA water and sewerage authority (which has built water tanks in the park), the Addis Ababa Sports Commission, the Ethiopian Orthodox Church (which has fenced a few square meters for the Timiket procession), and the BPCDAA. However, the city's environmental policy clearly states that the BPCDAA is in charge of the establishment and administration of urban parks in the city. However, Janmeda has become a name without a legal owner.

The above-mentioned stakeholders need access to a venue or platform to debate how Janmeda should be handled and set up a well-defined division of work so as to make Janmeda as important as before. The majority of the hard structures in the park were constructed in the 1950s, but since then, no repairs or maintenance have been performed, which has led to deterioration, which has led to the park's ineffectiveness. Unlike Janmeda, the findings show that Entoto Parks' management

is way better. The management of the parks is held by the Addis Ababa city administration, and supportive services are managed by the contract owners of the facility.

Table 5, below offers a concise comparative evaluation of Entoto Park and Janmeda Park across key aspects related to park accessibility, sociability, comfort, image projection, and sustainability. The sub-aspects within each category highlight the parks' distinctive features and performance in these crucial dimensions. This comparison aids in understanding the strengths and areas for improvement of both urban parks, providing valuable insights for future urban park developments.

Table 5 Comparative Evaluation of Urban Parks (Table by Author)

Aspect	Sub-Aspect	Entoto Park	Janmeda Park
Accessibility	Location	Historically-natural area	Central city location
	Entrances and exits	Defined, welcoming	Uncontrolled access
	Accessibility for All	Limited facilities	Limited facilities
	Traffic Flow	Car-free, pedestrian	Unrestricted access
Sociability	User Demographics	Diverse visitor range	Segmented user groups
	Social Interaction	Encourages interaction	Limited communal areas
	Events and Activities	Diverse activities	Limited options
Comfort	Safety and Security	Promotes visibility	Safety issues, poor facilities
	Shading and Seating	Shaded areas, seating	Lack of shading, seating
	Cleanliness	Well-maintained	Inadequate cleanliness
	Facilities	Well-facilitated	Lacks amenities
Image Projection	Aesthetics	Natural elements, statues	Historical features underutilized
	Historic Integration	Harmonious coexistence	Historical features underutilized
	Uniqueness	Unique, diverse amenities	Historical significance underutilized
Maintenance/ management	Ecological Impact	Positive ecological impact	Conflicting ownership
	Ownership Management actors	Conflicting ownership among different parties	The management is held by the city administration, and supportive services are managed by the contract owners.
	Maintenance	poorly maintained	well maintained
	Entrance fee	Free	Free

Implications for Developing Countries

The case analysis of Janmeda Park and Entoto Park provides valuable insights into the challenges and successes of urban parks in developing countries. By examining various aspects of urban park, holistic understanding of the factors that shape their impact on communities is gained. The lessons drawn from these cases can inform recommendations that extend beyond specific instances and contribute to the broader discourse on urban development in developing countries.

In the subsequent chapter, the study concludes by synthesizing the findings and proposing actionable recommendations to enhance the effectiveness of urban parks in developing countries. The lessons learned from the case studies can be applied to similar contexts, fostering the creation of vibrant and impactful urban green spaces.

5. Recommendations and Conclusion

In this concluding chapter, the findings from the case analysis of Janmeda Park and Entoto Park are synthesized to propose actionable recommendations for enhancing the effectiveness of urban

parks in developing countries. These recommendations are framed within the broader context of urban development, with the goal of creating green spaces that truly contribute to the well-being of communities.

5.1. Recommendations for Enhancing Urban Park Effectiveness

5.1.1. Improve Accessibility

Enhance Physical Accessibility:

- Pathways and Connectivity: Urban parks should be seamlessly integrated into the surrounding urban fabric with well-designed pathways and clear signage to ensure easy access from various parts of the city. Parks like Janmeda, with accessibility challenges, should prioritize the development of defined pathways and better connectivity to neighboring areas.
- Inclusivity: Implementing facilities that cater to visitors with disabilities is crucial. Parks should include ramps, specialized pathways, and other accessible features to ensure inclusivity for all user groups.

Expand Public Transportation Links:

- Transport Integration: To improve accessibility to parks like Entoto, which are farther from the city center, expanding public transportation links, such as shuttle services or dedicated bus routes, can encourage more visitors to utilize these green spaces.

5.1.2. Foster Sociability

Design for Social Interaction:

- Inclusive Layouts: Urban parks should be designed to facilitate interaction among diverse user groups. This includes creating communal gathering spaces, multipurpose areas, and strategically placing seating and activity zones to encourage social engagement.
- Diverse Programming: Offering a variety of events and activities that appeal to different age groups and interests, similar to Entoto Park's model, can help foster a more socially vibrant environment.

Address Territorial Behavior:

- Open-Layout Designs: Parks like Janmeda, where users tend to form territorial groups, should adopt more open-layout designs that discourage exclusivity and promote integration among different social groups.

5.1.3. Enhance Comfort and Safety

Improve Safety Measures:

- Visibility and Security: Parks should prioritize designs that enhance visibility and reduce secluded areas to improve safety. Regular patrols, adequate lighting, and clear sightlines can make parks feel safer and more welcoming.
- Security Infrastructure: Establish a well-defined security infrastructure, including surveillance systems, trained personnel, and emergency response plans, to ensure the safety of park visitors.

Upgrade Amenities and Facilities:

- Shading and Seating: Parks should provide adequate shaded areas and seating to enhance comfort, especially in areas where climate conditions necessitate protection from the sun.
- Restrooms and Shops: The availability of clean restrooms, refreshment stands, and shops at regular intervals within the park should be ensured, as seen in Entoto Park's successful model.

Maintain Cleanliness:

- Waste Management: Effective waste management systems, including regular cleaning schedules and the provision of sufficient waste disposal bins, are essential to maintaining a clean and pleasant environment in urban parks.

5.1.4. Strengthen Image Projection

Highlight Historical and Cultural Significance:

- Preserve Historical Features: Urban parks with historical significance, like Janmeda Park, should incorporate and celebrate these elements in their design. Interpretative signage, guided tours, and historical markers can enhance the cultural value of these spaces.
- Aesthetic Enhancements: Parks should blend natural beauty with art installations, statues, and landscaping that reflect the cultural heritage and unique identity of the area.

Promote Unique Identities:

- Distinctive Themes: Each park should have a distinctive theme or character that sets it apart from others. This could be achieved through specialized landscaping, unique architectural features, or themed recreational areas.

5.1.5. Improve Management and Maintenance

Clarify Ownership and Responsibilities:

- Unified Management: To avoid conflicts and inefficiencies, clear ownership and management responsibilities should be established for each park. For instance, the conflicting ownership issues at Janmeda Park should be resolved by designating a single entity responsible for the park's overall management.
- Collaborative Platforms: Establishing platforms for stakeholders to discuss and coordinate the management of urban parks can lead to more effective and cohesive operations.

Ensure Regular Maintenance:

- Routine Upkeep: Parks should implement regular maintenance schedules to prevent deterioration of facilities and infrastructure. This includes the upkeep of pathways, seating, playgrounds, and natural areas.
- Responsive Management: A management approach that is responsive to user feedback and emerging needs can help maintain high standards of park quality and visitor satisfaction.
- Community Involvement: Encouraging community participation in park maintenance and activities can foster a sense of ownership and responsibility among local residents, leading to better long-term sustainability.

By embracing these recommendations, cities in developing countries can transform their urban parks into vibrant, inclusive, and sustainable spaces that enhance the quality of life for their residents and contribute to the overall well-being of the community. These actions will help urban parks fulfill their potential as valuable assets in the face of rapid urbanization and environmental challenges.

5.2. Concluding Remarks

The case analysis of Janmeda Park and Entoto Park underscores the importance of holistic urban park development in addressing the needs and aspirations of communities in developing countries. While Janmeda Park highlights the challenges that arise from inadequate planning and management, Entoto Park offers a model of success in terms of effective design, management, and user experience.

Urban parks hold immense potential as catalysts for community well-being, environmental sustainability, and economic growth. As urbanization continues to shape the landscapes of developing countries, the creation and enhancement of urban green spaces become increasingly critical. By embracing the recommendations outlined in this study, urban planners, policymakers, and community stakeholders can collaborate to create vibrant and effective urban parks that enrich the lives of residents and contribute to the overall development of cities.

In conclusion, urban parks shouldn't solely defined by their physical attributes but also by their ability to foster connections, celebrate culture, and provide safe havens for recreation. As developing countries navigate the complexities of urbanization, urban parks offer a canvas on which to paint a more sustainable and harmonious future. Through careful planning, inclusive design, and collaborative management, urban parks can become true symbols of progress, community, and vitality.

References

Addas, A., & Maghrabi, A. (2020) 'A Proposed Planning Concept for Public Open Space Provision in Saudi Arabia: A Study of Three Saudi Cities', *International Journal of Environmental Research and Public Health*.

Addis Ababa Population (2021) 'Retrieved from world population review: https://worldpopulationreview.com/world-cities/addis-ababa-population'

Akhtar, R. (2018) 'Green spaces in urban areas: A review of current evidence', *Human Ecology*, *46*(4), pp. 529-547. [Online] DOI: 10.1007/s10745-018-0015-z

Ayala-Azcárraga, C., Diaz, D., & Zambrano, L. (2019) 'Characteristics of urban parks and their relation to user well-being', *Landscape and Urban Planning*, pp. 27-35. [Online] Available at: https://www.sciencedirect.com/science/article/pii/S0169204619302087

Bai, X., Nath, I., & Capon, A. (2018) 'Urban resilience and sustainability: From theory to practice', Landscape and Urban Planning, 170, pp. 1-4. [Online] DOI: 10.1016/j.landurbplan.2017.09.007

Bedimo-Rung, A. L., Mowen, A. J., & Cohen, D. A. (2005) 'The significance of parks to physical activity and public health: A conceptual model', *American Journal of Preventive Medicine*, *28*(2S2), pp. 159-168. [Online] DOI: 10.1016/j.amepre.2004.10.024

Bolund, P., & Hunhammar, S. (1999) 'Ecosystem services in urban areas', *Ecological Economics*, *29*(2), pp. 293-301. [Online] DOI: 10.1016/S0921-8009(99)00013-0

Carr, S., Francis, M., Rivlin, L. G., & Stone, A. M. (1992) 'Public space', *Cambridge University Press*.

City of Gold Coast (2018) 'Park design guidelines | *City of Gold Coast* (Vol. *2.0*)', gold coast. [Online] Available at: https://www.goldcoast.qld.gov.au/Planning-building/Development-resources/Park-design-guidelines

Endale, I. (2021) 'Utilization and management of public recreational parks in Addis Ababa', *GRIN Verlag*. [Online] Available at: https://www.grin.com/document/1045128

Giorghis, T., & Gérard, P. (2007) 'Addis Ababa: The City and Its Museums', *Journal of Ethiopian Studies*, *40*(1/2), pp. 1-16.

Glaeser, E. L., Kolko, J., & Saiz, A. (2001) 'Consumer city', *Journal of Economic Geography*, *1*(1), pp. 27-50.

Haile, S. G., & Getaneh, A. (1989, June) 'The Addis Ababa-Nazret volcanics: a Miocene-Pleistocene volcanic succession in the Ethiopian Rift', ISSN 0379-2897, pp. 1-24. [Online] Available at: https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1979047

Ismail, A. S. (2017) 'The Effectiveness of Public Park Management and Design for Sustainable Livelihood in Malaysian Context', *Computational and Theoretical Nanoscience*, *12*.

Kassaye, T. A. (2017) 'Estimating the recreational values of Addis Ababa parks using the Travel Cost Method: the case of Hamle 19 and Future parks', *World Scientific News*, *62*, pp. 124-135. [Online] Available at: http://www.worldscientificnews.com/wp-content/uploads/2016/11/WSN-62-2017-124-135.pdf

Kellett, J. E., & Rofe, M. W. (2009) 'Creating active communities: How can open and public spaces in urban and suburban environments support active living?: A literature review', *Australia*. [Online] Available at: https://www.researchgate.net/profile/Matthew-Rofe/publication/283505498_Creating_Active_Communities_How_Can_Open_and_Public_Spaces_in_Urban_and_Suburban_Environments_Support_Active_Living_A_Literature_Review_full_version/links/563bda7d08ae405111a77a99/Cre

Konijnendijk, C. C., Annerstedt, M., Nielsen, A. B., & Maruthaveeran, S. (2013) 'Benefits of urban parks: A systematic review', *Aarhus University*, Denmark. [Online] DOI: 10.13140/RG.2.1.1740.3446

Kuo, F. E., Sullivan, W. C., Coley, R. L., & Brunson, L. (1998) 'Fertile ground for community: Inner-city neighborhood common spaces', *American Journal of Community Psychology*, *26*(6), pp. 823-851. [Online] DOI: 10.1023/A:1022166810930

Lindhjem, H., Navrud, S., & Braathen, N. A. (2014) 'Valuing urban recreational parks: International evidence from 12 cities', *Environmental and Resource Economics*, *57*(1), pp. 91-112. [Online] DOI: 10.1007/s10640-012-9589-6

Lindsey, G., & Maraj, M. (2017) 'Urban park conservancies and the supply of public goods', *Journal of Environmental Economics and Management*, *82*, pp. 1-20. [Online] DOI: 10.1016/j.jeem.2016.11.003

Nowak, D. J., & Dwyer, J. F. (2000) 'Understanding the benefits and costs of urban forest ecosystems', in K. G. Mäler, C. Folke, C. S. Holling, B. O. Jansson, & L. A. Perrings (Eds.), Ecosystems and human well-being: A framework for assessment, pp. 149-188. *Island Press*.

Ogunlana, S. O., Promkuntong, K., & Jearkjirm, V. (2010) 'Strategies for delivering public construction projects in a developing country: Comparing Thailand with Nigeria', *International Journal of Project Management*, *28*(1), pp. 51-62. [Online] DOI: 10.1016/j.ijproman.2009.03.001

Oxford Learners' Dictionaries (2022) 'Effectiveness'. [Online] Available at: https://www.oxfordlearnersdictionaries.com/us/definition/english/effectiveness

Project for Public Spaces (2016) 'Placemaking- What If We Built Our Cities around Places?' [Online] Available at: Project for Public Spaces.

Roberts, H., Sullivan, H., & Urban Task Force (2012) 'Developing the city: From the urban task force to urban renaissance', *Routledge*.

Saikia, A. (2015, September 28) 'Urban Design Dimensions: 3.Social Dimension', *Vasturaag design group*. [Online] Available at: http://www.vasturaag.com/urban-design-social-dimension/

Tsegaye, K. (2007) 'Critical Assessment of the Current Operation of Planned public urban open public spaces in Addis Ababa urban environment: The Case of Meskel Square and Leghar Park', MA Thesis, Addis Ababa University. [Online] Available at: http://etd.aau.edu.et/bitstream/handle/123456789/3135/Kumlachew%20Tsegaye.pdf?sequence=1&isAllowed=y

UN-Habitat (2013) 'Urban patterns for a green economy: Working with nature', *United Nations Human Settlements Programme*. [Online] Available at: https://unhabitat.org/sites/default/files/2020/05/urban_patterns_for_a_green_economy_2013.pdf

United Nations (2018) 'World urbanization prospects: The 2018 revision', Department of Economic and Social Affairs, *Population Division*. [Online] Available at: https://population.un.org/wup/

Whyte, W. (1998) 'Open Space, and Environmental Activism', *Geographical Review*.

Wolch, J. R., Byrne, J., & Newell, J. P. (2014) 'Urban green space, public health, and environmental justice: The challenge of making cities 'just green enough'', *Landscape and Urban Planning*, 125, pp. 234-244. [Online] DOI: 10.1016/j.landurbplan.2014.01.017

Resume

Bruktawit Getachew Kebede, born in 1996 in Ethiopia, earned her bachelor's degree in architecture from Mekelle University in 2019. She completed her master's degree in architecture at Cyprus International University in 2023. Currently, she is pursuing a second master's degree in Heritage Conservation at Sapienza University, where she enrolled in 2023.

Devrim Yücel Besim, born in 1970 in Bodrum, Turkey. Received her bachelor's degree in 1992 and Master degree in 1995 from the Architecture Department at METU. Completed her Ph.D. on urban spaces in Bodrum at Ankara University, Department of Landscape Architecture in 2007. She worked in different scaled projects in Ankara. Continues her academic works at the Faculty of Fine Arts, Design and Architecture, Cyprus International University since 2012. She is the active member of Publishing Committee of Chamber of Turkish Cypriot Architects and interested in the relation between space, photography and literacy.

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Utilizing the vegetation health index to assess agricultural drought in the Constantine Region of Algeria

Maya Benoumeldjadj[*]
Malika Rached-Kanouni[**]
Abdelouahab Bouchareb[***]

Abstract

This research employs remote sensing techniques to map agricultural drought in the Constantine region of Algeria during the years 2021 to 2023. Using Landsat images processed through the Google Earth Engine platform, three indices (NDVI, VHI, and SPI) were calculated. The findings indicate deterioration in both climatic conditions and vegetation health. Specifically, NDVI and SPI exhibit decreases, while VHI shows an increase, signaling heightened water stress. The inverse relationship between NDVI and VHI underscores the connection between water availability and vegetation health. Additionally, a detailed analysis reveals severe drought conditions in the Southwestern part of the region. This study showcases the value of utilizing remote sensing technology on the Google Earth Engine platform for monitoring climate and vegetation patterns over space and time. These insights can help in forecasting the effects of climate change on agriculture and inform the adoption of suitable strategies to ensure food security.

Keywords: remote sensing, drought, VHI, Google Earth Engine, Constantine

1. Introduction

Drought, a consequence of climate change, is increasingly impacting regions globally, characterized by a temporary imbalance in water availability due to reduced precipitation levels. This phenomenon poses significant socio-economic challenges, especially in the agriculture sector, which is highly vulnerable to such climatic risks. Insufficient irrigation leads to struggles for farmers in maintaining healthy crops, resulting in diminished agricultural productivity, crop failures, and compromised food security. These concerns were prominently addressed at the recent Conference of the Parties in Egypt in November 2022, emphasizing the scientific consensus on the correlation between drought and climate change (Mostafa, 2023). Ongoing research endeavors are exploring innovative technologies and methodologies to tackle these urgent issues (Thomke, 2023).

Technological advancements, particularly in remote sensing, have revolutionized drought monitoring on a large scale. Remote sensing data provides a comprehensive perspective of the Earth's surface, facilitating the assessment of drought occurrences over vast regions. Various remote-sensing-based drought indices have been developed to quantify the duration, intensity, and severity of drought events. The Normalized Difference Vegetation Index (NDVI) has emerged as a widely accepted indicator for this purpose.

Combining vegetation indices with land surface temperature (LST) measurements has become a common practice for robust drought monitoring (Zhou et al., 2020). The Vegetation Health Index (VHI) stands out as a valuable tool for identifying agricultural drought and issuing early warnings (Bento, 2018). By integrating vegetation condition (VCI) and thermal condition (TCI) over a specific timeframe, the VHI provides a comprehensive evaluation of drought impacts. Utilizing remote

*(Corresponding author) Assist. Prof. Dr., Larbi Ben M'hidi Oum El Bouaghi University, Algeria, mayalabed@gmail.com
**Prof. Dr., Larbi Ben M'hidi University Oum El Bouaghi University, Algeria, kmalikbio@yahoo.fr
***Prof. Dr., Constantine 3-Salah Boubnider University, Algeria, abdelouahab.bouchareb@univ-constantine3.dz
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sensing data, including NDVI and LST, the VHI facilitates accurate drought assessments in agricultural regions.

The critical need for implementing adaptive measures to combat drought is apparent in today's context. Strategies include embracing resilient agricultural practices like cultivating drought-tolerant crop varieties and employing efficient irrigation systems. Strengthening drought monitoring and forecasting capabilities is essential to enable timely proactive interventions, such as implementing water management strategies and conducting awareness campaigns on drought mitigation. The data generated from these efforts serves as valuable decision-making resources.

Algeria, particularly the Constantine region, faces significant drought challenges due to climatic changes marked by decreasing rainfall and increasing temperatures, exacerbating agricultural vulnerabilities in a region reliant on rain-fed agriculture. Historical patterns reveal alarming reductions in precipitation, which threaten food security and economic stability, while the reliance on inadequate irrigation infrastructure further compounds these issues. The ecological impacts include soil degradation and reduced biodiversity, necessitating urgent policy interventions focused on effective water resource management, the adoption of drought-resistant crops, and sustainable land practices. Integrating remote sensing technologies with meteorological data enables policymakers to make informed decisions, while community engagement is crucial for developing resilience to ongoing climate challenges and ensuring sustainable agricultural practices.

In our study, two approaches were employed. The first approach utilized spatial remote sensing data from Landsat satellite imagery, focusing on key indices such as the Normalized Difference Vegetation Index (NDVI), the VCI, and the VHI to evaluate vegetation health and drought conditions. The second approach involved calculating the Standardized Precipitation Index (SPI), a crucial meteorological indicator for assessing drought severity. By correlating VCI, VHI, and SPI, a comprehensive understanding of drought origins was achieved. The study period covered the last three years (2021, 2022, and 2023) during the agricultural season from October to May.

The main objective of this research is to map agricultural drought in the Constantine region by leveraging specific indices derived from Landsat satellite data. Additionally, a comparative analysis of drought conditions across 2021-2023 was conducted to assess temporal variations and the extent of drought impact during the specified timeframe.

The unique contribution of this study is its synthesis of remote sensing technology and meteorological data, which cultivates a deeper understanding of agricultural drought within a specific region. This comprehensive approach equips policymakers and stakeholders with practical insights that can improve drought management strategies and advance sustainable agricultural practices. By analyzing patterns and trends over multiple growing seasons, this research seeks to guide decision-making, optimize resource distribution, and bolster resilience against the ongoing challenges posed by climate change.

1.1. The Study Area

Located between coastal cities and the Aurès massif, Constantine spans an area of 2 297.20 km^2 and sits at 36° 17' latitude and 6° 37' longitude, with elevations ranging from 350 to 1100 meters. The city experiences a climatic pattern characterized by cold winters and hot summers, influenced by continentality. Annual rainfall typically falls between 350 to 700 mm, varying notably from north to south. Precipitation often manifests in heavy showers or sudden storms, with spring frosts occurring around 17 days per year. The region grapples with a persistent aridity threat, exemplified by a cyclical pattern of a wet year succeeded by two dry years.

In 2018, Constantine boasted a population of 1 272488 residents, displaying a growth rate of 1.5% (Figure 1).

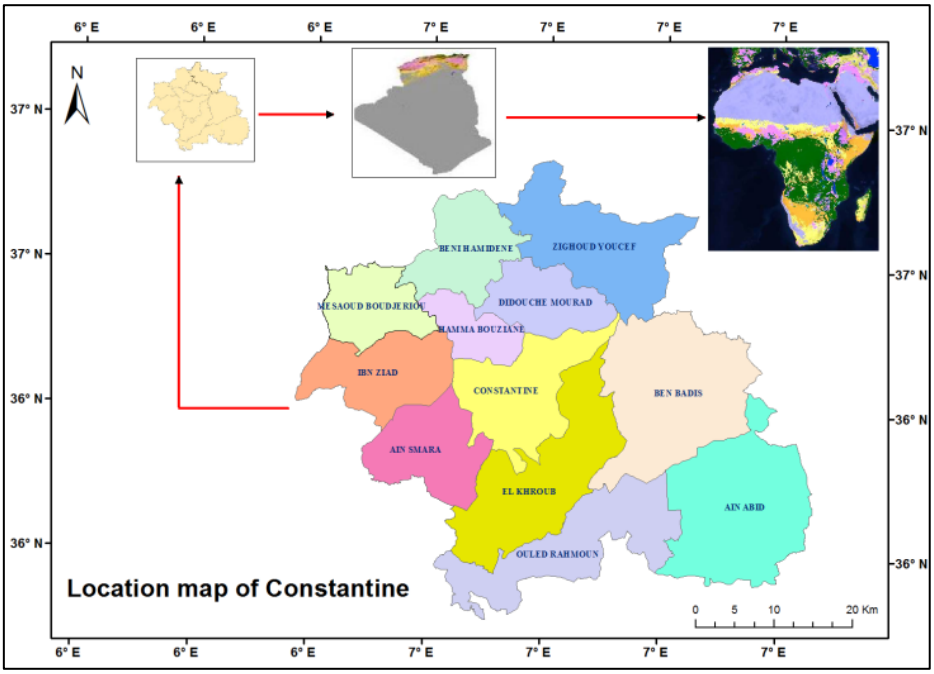


Figure 1 Location map of the Constantine

2. Method and Materials

The research methodology adopted in this study is centered on characterizing meteorological drought during the agricultural seasons from October to May across the years 2021, 2022, and 2023. The primary goal is to evaluate the severity of drought in the Constantine region and its implications for agriculture.

Multiple indices have been employed to enhance the identification and assessment of drought, with a specific focus on the normalized difference vegetation index (NDVI). NDVI is a well-established metric for gauging vegetation health, determining plant growth stages, and estimating biomass (Yengoh et al., 2015). Recognized for its sensitivity to the presence of green vegetation and its effectiveness in drought monitoring, NDVI is computed as the ratio of the difference to the sum of near-infrared (NIR) and red band reflectance.

The Normalized Difference Vegetation Index (NDVI) values range from -1 to +1, with specific ranges that correspond to different types of land cover and vegetation health:

NDVI < 0: Values less than zero typically indicate non-vegetated surfaces, such as water bodies, barren land, or areas with snow and ice.

NDVI 0 - 0.2: This range is associated with sparse vegetation, such as grasslands or areas with low plant cover. It indicates stressed or low biomass vegetation.

NDVI 0.2 - 0.5: Values in this range are indicative of moderate vegetation cover, such as shrublands or agricultural areas with healthy crops.

NDVI 0.5 - 0.75: This range reflects high vegetation density and health, typical of healthy forests or dense crops. It suggests robust and productive plant growth.

NDVI > 0.75: Values above 0.75 indicate very high vegetation density, often associated with dense forests or lush vegetation, reflecting optimal conditions for plant growth.

This index highlights the disparity between the visible red band (R) and the near-infrared band (NIR) and is mathematically expressed as follows:

$$NDVI = \frac{NIR - Red}{NIR + Red}$$

Another significant index developed based on NDVI to minimize the influence of soil reflectance and atmospheric effects is the "Vegetation Condition Index" (VCI) introduced by F. N. Kogan in 1995 (Yengoh et al., 2015). VCI normalizes the minimum and maximum interannual NDVI values at a specific location, making it a widely utilized normalized index for monitoring drought conditions (Gidey et al., 2023). It captures the spatial and temporal variations in vegetation, enabling the quantification of climate-induced impacts on vegetation health (Ramo et al., 2018). VCI is valued for its reliability and efficiency in detecting drought conditions across various vegetation types.

This index provides insights into the vegetation status relative to extreme conditions (Min and Max) over the analyzed period. It is calculated using the formula introduced by F. N. Kogan in 1995 :

$$VCI = \left(\frac{NDVI(a) - NDVI(\min)}{NDVI(\max) - NDVI(\min)}\right) x100$$

In the VCI calculation, NDVI(a) represents the NDVI value for the current period, while NDVI(min) and NDVI(max) correspond to the minimum and maximum NDVI values observed over the entire monitoring period. As outlined by Kogan (2002), the Vegetation Condition Index (VCI) is categorized into five classes, as detailed in Table 1.

Table 1 Classification of VCI Degrees

Drought classes	**VCI(%)**
Extreme drought	0<VCI<20
Severe drought	20<VCI<40
Moderate drougt	40<VCI<60
Mild drought	60<VCI<80
No drought	80<VCI<100

To enhance the accuracy of drought analysis beyond the Vegetation Condition Index (VCI), a new index called the Temperature Condition Index (TCI) was developed (Zambrano et al., 2016). The objective was to consider diverse vegetation reactions to local temperature variations by incorporating thermal channels for drought monitoring (Tsiros et al., 2004). TCI, rooted in brightness temperature data, is suitable for regional or continental-scale applications, providing real-time insights or assessments over extended time frames, up to one year. TCI serves as a valuable indicator of vegetation stress triggered by soil moisture deficits (Chuvieco et al., 2010).

The formula for calculating the Temperature Condition Index (TCI) as provided by Kogan (1995) is:

$$TCI = \left(\frac{LST(max) - LST(\mathrm{a})}{LST(\max) + LST(\min)}\right) x100$$

Land Surface Temperature (LST) is a critical parameter that represents the temperature of the Earth's surface as measured by remote sensing techniques, typically using thermal infrared sensors. LST is significant in various applications, including climate studies, land cover classification, and, notably, in assessing vegetation health and drought conditions.

LST(max): This represents the maximum land surface temperature recorded for a specific time period, typically over a season or yearly cycle. LST(max) is crucial as it reflects the potential upper limit of temperature that vegetation can experience. It serves as a baseline reference for assessing thermal stress on plants.

LST(min): This denotes the minimum land surface temperature recorded over the same time period. LST(min) indicates the lower threshold of temperature that vegetation can endure. It helps to establish the range of temperature fluctuations that plants are exposed to and is essential for understanding the thermal dynamics affecting vegetation health.

LST(a): This is the actual land surface temperature at a specific point in time, which may vary daily and is subject to environmental influences. LST(a) reflects the current thermal condition of the land surface and is used in conjunction with LST(max) and LST(min) to evaluate whether the vegetation is experiencing stress due to elevated temperatures.

Given the diverse agricultural land use in the study area of Constantine, which includes cereals, orchards, market gardening, pulses, olive trees, and fodder, the need for a versatile vegetation index was evident. The Vegetation Health Index (VHI) has emerged as an effective tool for drought monitoring and assessment across various crop types (Nasser et al., 2020). VHI is instrumental for near real-time monitoring of vegetation health and climate impacts, particularly in agriculture. When combined with field data, these indices serve as robust tools for drought monitoring.

The Vegetation Health Index (VHI) combines two key indicators, as outlined by Kogan (1997): one for vegetation health (Vegetation Condition Index, VCI) and the other for temperature conditions (Temperature Condition Index, TCI). VCI is derived from vegetation index data, such as the Normalized Difference Vegetation Index (NDVI), and is calculated using the following formula (Unganai & Kogan, 1998):

$$VHI = \lambda VCI + (1-\lambda)TCI$$

The Vegetation Health Index (VHI) serves as a versatile tool with various applications, including drought detection, assessment of drought duration, and prediction of crop yield and production over the vegetation period (Gomes et al., 2017). The research utilized a uniform weighting factor (λ) of 0.5 for index weighting, in line with previous studies (Clarke et al., 2006). Furthermore, this study introduces a specific classification system for drought monitoring, as detailed in Table 2.

Table 2 Drought Mapping Classification (Diédhiou et al., 2020)

Drought classes	VHI %
Extreme drought	<10
Severe drought	10-20
Moderate drought	20-30
Mild drought	30-40
No drought	>40

The Standardized Precipitation Index (SPI) is a widely employed metric for detecting meteorological drought owing to its flexibility across various timescales and climatic settings (Zhu et al., 2016). It enables the identification of drought events and assessment of drought severity over periods ranging from one month to 48 months. In our study, SPI was computed for an eight-month duration spanning from October to May. The calculation of SPI involves the following formula:

Where: SPI = Standardized Precipitation Index, Pi = Precipitation for the ith period

$\overline{P}$ = Mean precipitation for the n periods, σ = Standard deviation of the n periods

$$SPI = \frac{(Pi - Pm)}{\sigma} x\ 100$$

This study utilized variograms in Python to evaluate the correlation between variables, process measurements, calculate averages, and generate diagrams. Landsat 8 data was employed to identify drought conditions through the analysis of the Normalized Difference Vegetation Index (NDVI) and Land Surface Temperature (LST). Maps derived from the multispectral and thermal data were created in Google Earth Engine and then exported to ArcMap for further analysis (Mälicke, 2022).

The minimum and maximum reflectance values of NDVI and LST were extracted to compute the Vegetation Condition Index (VCI) and Temperature Condition Index (TCI). By combining VCI and TCI through an algorithm, Vegetation Health Index (VHI) images were produced, representing both

thermal stress and vegetation health. Subsequently, a correlation analysis was conducted between the spectral indices using MiniTable Software to understand their impacts on biomass and urban agriculture (Figure 2).

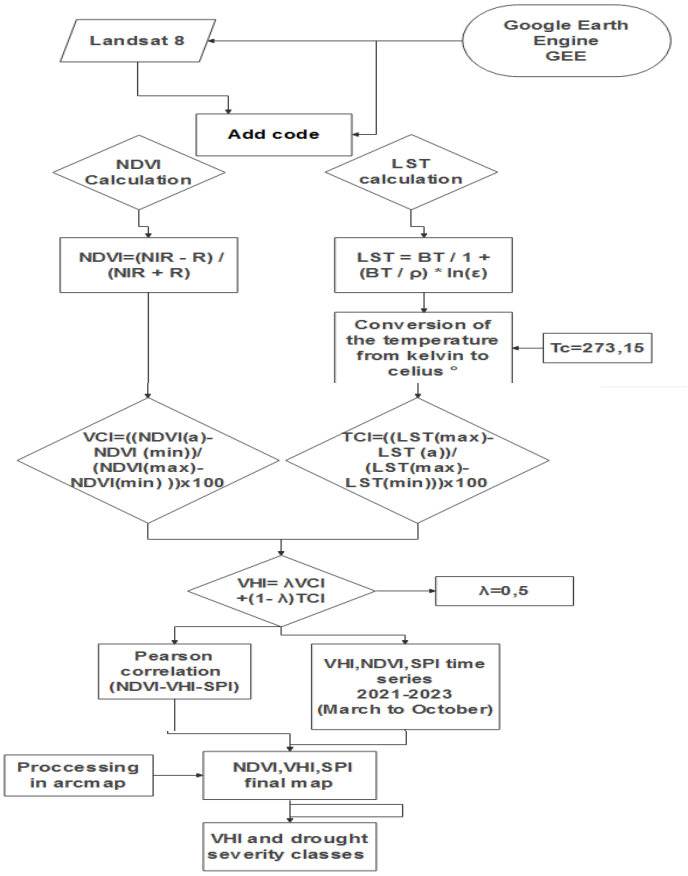


Figure 2 Flowchart of the study

3. Results

Spectral Indices Used

The NDVI values for the years 2021 (NDVI21), 2022 (NDVI22), and 2023 (NDVI23), representing photosynthetic activity and plant biomass, averaged at 0.123 in 2021, decreased to 0.121 in 2022, and further declined to 0.101 in 2023. These values fall within the range of 0.01 to 0.35.

Specifically:

- Regions with low NDVI values (0.01-0.10) were observed in the Northeast and Southwest areas.

- Moderate NDVI values (0.10-0.20) were noted in the central region (Figure 3).

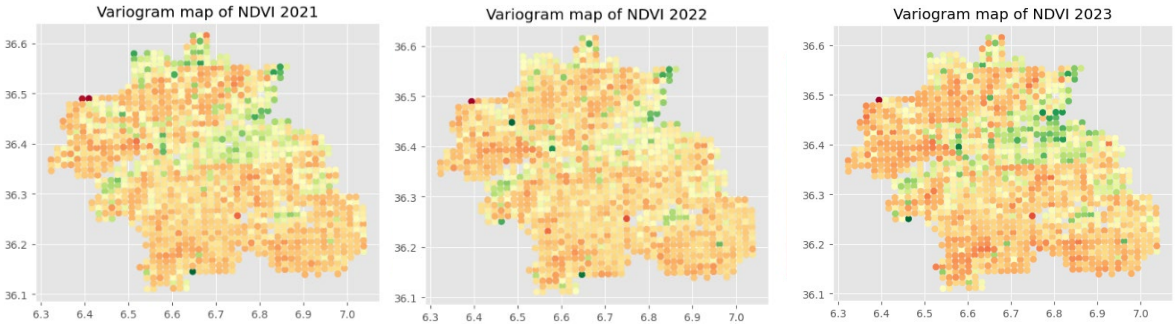


Figure 3 Variogram map of NDVI

The Vegetation Health Index (VHI), utilized for evaluating the water status of vegetation, demonstrated average values of 10.90 in 2021, 14.69 in 2022, and 13.61 in 2023, with a range from 7.45 to 19.9. Nevertheless, there is notable spatial variability in VHI:

- Low values (< 11) were observed in the Southwest and East of the area.

- High values (> 14) were seen in the Northwest and center regions (Figure 4).

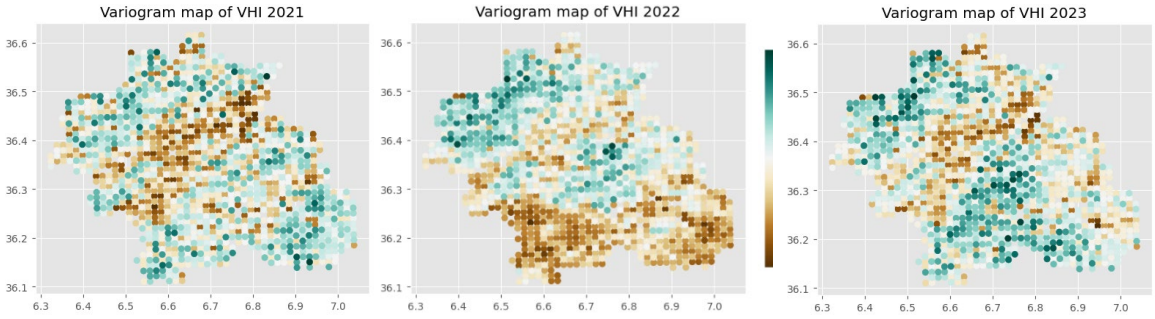


Figure 4 Viogram map of VHI

The Standardized Precipitation Index (SPI) is utilized as an indicator of chlorophyll content in vegetation. Elevated SPI values indicate vegetation rich in chlorophyll, with an average value of 6.62 in 2021, 0.58 in 2022, and 0.51 in 2023. Spatially, significant variations in SPI are noted:

- Lower values (< 0.5) are observed in the Southwest and Northeast regions.

- Moderate to high values (> 0.6) is present in the central and northwest areas (Figures 5, 6, and 7).

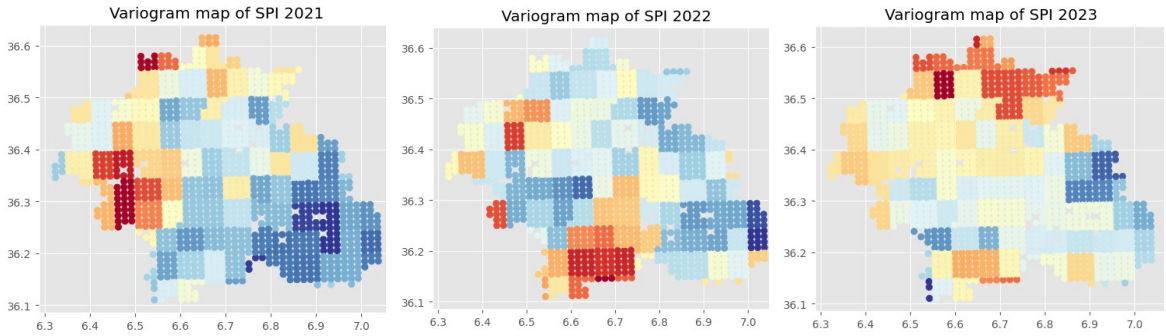


Figure 5 Viogram map of SPI

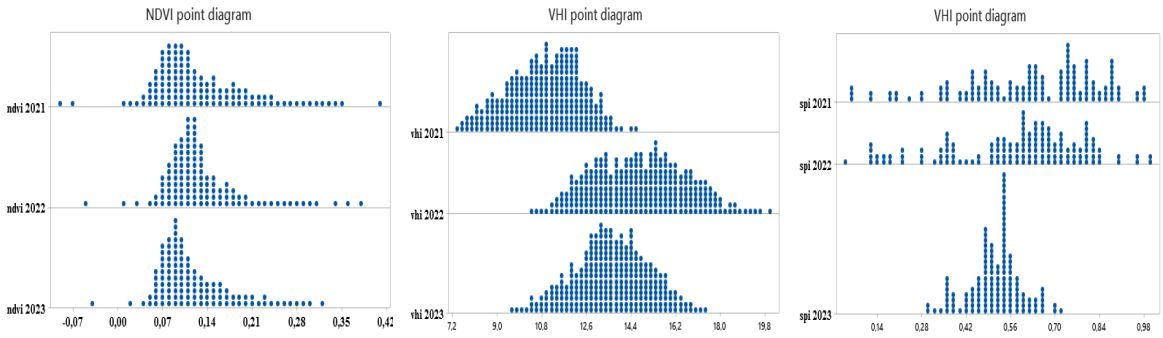


Figure 6 NDVI, VHI, SPI' points diagrams

The point diagram graphs analyze and express different environmental indices over three years (2021, 2022, and 2023).

NDVI point diagram: Distribution of points shows variability in vegetation health. Peaks indicate common NDVI values, while spreads reflect health variability. Trends over the years reveal changes in vegetation health.

VHI point diagram: Similar to NDVI, the distribution shows health trends in vegetation. Peaks and spreads provide insights into changes in vegetation condition.

SPI point diagram: The diagrams collectively provide insights into vegetation health and environmental conditions over the years, informing strategies for land management and conservation based on observed trends.

Between 2021 and 2022, there was a slight increase in NDVI followed by a decrease in 2023. The NDVI levels remained relatively low at around 0.12, suggesting sparse vegetation with low density, likely dominated by bare soils and/or an herbaceous layer.

The Vegetation Health Index (VHI) exhibited a notable increase from 2021 to 2022, indicating improved water conditions for vegetation. In 2023, the VHI slightly decreased but remained at a high level. Conversely, the Standardized Precipitation Index (SPI) showed a gradual decrease over the period, reflecting a decline in chlorophyll content in vegetation.

In summary, the spectral indices demonstrate a modest enhancement in vegetation conditions from 2021 to 2022, followed by a slight deterioration in 2023, while maintaining relatively low NDVI levels and high VHI. The declining SPI indicates a reduction in chlorophyll content over the three-year period (Figure 8).

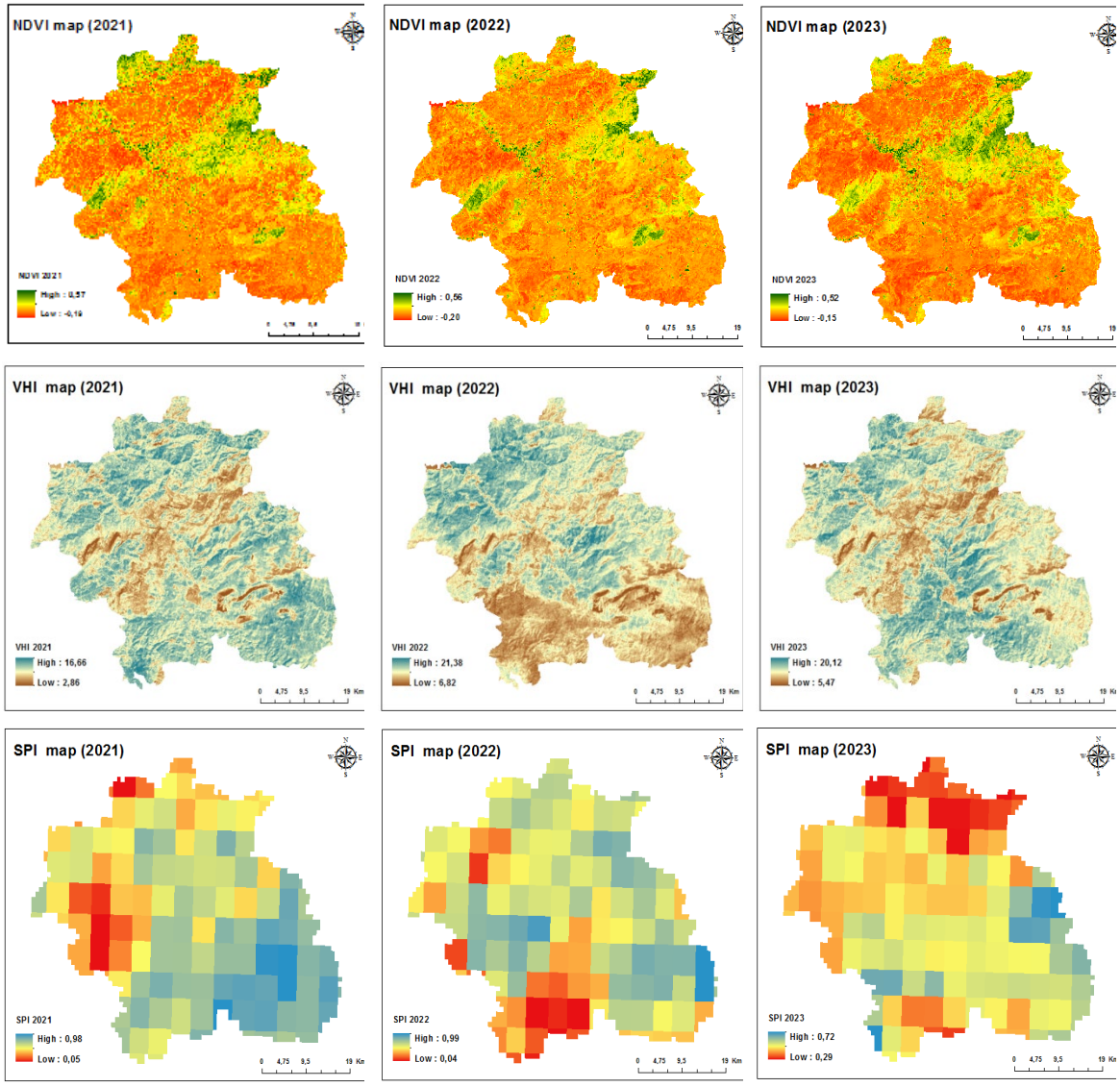


Figure 7 NDVI, VHI and SPI maps (2021-2022-2023) in order

The drought classification system for the Constantine region from 2021 to 2023 reveals significant variations in precipitation and moisture levels over the years.

In 2021, the Southwest and Eastern regions experienced moderate drought, indicating a substantial moisture deficit that adversely affected both vegetation and water resources. In contrast, the central areas maintained near-normal conditions, indicating an adequate supply of moisture that supported healthy plant growth. Additionally, the Northwest region reported mild wetness, suggesting surplus rainfall that could benefit agricultural practices.

By 2022, the overall moisture conditions in the Constantine region improved, with most areas experiencing near-normal levels. This shift indicated sufficient precipitation throughout the year. Nevertheless, some regions in the center and north exhibited mild wetness, indicating localized rainfall events that enhanced soil moisture and promoted vegetation health.

In 2023, moderate drought conditions resurged in the Eastern and Southwestern regions, mirroring the challenges faced in 2021. The Northwest continued to show near-normal moisture levels, highlighting its resilience to potential water shortages. Notably, mild wetness was again recorded in the central region, reflecting fluctuating precipitation patterns that allowed for some recovery and growth, even amid surrounding drought conditions.

In summary, the drought classification data from these three years paints a complex picture of changing moisture dynamics, emphasizing the region's susceptibility to climatic fluctuations and the pressing need for robust water management strategies to address these ongoing challenges (Table 3).

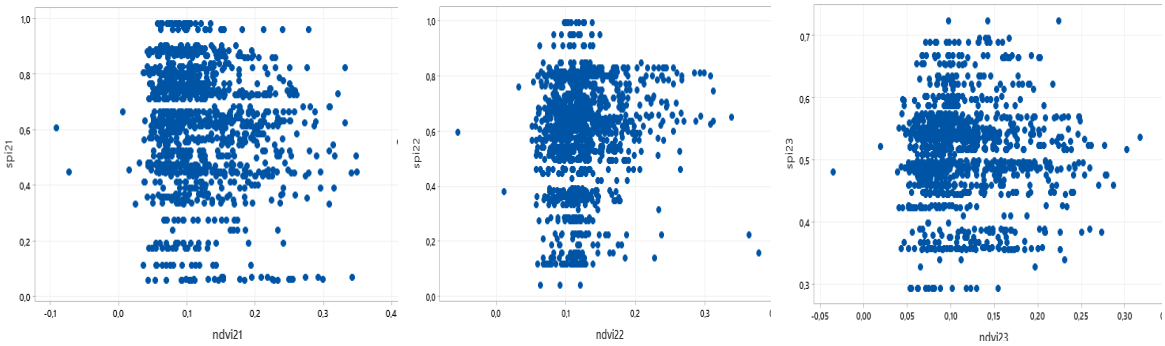
Table 3 The VHI and Drought Severity Classes in Constantine

Year	VHI %	Drought classes
2021	10.90	Severe drought
2022	14.69	Severe drought
2023	13.61	Severe drought

Correlation Between Indices

A negative correlation between NDVI and VHI was observed for the years 2021, 2022, and 2023, with correlation coefficients of -0.42 in 2021, -0.46 in 2022, and -0.51 in 2023.

An integrated analysis of NDVI, VHI, and SPI indicates a decline in climatic conditions in the studied area from 2021 to 2023. This decline involved decreased rainfall and increased water stress on vegetation, resulting in a slight reduction in plant photosynthetic activity (Figure 8).



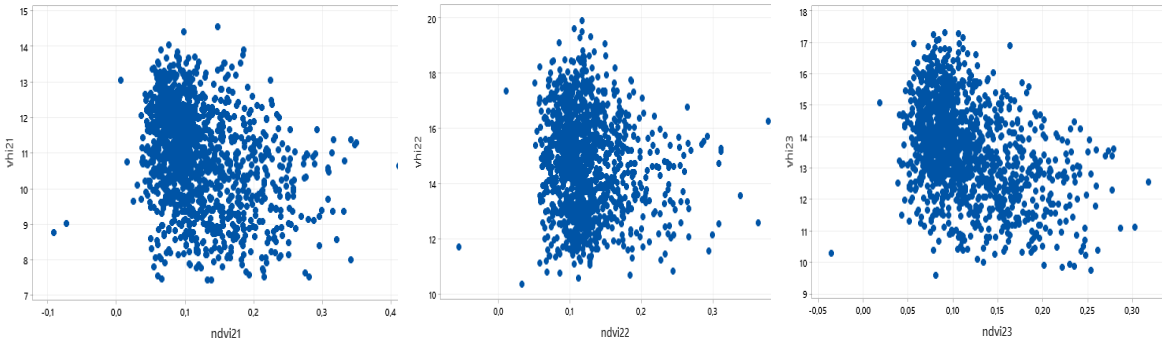


Figure 8 Correlation between indexes

The decline in the Normalized Difference Vegetation Index (NDVI) observed in the Constantine region from 2021 to 2023 mirrors trends documented in other semi-arid regions in recent years. For example, a study in West Africa by Andrieu (2008) noted a significant 15% reduction in NDVI values across several Sahelian countries between 1982 and 2003, correlating this loss with decreased rainfall and soil degradation. Similarly, research by Luis et al. (2009), highlighted an 8% decline in NDVI in the Sahel over the same timeframe, primarily attributed to prolonged drought conditions and human activities impacting vegetation cover.

In contrast, the Vegetation Humidity Index (VHI) showed an increasing trend from 2021 to 2023, indicating heightened moisture stress in vegetation and the impact of rising temperatures that worsen water scarcity. These observed trends can be largely attributed to reduced rainfall during this period, leading to soil drying and heightened evapotranspiration rates due to climate change. Supporting this, For (2016) found VHI to have a stronger correlation with vegetation conditions compared to both the Vegetation Condition Index (VCI) and the Temperature Condition Index (TCI).

Moreover, changes in the Standardized Precipitation Index (SPI) signal a drought episode in 2022, characterized by below-average rainfall compared to seasonal norms. In contrast, precipitation levels in 2021 and 2023 either met or slightly exceeded the seasonal averages. The rainfall decline in 2022 may be explained by a temporary disruption in established precipitation patterns, potentially linked to natural climate variability and the broader effects of climate change.

The negative correlation between NDVI and VHI, as identified by Wang et al. (2010), underscores the relationship that as NDVI increases—indicating greater photosynthetic activity—VHI decreases, reflecting reduced water availability and heightened vegetation stress. This connection between vegetation health and moisture levels is further supported by an increasing strength of correlation from moderate to medium between 2021 and 2023, as evidenced by the coefficients. This trend suggests enhanced sensitivity of vegetation's water status in relation to chlorophyll activity during this period.

While this study effectively identifies temporal and spatial variations in vegetation health and moisture conditions, it falls short in addressing relevant policy and planning measures to counteract these findings. To enhance the significance and applicability of the research, it is essential to discuss potential policy implications and strategies to address the ecological challenges identified. For example, implementing sustainable water management practices, promoting reforestation efforts, and adapting agricultural practices could significantly improve the Constantine region's resilience to ongoing climate variability and drought conditions.

Furthermore, engaging stakeholders and incorporating community-level planning can lead to more effective responses to moisture and vegetation challenges. Policymakers should leverage insights derived from NDVI, VHI, and SPI analyses to create adaptive strategies aimed at strengthening ecosystem resilience and ensuring the sustainable management of natural resources amid changing climatic conditions. A thorough revision of the discussion section that incorporates

these considerations would greatly enhance the study's relevance and its practical implications for local and regional decision-makers (Figure 9).

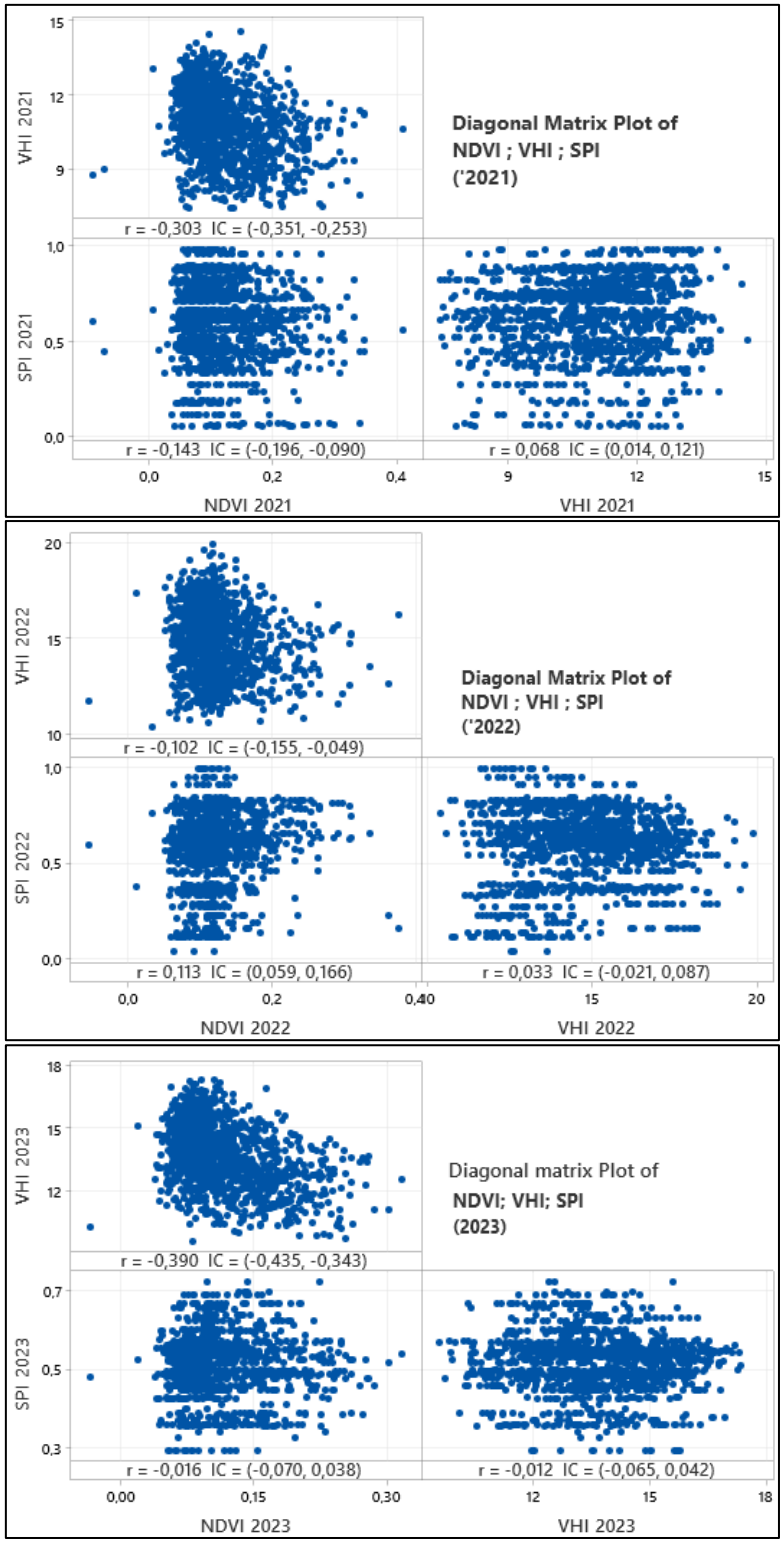


Figure 9 NDVI, VHI and SPI pearson correlation

The strength of the correlation between NDVI and VHI varies throughout different seasons within the same year, as evidenced by 2021, where the coefficient reaches -0.4 in summer but only -0.29 in winter. This seasonal disparity suggests that factors beyond water availability, such as temperature and sunlight, also influence the NDVI/VHI relationship.

Spatially, the correlation between NDVI and VHI is more pronounced in arid regions (south of the study area) compared to the relatively more humid northern areas. The heightened link between vegetation status and water availability in drier regions implies that water stress amplifies the relationship between these two factors.

Our spatial analysis, demonstrating the strengthening of the NDVI/VHI correlation in the arid southern regions, aligns with findings from prior research (Acharki et al., 2023). This supports the idea of a significant association between water availability and vegetation condition in arid or semi-arid landscapes 5 (A landscape is a visible area of land that includes various physical features, such as terrain, vegetation, water bodies, and human structures, shaped by natural and environmental processes, contributing to its aesthetic and ecological character).

The combined outcomes of the NDVI, VHI, and SPI indices signal a gradual decline in climatic conditions and vegetation health in the Constantine region between 2021 and 2023 (Figure 10).

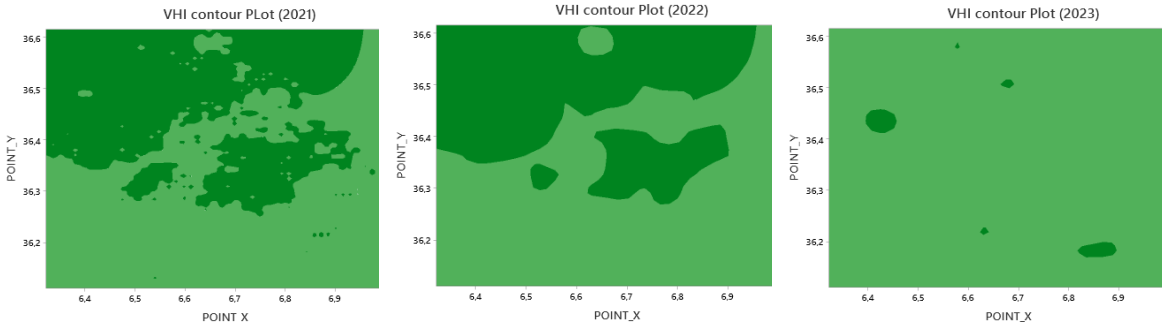


Figure 10 VHI contour plot (2021, 2022, 2023) in order

4. Conclusion

In essence, the research on remote sensing indices (NDVI, VHI, SPI) reveals a degradation in climatic conditions and vegetation health in the Constantine region from 2021 to 2023. The diminishing NDVI indicates a decline in photosynthetic activity and plant biomass, while the increasing VHI signals heightened water stress on vegetation. Concurrently, the SPI data illustrates a downward trajectory in rainfall over this period, consistent with trends in similar semi-arid zones and indicative of larger-scale global climate change impacts. These results emphasize the pivotal role of remote sensing in monitoring biophysical shifts that signal environmental decline.

The persistent negative correlation between NDVI and VHI, both spatially and temporally, underscores the robust link between water availability and chlorophyll activity in semi-arid settings, albeit influenced by seasonal variations and other factors.

This study unveils prospects for further exploration of climate change effects through the integration of additional indices, weather data, and field measurements. Leveraging high-resolution satellite monitoring stands as a critical tool for forecasting agricultural implications and enacting effective adaptation measures in response to evolving environmental dynamics.

References

Acharki, S., Singh, S. K., do Couto, E. V., Arjdal, Y., & Elbeltagi, A. (2023). Spatio-temporal distribution and prediction of agricultural and meteorological drought in a Mediterranean coastal watershed via GIS and machine learning. Physics and Chemistry of the Earth, Parts A/B/C, 103425. https://doi.org/https://doi.org/10.1016/j.pce.2023.103425.

Andrieu, J. (2008). Cartographie Par Télédétection Végétale Sur La Bande Littorale Ouest-Africaine : Exemple Des Rivières Du Sud Du Delta Du Saloum (Sénégal) Au Rio Geba (Guinée-Bissau). Revue Télédetection, *8*(2), 93-118. https://shs.hal.science/halshs-00388170.

Bento, V. A., Gouveia, C. M., DaCamara, C. C., & Trigo, I. F. (2018). A climatological assessment of drought impact on vegetation health index. *Agricultural and forest meteorology*, *259*, 286-295. https://doi.org/10.1016/j.agrformet.2018.05.014.

Clarke, K. R., Chapman, M. G., Somerfield, P. J., & Needham, H. R. (2006). Dispersion-based weighting of species counts in assemblage analyses. *Marine Ecology Progress Series*, *320*, 11-27. https://www.int-res.com/abstracts/meps/v320/p11-27/.

Diédhiou, I., Mering, C., Sy, O., & Sané, T. (2020). Cartographier par télédétection l'occupation du sol et ses changements. *EchoGéo*, (54), 0-41. https://doi.org/10.4000/echogeo.20510.

Gidey, E., Mhangara, P., Gebregergs, T., Zeweld, W., Gebretsadik, H., Dikinya, O. & Fisseha, G. (2023). Analysis of drought coping strategies in northern Ethiopian highlands. *SN Applied Sciences*, *5*(7), 195. https://doi.org/10.1007/s42452-023-05409-5.

Gomes, A. C. C., Bernardo, N., & Alcântara, E. (2017). Accessing the southeastern Brazil 2014 drought severity on the vegetation health by satellite image. *Natural Hazards*, *89*, 1401-1420. https://doi.org/10.1007/s11069-017-3029-6.

Mälicke, M. (2022). SciKit-GStat 1.0: a SciPy-flavored geostatistical variogram estimation toolbox written in Python. *Geoscientific Model Development*, *15*(6), 2505-2532. https://doi.org/10.5194/gmd-15-2505-2022.

Mostafa, A.-M. (2023). An update on Egypt climate change policies post-coronavirus. *Journal of Legal and Economic Research*, *13*, 101-186. https://mjle.journals.ekb.eg/article_315095.html.

Ramo, R., García, M., Rodríguez, D., & Chuvieco, E. (2018). A data mining approach for global burned area mapping. *International journal of applied earth observation and geoinformation*, *73*, 39-51.

Thomke, S. H. (2003). *Experimentation matters: unlocking the potential of new technologies for innovation*. (S.l.): Harvard Business Press.

Tsiros, E., Domenikiotis, C., Spiliotopoulos, M., & Dalezios, N. R. (2004). Use of NOAA/AVHRR-based vegetation condition index (VCI) and temperature condition index (TCI) for drought monitoring in Thessaly, Greece. Dans *EWRA Symposium on water resources management: risks and challenges for the 21st century, Izmir, Turkey* (pp. 2-4).

Unganai, L. S., & Kogan, F. N. (1998). Southern Africa's recent droughts from space. *Advances in Space Research*, *21*(3), 507-511.

Wang, S., Chen, H., & Yao, X. (2010). Negative correlation learning for classification ensembles. Dans *The 2010 international joint conference on neural networks (IJCNN)* (pp. 1-8). IEEE. DOI: 10.1109/IJCNN.2010.5596702.

Yengoh, G. T., Dent, D., Olsson, L., Tengberg, A. E., & Tucker III, C. J. (2015). *Use of the Normalized Difference Vegetation Index (NDVI) to assess Land degradation at multiple scales: current status, future trends, and practical considerations*. (S.l.): Springer.

Zambrano, F., Lillo-Saavedra, M., Verbist, K., & Lagos, O. (2016). Sixteen years of agricultural drought assessment of the BioBío region in Chile using a 250 m resolution Vegetation Condition Index (VCI). *Remote Sensing*, *8*(6), 530.

Zhou, X., Wang, P., Tansey, K., Zhang, S., Li, H., & Wang, L. (2020). Developing a fused vegetation temperature condition index for drought monitoring at field scales using Sentinel-2 and MODIS imagery. *Computers and electronics in agriculture*, *168*, 105144.

Zhu, Y., Wang, W., Singh, V. P., & Liu, Y. (2016). Combined use of meteorological drought indices at multi-time scales for improving hydrological drought detection. *Science of the Total Environment*, *571*, 1058-1068.

Resume

Maya Benoumeldjadj is a teaching researcher and assistant professor B. After obtaining her State Architect diploma from the University of Constantine (Algeria), she worked for eighteen years in private study offices as well as within local communities. She earned her Master's degree in 2014 from Salah Boubnider University, Constantine 3, and was recruited as an assistant professor B at Larbi Ben Mhidi University, Oum El Bouaghi, in 2015. In 2023, she defended her PhD in urban planning with a focus on urban projects and earned the title of assistant professor B.

Malika Rached Kanouni is a teacher researcher at at Larbi Ben Mhidi University, Oum El Bouaghi, Algeria, where she works a professor specialist in the development of natural environments for academic ecology and environment training.

Abdelouahab Bouchareb is a lecturer and researcher at the University of Constantine 3, affiliated with the AUTES laboratory. Professor, holder of adoctorate in urban planning 2006. Area of interest; urban heritage, projects and actions.

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Perceptual effect of color use in patient rooms

Mehmet Noraslı*

Abstract

Messages are conveyed to users through every element within the space. People receive these messages through sense organs. People and space interact constantly because of the way that they perceive and transmit space. People also establish their action boundaries, identify their motivational criteria, and feel a sense of belonging to the place they experience as a result of this interaction. In this way, the location, with all of its characteristics, influences the mental health of those who inhabit it. The colors chosen for patient rooms have a significant impact on the emotional and mental health of the patients, given the medical procedures and rehabilitation programs that they undergo. Patients' healing processes may vary based on the physical characteristics of the environment in which they are situated. Hospitals are intricate functional structures, so specific design requirements should be established by assessing every department independently. The purpose of this study is to determine how people's perception of spatial quality in general patient rooms where two adults stay during treatment is affected by the use of color. In the research method, adjective pairs were determined in line with spatial quality in order to reveal the perceptual effect of color variables in patient rooms. The survey technique was applied according to this experimental design. By simulating the patient room- which was proposed as the study area- in a digital environment with a one-to-one scale, the colors identified as the dependent variable in the study's methodology were visualized independently. The survey technique was employed to ask questions about the perceptual effect of colors on people who have experienced patient rooms by using adjective pairs based on the spatial quality level. The orange color used in patient room interior design was found to be eye-catching, communication facilitator, inviting, pleasing, encouraging, and sincere, while the blue color was found to be comforting and refreshing, based on data acquired from the survey, which was administered to 168 people in total. Many spaces in hospital buildings serve a variety of purposes, and the patients who use these spaces have a range of needs. For this very reason, it is advised that these hospital units be included in the interior design process utilizing information supported by empirical research, with each space being specially designed to meet its unique requirements and functions.

Keywords: hospital, patient room, spatial perception, color

1. Introduction

Space has a significant impact on how people act (Roth, 2006). Although space expresses its own qualities, the individual experiencing it displays behaviors by projecting their own emotions on it (Pallasmaa, 2018). People therefore require physical environments, or locations, that are associated with their memories and serve as reminders of important life events. Every location has a memory that sets it apart from the others. Because of this, space structures its distinct identity with its designer to prioritize human comfort (Tağrikulu, 2022). In this sense, space is an integral component of life on Earth.

Environmental elements in space are created and used by movements of an individual within it. The idea of spatial perception is revealed as the subject forms a connection with the surroundings and interacts with the space during this perception process. The formation of spatial perception is associated with an individual's experience of a place and their subsequent memory of that place as a result of that experience. Depending on how individuals move in space, this experience evolves and changes (Garip, 2009). A person becomes a user once they have visited any location. The perception of space is directly correlated with the number of times the user interacts with it. Using

*(Corresponding author) Assist. Prof. Dr., Selcuk University, Türkiye, mehmetnorasli@selcuk.edu.tr
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a variety of mental images, the human mind constructs physical characteristics of the space and converts them into behavior during the process of spatial perception. These mental pictures also have the power to influence how people behave (Hasgül, 2011).

According to İzgi (1999), one of the most crucial components in the perception of space is visual perception. Color within the context of environmental factors are among the most fundamental elements influencing visual perception (Noraslı, 2022). People may experience different emotions or ideas in a space depending on the color of the various elements. Functioning elements and the overall quality of space have an impact on people's feelings and thoughts in addition to environmental elements like color. Because of this, assumptions about the purpose and use of location lead to psychological prejudice in individuals. This highlights the need for a distinct design strategy based on the characteristics of each space.

One type of building that needs a special design approach is a hospital. These are multifunctional, complex structures that house a variety of users, including patients, visitors, and medical professionals. As places where patients, injured people, and those who suspect a disease and want to have their health conditions checked are observed, examined, diagnosed, treated, and rehabilitated as outpatients or inpatients, hospitals are the type of organizations that are more functional and have the most complex structure compared to other structures of similar size (Eceoğlu, 2010). In this case, the user-oriented requirements for each hospital space are demarcated by its specific function. Scientific research should be conducted to identify these needs, and interior design procedures should make use of them.

The purpose of this study is to investigate how users' perceptions of space are affected by the colors used in patient room interior design. Although many studies have been conducted on the effect of color use in hospitals, the results are based on the general perception values that colors create on people. In addition, since hospitals are multifunctional structures, they consist of multiple spaces, each unit of which must be evaluated separately with color variables. In this context, the originality of the study is that the colors that will affect the psychology of the patients are examined specifically according to their spatial quality attributes, by going through a setup only for the patient room. Eight different adjective pairs, three distinct color variables, and spatial quality levels established during the study's management were used to create a survey system specifically. A survey that was administered to 168 persons who used the patient room yielded the data. The colors chosen for patient room interiors that influence users' perceptions were analyzed in accordance with the data. Significant differences were noted in each pair of adjectives, according to the findings. The data revealed that, in comparison to other color variables, orange was more eye-catching, communication facilitator, inviting, pleasing, encouraging and sincere. When compared to other color options, blue was discovered to be more comforting and refreshing.

1.1. Spatial Perception Depending on Human-Space Interaction

Humans mostly use their senses to perceive their surroundings. They exhibit their behavior in space according to emotional and thought state they perceive. Therefore, to the extent that they are able to perceive space, humans reveal their behavioral reactions. People and space interact as demonstrated by the way they perceive and respond when they enter a space that contains both functional and aesthetic elements. As a result, the central component of architecture- space- appears to have the ability to control people's emotions. Places and people are constantly interacting, according to Zevi (1990), who views space as "the leading actor of architecture" and architecture as "the art of creating space".

The idea of space has a long history that started in antiquity. Space keeps reinventing itself in this way, showing up in all of its forms and perceptual components. Ever since the beginning of time, humans have had difficulty surviving in hostile environments. So much so they were in danger of going extinct during this process. Men made the most of nature throughout this struggle, beginning with the tools it provided them in its raw form and gradually learning to shape them (Öztürk Çelebi, 2018). In the past, humans found refuge in naturally occurring structures like

caverns and tree holes, but with time, they started to modify these areas to suit their needs. Living spaces have evolved over the ages due to the intelligence that sets humans apart from other living things, and as a result, the concept of space from an architectural perspective has emerged.

Space is the void that permits people to act and, to some extent, separates them from their surroundings (Hasol, 1993). While being the focus of numerous studies, space is portrayed in various ways. Hence, while Von Meiss (2013) claims that space's external forms are constrained by spatial elements and that there is a void in the space that is filled from the inside, Zevi (1990) defines space as a void that exists, is lived in, and is limited by structural elements.

Research on the integrated relationship between architecture and the concept of space has always been ongoing. In certain studies, space has been categorized and examined in terms of architecture. The relationship between space and its perception dimension was established by Norberg Schulz (1974), who also classified the various forms of space into five categories: pragmatic space, existential space, perceptual space, cognitive space, and abstract space. On the other hand, Gür (1996) defined space as the location of an individual or a group and talked about how space is classified into five categories based on Norberg Schulz's classification: useful space, symbolic space, existential space, architectural structural space and abstract geometric space.

The incorporation of space into human life is a crucial aspect of architecture. Thus, Ching (2002) claimed that space surrounds us constantly and that human activity can occur anywhere in its volume. According to Ching, architecture will also emerge when space starts to be encircled, shaped and arranged by elements that are grouped together. However, Kuban (2016) emphasized the significance of the concept of space in terms of architecture, saying that this unique void- which is expressed as space- is what distinguishes architecture from other building actions and how architecture shows its effect by separating the living and the user from the natural life.

The way people perceive space makes it more valuable and selective. The concept of space has malleable meanings due to the spiral relationship that exists between its physical attributes and the emotional and intellectual behavior patterns of life's functional process. Through the use of their senses, humans experience and comprehend space by connecting it to one another. The space is experienced with all of its messages, but objects only acquire meaning when humans are able to categorize or interpret the information gathered through the senses. The effect of the objective environment on the sensory organs is what causes sensation, which is the first step in the perception process. (Aslan et al., 2015; Erkan Yazıcı & Çakıcı Alp, 2017). According to Leland (2006), perception is employed to value the pleasure that architecture provides. This value has to do with how one views and understands the information gleaned from sensation.

Reacting to physical stimuli can help one establish balance and achieve harmony with their surroundings. To exhibit this harmony, one must be able to identify and comprehend their surroundings (Aydıntan, 2001). The process of organizing sensory data to give objects or events around us meaning is called perception. Individuals interpret the stimuli by giving them personal meaning after this process (Siegel, 2006; Smith, 2002). Associating, thinking, and other cognitive processes all involve perception, which varies based on an individual's cognitive structure (Goldstein, 2010).

Certain types of perception influence how space is perceived by concentrating on the senses of sight, touch, hearing and smell. Visual perception is the most significant of these. The sense of sight is the most fundamental that influences perception since it provides the majority of the information that is gathered from the surroundings. Those who experience the space perceive color, light, texture and form as elements of spatial stimulation through their visual sense. The ear becomes more noticeable when vision blurs or completely disappears. Since there are many different ways to perceive space, senses like hearing, smell and touch either greatly influence or contribute to this perception (İzgi, 1999).

A person's mental process of perception can influence how they perceive space, paving the way for the fact that space is conceptualized in the mind while the person perceives it, as the brain is

capable of multitasking. By creating spatial relationships, one can also conjure up imagined spaces (Wang et al., 2007). Humans generate and assess environmental cues through mental movement, combining existing knowledge with new information to form formation processes (Garip, 2009). The idea of spatial perception is revealed by the way that perception interacts with space by creating a connection between people and their surroundings.

Spatial perception is a formation that is connected to a person's memory of the place through experience via the creation of various images, the human mind converts the physical characteristics of space into behavior during the process of spatial perception. According to Gollodge (1999), these brain-formed images have the capacity to influence people's behavior. People experience the space and engage with their perceptions in this way, directly connecting with their present psychological states.

1.2. Color Factor in Space

Depending on how it is used in the space, color, one of the key elements affecting readability, can have an impact on people's psychological states (Carpman & Grant, 2016). The Optical Society of America's Colorimetry Committee defined color as the spatial or transient characteristics of luminous energy that are produced by stimulation of the retina in the eye and are perceived by an observer through visual perceptions (Hardeberg, 1999).

When light strikes an object, it can reflect, refract, absorb or transmit the light. Color is defined as the image that appears in the eye when the light strikes an object, reflects off of it and sends sensory information to the brain (Güller, 2007). An in-depth examination of the physiological definition of color- which is essentially the result of light waves entering the eye- reveals that color is created when light strikes an object, reflecting the majority of the colors the object contains because of its molecular makeup while absorbing the remaining colors (Tepecik, 2002).

The perception of color requires a second light source, where the reflected light enters the eye's retina, and the change in incoming light during absorption or reflection determines the color's perception (Özdemir, 2005). As a result, color is the impression that light waves have on a person as they enter their eyes and reflect off of objects. This effect is a physical phenomenon that happens due to the strength of light. Color formation is directly influenced by light intensity, which varies based on our surroundings and results in a range of colors and tones. As a result, the balance of colors is flawless in nature (Göker Paktaş, 2018).

The way that color is symbolized in nature is usually through natural analogies. For example, the color red is associated with fire, warmth and energy, while the color blue is associated with the sea, which is associated with coldness and serenity (Heschong, 2002). There is no universally accepted theory regarding the psychological effects of colors on humans; however, colors are classified into two categories based on their psychological impact and intensity. These categories are influenced by factors such as gender, culture and geography. Warm colors are found on the red and orange side of the line connecting yellow and purple, and cold colors are seen on the green and blue side. This is true when full yellow and full purple are positioned opposite each other on the color wheel (Hidayetoğlu, 2010).

Warm colors, such as orange, red, and yellow, evoke feelings of coziness and dynamism in human psychology. They are vivid, provocative, and ostentatious, with long wavelengths that strike the retina first due to high vibrations. Colors that convey a sense of calmness or coolness are known as cool colors. This group mostly consists of green, purple and blue tones. Shades of purple and green in this color family typically lead to contradiction. Green and purple are created by combining two warm and cold colors in a specific ratio because they are intermediate colors. As a result, blue is the only color in the cold color group that has an entirely cold effect. Cool hues are used in hospitals to soothe patients and slow down metabolism. Cleanliness is evoked by cool blue and green tones. These hues often have a more receding and stagnant effect because they appear on the retina of the eye later than other colors. They give the impression that the volume they are in is wider and larger because of these slow effects and their backward appearance (Güngör, 2005).

Numerous color tones are discernible and observable to the human eye. Owing to the wide range of color tones, descriptive parameters including color type, value, saturation and mixtures are required to accurately classify and choose a color that has been requested or specified by someone else. Because color tones vary so much, they are treated using descriptive criteria. The criteria that are most frequently used are color type, value and saturation.

Type is a classification that varies based on the color's wavelength and gives the color its name, such as red, green or blue. The color's tone is determined by the value. It displays the amount of light reflection, or how light or dark a color is (Ulaş, 2002). One criterion that relates to the color of the light is saturation. White is equivalent to the total absence of color in this sense. Highly saturated colors do not contain white. To put another way, colors have a high saturation level when they are bright, pure and vibrant (Sema, 2006).

The eye is drawn to a color combination with strong contrast. Combining visually appealing elements can lead to misunderstandings. (Doğu & Erkip, 2000). People can interact with their surroundings through color because of its physiological and psychological effects. Color is a useful tool for designing places that are aesthetically pleasing, functional and symbolic because it conveys information about the surrounding area. As a result, color is used intentionally when incorporated into a design (Müezzinoğlu, 2018).

Primary colors and strong colors like red, yellow, and blue can initially seem emphatic but eventually wear people out and make them tense. Yellow is a color that promotes spiritual development, but because it reflects aging and jaundiced skin tones, care should be taken when using it in hospital buildings. The use of tones between yellow and green ought to be avoided because they are associated with bodily fluids (Leibrock, 2000).

Green is a comforting color that makes us think of nature, so making it the primary color in operating rooms helps keep surgeons' eyes from getting tired from staring at body tissue. Because the color blue is associated with peace and relaxation, it lowers blood pressure, which helps treat neurological conditions. Spaces requiring a high degree of visual sensitivity, quiet, and concentration should be designed with green and blue hues (Marberry, 1997).

Protecting patients' physical and mental well-being through the use of color can enhance healing environments. It ought to support medical diagnosis, therapy, and recovery initiatives. Consequently, color expression should be considered when choosing the right lighting. Hospital hallways, patient rooms, and exam rooms should adhere to general color guidelines, but designers should prioritize creating the "ideal home" atmosphere over maintaining a "corporate appearance" (Mahnke, 1996). When used correctly, colors can also provide social support by reducing stress levels (Kocaoğlu et al., 2020). The correct choice of colors used also affects people's actions and orientation (Kalantari et al., 2021; Al Sharaa et al., 2022). In this context, it is important to choose colors to increase the comfort level of users (Long et al., 2021).

Numerous studies have examined the combined effects of color and light, which have a natural power that can influence a person's soul. When it comes to using color in architecture to create a healing space, it is crucial to use it properly. In this way, color influences patients as an element of architectural design. It is anticipated that hospitals with well-chosen interior designs will facilitate faster patient recovery and give both patients and medical personnel a greater sense of space (Khaleghimoghaddam, 2023).

1.3. Hospital and Patient Rooms

The World Health Organization (WHO) defines hospitals as inpatient institutions that provide health services that can be grouped as observation, diagnosis, treatment and rehabilitation, and where patients receive long or short-term treatment. In the Inpatient Treatment Institutions Operation Regulation, on the other hand, hospitals are characterized as institutions where patients, injured people, and those who suspect a disease, want to have their health conditions checked,

birth givers, are observed, examined, diagnosed, treated and rehabilitated as outpatients or inpatients (Eceoğlu, 2010).

There have been notable changes in hospital structures with the advancement of medicine. Houses of worship were utilized for patient care even though religious beliefs and medical science were once understood in tandem (Ergenoğlu & Aytuğ, 2007). Medical and therapeutic institutions have evolved and improved with time. Due to the diversity of diseases, urbanization, population growth, differences in lifestyles, and advancements in medical technology, hospital structures have changed over time (Tipi, 2007).

The pavilion system was introduced to hospital buildings as a result of the diseases that followed the continental wars that broke out in Europe and America in the 1850s. Patient beds were set up along a long corridor in this system. Due to advancements in building technology and the adoption of the pavilion system, which covered enormous areas, the Monoblock system started to be implemented in the 1900s. Depending on their capacity and land size, these hospitals are now designed using both vertical and horizontal planning strategies (Aydın, 2009). With the advancement of technology and medicine, health campuses are becoming more and more prominent. Health campuses aim to address all needs through their services and look for solutions to illnesses (Ayan, 2019). These hospital building types are campus layouts that cater to sizable regions with various settlement patterns.

Patients, companions, and medical staff are among the many and diverse users found in hospitals, which house numerous units. Personnel and units in hospitals that differ in terms of service delivery may also differ based on the services rendered (Aydın, 2001). Hospitals are classified into five categories based on the services they offer: training and research hospitals, general hospitals, special branch hospitals, district hospitals, and day hospitals. District hospitals are medical facilities that offer admission and treatment services to patients. In cases where patients need more advanced testing and care, they stabilize patients and refer them appropriately. Day hospitals are the ones that were built either inside or in conjunction with hospitals and offer daily outpatient examination, diagnosis, and treatment services (Aydın, 2009). Private branch hospitals are facilities where patients with specific demographic traits and unique health problems are observed, examined, diagnosed, treated, and rehabilitated. In contrast to general hospitals, which are physical establishments where national health services are offered to the public with all equipment and specialties, regardless of age and gender. Training and research hospitals are private, general medical facilities that conduct research, provide education, and train specialists and subspecialists (Ayan, 2019).

Hospitals are categorized into three groups based on regional distribution: regional hospitals, secondary regional hospitals, and local hospitals. Within this framework, regional hospitals are defined as 500–1000-bed hospitals, as well as medical centers or university hospitals that house various types of medical research labs and educational establishments. Regional hospitals classified as second-degree, having between 100 and 500 beds, are designed to offer complete medical care. Local hospitals are medical facilities with between 30 and 100 beds that offer special care and surgical services as needed (Aydın, 2009).

In addition to hospital buildings, the current hospital design approach strives to create environments where service providers and recipients can meet all of their needs, including lodging, childcare, entertainment, social activities, and shopping. This approach also incorporates patient- and user-oriented designs and explains the emergence of health campuses that provide services across wide geographic areas. Consistent with the human-centeredness principle, hospital care units are increasingly adopting a patient-centered approach rather than a care-centered (Ergenoğlu & Aytuğ, 2007). The human-centered design approach in patient rooms has been made clear by this circumstance.

Depending on the patient's condition and the number of visitors, patient bedrooms have different action areas and sizes. Seven categories can be used to group patient rooms: general,

disabled, infected, psychiatric, maternity, suite, and children's patient bedroom. Depending on the user group, different design elements are applied in each patient room. Generally speaking, based on the purpose and activities of a modern patient room, the areas can be divided into four sub-spaces: the first is the area where the patient lies down and where the bed is situated; the second is where staff performs care actions; the third is the area where companions perform sitting and resting actions; and finally the area where the patient performs cleaning actions (Aksoy & Aydın, 2022).

Function, adaptability, space, safety, aesthetics, and efficiency are factors that influence the standard of care and recuperation in the patient room. Physically and psychologically, the patient room needs to provide the following: seclusion from other patients when needed, companionship from other patients when appropriate, cleanliness, security, the feeling of being cared when assistance is needed, privacy, quiet, and the freedom to move around the room. Access to showers and baths, proper and sufficient lighting, ease of use of bed and TV remote controls, phone, nurse call sign, sufficient and accessible space for personal belongings, guest accommodations, outside visibility, and aesthetically beautiful surroundings are all examples of encouraging elements (Sungur Ergenoğlu & Tanrıtanır, 2013).

Because these factors have a positive impact on patients' healing processes, thorough literature research on these factors and global knowledge of technological and digital advancements have made it possible for qualified practices to be used widely. Future patient room designs must be adaptable enough to accommodate various disease treatments in terms of both space and technology. The needs are identified by means of an integrated study of the technological structure and building design; consequently, among the design inputs are the creation of visually appealing space layouts that minimize the potential for physical and psychological harm to patients and their relatives, as well as the development of patient-centered, flexible patient care models (Aksoy & Aydın, 2022).

In addition to demarcating the hospital's capacity, patient rooms are the primary factor influencing architectural form and character. The primary design factors that should be taken into account in patient-centered room designs are color, texture, lighting, noise control, view, and ergonomic furniture (Stoufer, 2000). The design elements utilized in patient rooms and their relationships to one another are rather significant in the context of space and human interaction, according to the patient-centered design approach, which takes into account the rehabilitation process, psychological state, morale, and motivation of patients receiving inpatient treatment.

2. Method

According to the patient-centered design approach, the research investigated how people perceive the colors used in patient rooms. Thus, the following is the research hypothesis: "Perceptual evaluations differ depending on the colors used in patient room design.” In line with this questioning, an experimental design was created. Accordingly, a survey technique was applied with color variables determined by limiting adjective pairs that reveal spatial quality.

In this sense, a double patient room at Konya City Hospital was chosen as the study area. The survey technique was employed in the research method to obtain data. As independent variables, orange (R:191; G:120; B:56), blue (R:72; G:102; B:164), green (R:88; G:150; B87) and gray (R:150; G:150; B:150) colors were used. Studies on the use of color in healthcare buildings have shown that while red has an exciting effect, it raises blood pressure, so it is not advised to be used in treatment areas with the exception of Alzheimer's patients. (Marberry, 1997). Red is not included in the study's purview in this context. Although yellow color increases spiritual development, it was not included in the scope of the study because it reflects aging and jaundiced skin tones and caution should be taken when using it in hospital buildings (Leibrock, 2000).

Previous studies that evaluated spatial perception and were found to be valid and safe (İmamoğlu, 2000; Başkaya et al., 2006; Yıldırım et al., 2007; Çağatay et al., 2017; Müezzinoğlu et al.,

2021) were used to identify the adjective pairs regarding the perceptual effect of colors. A total of eight different adjective pairs and a five-stage semantic differentiation scale ranging from positive to negative were employed: eye-catching - distractive, communication facilitator-communication hinderer, invitatory - repellent, pleasing - unpleasing, encouraging - passivating, comforting - discomforting, formal-sincere, refreshing-boring.

Three-dimensional images were created in four different ways, as illustrated in Figure 1, based on the colors chosen for the survey application. All physical conditions, including the size, scale and spatial organization of the patient rooms experienced by the participants, were kept the same. The 40m2 work area was digitally modeled at to produce the visuals. Not every surface of the wall was painted in the designated colors. The wall surfaces' colors were limited to white and employed as emphasizing pieces. The wall surfaces that users see the most in the entrance and lying positions were used as references in the three-dimensional patient room visualizations that were produced.

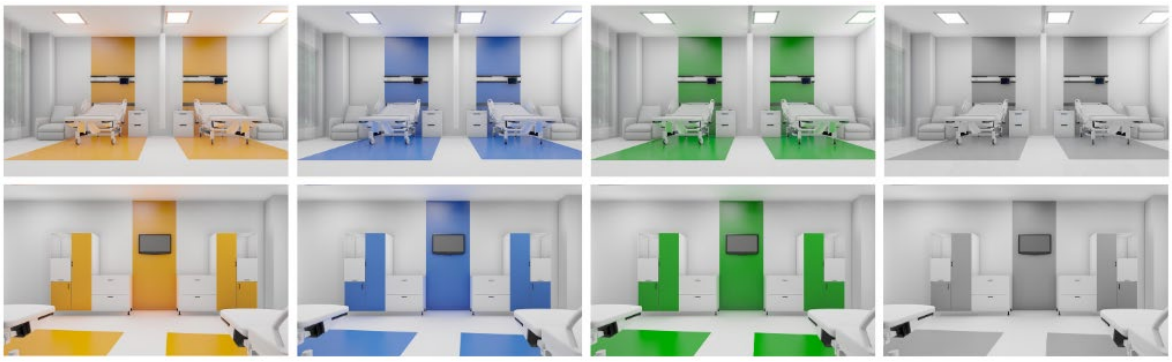

Figure 1 Visuals used in the survey application

A total of 168 persons who visited the patient room completed the survey that was created in accordance with all of these data. People using public patient rooms participated in the survey. The survey was approved by the scientific ethics committee, and participant consent was acquired. The SPSS 18 software was utilized for the analysis of the survey data. The data from the normal distribution were subjected to the ANOVA test, which is used for parametric data. The analyses ascertained to have significant differences as a result of this test were compared with the Tukey test.

3. Findings

The reliability of the data obtained from the study was analyzed with Cronbach's Alpha. According to Cronbach's Alpha reliability analysis, the coefficient value varies between 0-1; between 0.00-0.40 the scale refers to be unreliable, 0.40-0.60 is considered low reliability, 0.60-0.80 is quite reliable, and 0.80-1.00 highly reliable (Tavşancıl, 2005). Accordingly, the reliability analysis coefficient of the research was found to be 0.940 and its internal consistency is thus highly reliable.

Normal distribution of the data depends on the skewness and kurtosis values being between ±3 (Shao, 2002). According to the normality analysis results of the scales, it is observed that the values have a normal distribution. As stated in Table 1, the skewness and steepness coefficients of the expressions related to the scale for each adjective pair are as follows: Skewness coefficient for Eye-catching - Distractive adjective pair = -0.113, and steepness coefficient = -1.173, Skewness coefficient for Communication Facilitator- Communication Hinderer adjective pair = -.015 and steepness coefficient = -1.085, Skewness coefficient for Invitatory- Repellent adjective pair = .017 and coefficient of steepness= -1.246, coefficient of skewness= -.081 and coefficient of steepness= -1.134 for the adjective pair Pleasing-Unpleasing, coefficient of skewness= -.063 and coefficient of steepness= -1.174 for the adjective pair Encouraging-Passivating. , Skewness coefficient for Comforting - Discomforting adjective pair = .012 and steepness coefficient = -1.070, Skewness coefficient for Sincere - Formal adjective pair = -.093 and steepness coefficient = -1.356, and

Skewness coefficient for Refreshing-Boring adjective pair scale = -1.356. -0.021 and steepness coefficient = -1.312.

Table 1 Normal Distribution of Color Variables by Adjective Pairs

Adjective pairs	Skewness value		Kurtosis value	
	Statistics	Standard deviation	Statistics	Standard deviation
Eye-catching-Distractive	-,113	,094	-1,173	,188
Communication facilitator-Communication hinderer	-,015	,094	-1,085	,188
Invitatory-Repellent	,017	,094	-1,246	,188
Pleasing-Unpleasing	-,081	,094	-1,134	,188
Encouraging-Passivating	-,063	,094	-1,174	,188
Comforting-Discomforting	,012	,094	-1,070	,188
Sincere-Formal	-,093	,094	-1,356	,188
Refreshing-Boring	-,021	,094	-1,312	,188

The results of the single-factor analysis of variance are indicated in Table 2. Accordingly, there is a significant difference at P<0.05 level in the scores given to the adjective pair 'Eye-catching – Distractive' according to colors (F (3,668) = 49.686; P= .000). Reviewing the multiple comparison Tukey test results showing which two groups the differences originate from, orange (M= 3.64; SD= 1.20), blue (M= 3.46; SD= 1.22), green (M= 3,07; SD= 1,39) and gray (M= 2.14; SD= 1.07) are observed to have a difference between the answers given to the adjective pairs. Orange color is the most eye-catching color while blue seems more eye-catching than gray and green.

There is a significant difference at the P<0.05 level in the scores given to the adjective pair 'Communication Facilitator - Communication Hinderer' according to colors (F (3,668) = 48.939; P =.000). Looking at the results of the multiple comparison Tukey test showing which two groups the differences originate from, orange color (M = 3.49; SD = 1.12), blue color (M = 3.30; SD = 1.13), green color (M=3,00; SD= 1,19) and gray color (M= 2.04; SD= 1.29) are observed to have a difference between the answers given to the adjective pairs. While the color orange is the most communication-facilitating color compared to gray and green; gray is the most hinderer. Blue color, close to orange color, seems to facilitate communication.

There is a significant difference at the P<0.05 level in the scores given to the adjective pair 'Invitatory-Repellent' depending on the colors (F (3,668) = 67.837; P= .000). Looking at the results of the multiple comparison Tukey test showing which two groups the differences originate from, orange color (M= 3.52; SD= 1.24), blue color (M= 3.27; SD= 1.20), green color (M= 2,92; SD= 1,19) and gray color (M= 1.19; SD= 1.16) are observed to have a difference between the answers given to the adjective pairs. While orange is the most invitatory compared to gray and green, blue is more invitatory than gray and green.

It seems that there is a significant difference at the P<0.05 level in the scores given to the adjective pair 'Pleasing-Unpleasing' depending on the colors (F(3,668) = 114.905; P= .000). Considering the multiple comparison Tukey test results showing which two groups the differences originate from, orange color (M= 3.67; SD= 1.07), blue color (M= 3.33; SD= 1.15), green color (M= 3,20; SD= 1,06) gray color (M= 1.66; SD= 1.01) are observed to have a difference between the answers given to the adjective pairs. While orange is the most pleasing, blue is more pleasing than gray and green.

A significant difference can also be observed at the P<0.05 level in the scores given to the adjective pair 'Encouraging-Passivating' depending on the colors (F(3,668) = 115.620; P= .000).

When we look at the multiple comparison Tukey test results showing which two groups the differences originate from, orange color (M= 3.70; SD= 1.12), blue color (M= 3.26; SD= 1.20), green color (M= 3,16; SD= 1,04) and gray color (M= 1.61; SD= 0.98) are observed to have a difference between the answers given to the adjective pairs. The color orange is most encouraging while blue is more encouraging compared to gray color.

There is a significant difference at the P<0.05 level in the scores given to the adjective pair 'Comforting-Discomforting' depending on the colors (F (3,668) = 61.219; P= .000). Considering the results of the multiple comparison Tukey test showing which two groups the differences originate from, orange color (M = 3.27; SD = 1.10), blue color (M = 3.54; SD = 1.21), green color (M= 3,05; SD= 1,20) and gray color (M = 1.94; SD = 1.12) are observed to have a difference between the answers given to the adjective pairs. The color blue is the most comforting color. Orange is comforting compared to gray color. Green color has a more comforting effect than gray color.

A significant difference appears in the scores given to the adjective pair 'Sincere-Formal' according to colors at the P < 0.05 level (F (3,668) = 142.112; P = .000). Considering the results of the multiple comparison Tukey test showing which two groups the differences originate from, orange color (M = 4.09; SD = 1.04), blue color (M = 2.98; SD = 1.33), green color (M=3,36; SD= 1,09) and gray color (M=1.59; SD= 1.06) are observed to have a difference between the answers given to the adjective pairs. While orange is the sincerest color, green is found to be more sincere than blue and grey.

There is a significant difference at the P<0.05 level in the scores given to the adjective pair 'Refreshing-Boring' depending on the colors (F (3,668) = 103.877; P= .000). Looking at the results of the multiple comparison Tukey test showing which two groups the differences originate from, orange color (M= 3.50; SD= 1.16), blue color (M= 3.52; SD= 1.26), green color (M= 3,23; SD= 1,27) and gray color (M= 1.57; SD= 1.03) are observed to have a difference between the answers given to the adjective pairs. Blue color seems to be the most refreshing color while orange has an effect close to the color blue, but it is more refreshing than green.

Table 2 Single-Factor Analysis of Variance ANOVA Test

Adjective pairs	Orange		Blue		Green		Grey		ANOVA		
	M	SD	M	SD	M	SD	M	SD	df	F	Sig.
Eye-catching-Distractive	3,64	1,20	3,46	1,22	3,07	1,39	2,14	1,07	3,668	49,686	,000
Communication facilitator-Communication hinderer	3,49	1,12	3,30	1,13	3,00	1,19	2,04	1,29	3,668	48,939	,000
Invitatory-Repellent	3,52	1,24	3,27	1,20	2,92	1,19	1,79	1,16	3,668	67,837	,000
Pleasing-Unpleasing	3,67	1,07	3,33	1,15	3,20	1,06	1,66	1,01	3,668	114,905	,000
Encouraging-Passivating	3,70	1,12	3,26	1,20	3,16	1,04	1,61	0,98	3,668	115,620	,000
Comforting-Discomforting	3,27	1,10	3,54	1,21	3,05	1,20	1,94	1,12	3,668	61,219	,000
Sincere-Formal	4,09	1,04	2,98	1,33	3,36	1,09	1,59	1,06	3,668	142,112	,000
Refreshing-Boring	3,50	1,16	3,52	1,26	3,23	1,27	1,57	1,03	3,668	103,877	,000

*Note: M: Mean value. SD: Standard deviation. High value indicates positive answers. Sig.: ANOVA analysis result is significant at *p<0.05 level.*

According to the findings obtained from the analysis, the color orange is evaluated as more eye-catching, communication facilitator, invitatory, pleasing, encouraging and sincere while the color blue is found to be more comforting and refreshing. According to the analysis, it is seen that there exist significant differences in all adjective pairs. In this context, the hypothesis "Perceptual evaluations differ depending on the colors used in patient room design" is supported.

4. Conclusion

One of the most fundamental needs of humankind has always been the concept of space, which has existed from ancient times. In this particular context, one of the most potent factors influencing people's comfort level is space. Each space gains meaning by being designed for its purpose, which aims to increase comfort levels and positively impact people's lives with new insights.

In addition to people's innate capacity for perception, the physical components of the environment convey messages to its users, and people and the environment are constantly interacting. People establish their action boundaries, identify their motivational criteria, and feel a sense of belonging to the place they experience as a result of this interaction. In this way, the location, with all of its characteristics, has a direct impact on the mental health of those who occupy it.

Human and space interaction is influenced by a variety of factors, including people's demographics, social and cultural contexts, and the cognitive and perceptual effects of space. Depending on their illness, people's thoughts and feelings may also be included in this situation. In this regard, it is crucial that the designs used in patient rooms are made with the users of the space in mind.

People perceive and manage their emotions in different ways depending on the color of the walls, which sends a clear visual message to everyone in the room. As a result, the use of color, which is regarded by the place's nature as one of its environmental factors, distinguishes that location. Extended periods of time spent in patient rooms expose people to the perceptual effects of the colors used in the room. The psychological well-being and developmental trajectory of inpatients may be impacted by this circumstance as they undergo treatment.

The aim of the study was to determine the perceptual effect of the colors used in patient rooms of multifunctional hospitals on patients. For this purpose, in the context of the experimental setup created by using color variables and adjective pairs, data based on spatial quality affecting the psychological state of the patients were obtained as a result. The study found that people's perceptions are affected by the colors used in patient room interior design suggesting that orange and blue colors have advantageous effects. According to the results, the perceptual effect of the colors used in patient rooms is as follows:

• According to the findings obtained from the analysis, orange color; It was evaluated as remarkable, communication facilitator, inviting, happy, encouraging and sincere.

• The color blue was found relaxing and refreshing by the people who participated in the research.

• Although green and gray colors are preferred in themselves, they did not provide significant differences according to adjective pairs.

These findings align with those of previous research, including Hidayetoğlu (2010), Müezzinoğlu et al. (2021), Akçaova (2022), and Noraslı (2022). This demonstrates how people's perceptions of color are influenced and how they create parallel impressions in spaces used for various purposes.

Every color has a different psychological impact, and every space has a different purpose. Sometimes, because of the way the place operates, people might feel pressured by it. The perception that the operating room and the outpatient clinic evoke, for instance, might be different from one another. It is not reasonable to assume that the colors chosen for patient rooms will have the same psychological impact in other areas of hospital buildings, given the variety of spaces within. In this research, a standard two-person adult patient room was determined as the sample area and study results were obtained on these limitations. This work: It can also be developed by testing it in the rooms of hospitals in different structures such as public hospitals, private hospitals, children's hospitals. In this instance, it ought to be advised that the colors chosen for each space's design be taken into account independently and supported by research from scientific sources.

References

Akçaova, A. (2022). *Stadyum soyunma odası tasarımında kullanılan çevresel faktörlerin sporcu motivasyonu ve performansına etkisinin incelenmesi – Konya Büyükşehir Belediyesi Stadyumu*. Doktora Tezi, Lisansüstü Eğitim Enstitüsü, KTO Karatay Üniversitesi, Konya.

Aksoy, E., & Aydın, D. (2022). Hastane tasarımlarının geçmişten günümüze değişiminin hasta odaları üzerinden incelenmesi. *Bodrum Journal of Art and Design*, *1*(2). 221-240.

Al Sharaa, A., Adam, M., Amer Nordin, A. S., Alhasan, A., & Mundher, R. (2022). A user-centered evaluation of wayfinding in outpatient units of public hospitals in malaysia: ummc as a case study. *Buildings*, *12*(3), 364.

Aslan, A., Aslan, E., & Atik, A. (2015). İç mekânda algı. *İnönü Üniversitesi Sanat ve Tasarım Dergisi*, *5*(11), 139-151.

Ayan, G. S. (2019). *Yeni nesil sağlık yapılarının mekân dizim yöntemi ile incelenmesi: İstinye Üniversitesi Hastanesi Liv Hospital Bahçeşehir ve VM Medical Park Pendik Hastanesi örneği*. Yüksek Lisan Tezi, Fen Bilimleri Enstitüsü, Süleyman Demirel Üniversitesi, Isparta.

Aydın, D. (2001). *Genel hastanelerde teknolojik gelişmelerin bina ihtiyaç programına etkilerinin araştırılması*. Doktora tezi, Selçuk Üniversitesi, Fen Bilimleri Enstitüsü, Konya.

Aydın, D. (2009). *Hastane mimarisi, ilkeler ve ölçütler*. TMMOB Mimarlar Odası Konya Şubesi Yayını, Entegre Matbaacılık, İstanbul.

Aydıntan, E. (2001). *Yüzey kaplama malzemelerinin iç mekân algısına anlamsal boyutta etkisi üzerine deneysel bir çalışma*. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Karadeniz Teknik Üniversitesi, İstanbul.

Başkaya, A., Wilson, C., Ozcan, Y. Z., & Karadeniz, D. A. (2006). Study in reestablishing the corporate identity of a post Office institution with genderrelateddifferences in perception of space. *Journal of Architecturaland Planning Research*, *23*, 43-59.

Carpman, J. R., & Grant, M. A. (2016). *Design that cares: planning health facilities for patients and visiors*. American Hospital Publishing, Chicago.

Ching, F. D. K. (2002). *Mimarlık biçim, mekân & düzen*. (Gizem Parlak, Çev.). Nobel Yayınları, İstanbul.

Çağatay, K., Hidayetoğlu, M., & Yıldırım, K. (2017). Effects of colors used for corridor walls of high schools on perceptual evaluations of students. *Hacettepe University Journal of Education*. *32*(2), 466-479.

Doğu, U., & Erkip, F. (2000). Spatial factors affecting wayfinding and orientation: a case study in a shopping mall. *Environment and Behavior*. *32*(6), 731-755.

Eceoğlu, A. (2010). *Değişen kullanım ihtiyaçları karşısında hastane giriş mekânlarının şekillenmesi*. Sanatta Yeterlik Tezi, Fen Bilimleri Enstitüsü, Mimar Sinan Güzel Sanatlar Üniversitesi, İstanbul.

Ergenoğlu, S. A., & Aytuğ, A. (2007). Sağlık Kurumlarında Değişen Paradigmalar ve İyileştiren Hastane Kavramının Mimari Tasarım Açısından İrdelenmesi. *Yıldız Teknik Üniversitesi Mimarlık Fakültesi E-Dergisi*, *2*(1), 44-63.

Erkan Yazıcı, Y., & Çakıcı Alp, N. (2017). Duyuların mekânsal deneyimi şekillendirmesi: Sagrada Familia Kilisesi. *Art-e Sanat Dergisi*, *10*(19), 55-77.

Garip, E. (2009). *Büyük mağazalarda tüketici mekânsal davranışının mekânsal dizim çerçevesinde irdelenmesi*. Doktora Tezi, Fen Bilimleri Enstitüsü, İstanbul Teknik Üniversitesi, İstanbul.

Goldstein, E. B. (2010*). Encylopedia of perception*. Sage Publishing, New York.

Gollodge, R. G. (1999). *Wayfinding behavior: cognitive mapping and other spatial processes*. Johns Hopkins University Press, USA.

Göker Paktaş, M. (2018). İç mimarlıkta rengin mekân algısı üzerindeki etkisi. *Journal of Interdisciplinary and İntercultural Art*, *3*(6), 137-144.

Güller, E. (2007). *Sağlık yapılarında renk olgusunun özel dal hastaneleri hasta yatak odası örneklerinde araştırılması*. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Dokuz Eylül Üniversitesi, İzmir.

Güngör, İ.H. (2005). *Görsel sanatlar ve mimarlık için temel tasar*. Esen Ofset, İstanbul.

Gür, Ş. Ö. (1996). *Mekân örgütlenmesi*. Gür Yayıncılık, Trabzon.

Hardeberg, J. Y. (1999). *Acquisition and reproduction of colour images; colorimetric and multispectral approaches*. PhD Thesis, Ecole Nationale Superieure des Telecummunications, Paris.

Hasgül, E. (2011). *İç mekânda yön bulma: büyük ölçekli binalarda inceleme.* Yüksek Lisans Tezi, Sosyal Bilimler Enstitüsü, İstanbul Teknik Üniversitesi, İstanbul.

Hasol, D. (1993). *Ansiklopedik mimarlık sözlüğü*. YEM Yayın, İstanbul.

Heschong, L. (2002). Daylighting and human performance. *ASHRAE Journal*, *44*(6), 65-67.

Hidayetoğlu, M. L. (2010). *Üniversite eğitim yapılarının iç mekânlarında kullanılan renk ve ışığın mekânsal algılama ve yön bulmaya etkileri*. Doktora Tezi, Fen Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.

İmamoğlu, C. (2000). Complexity, liking and familiarity: architecture and non-architecture turkish students' assessments of traditional and modern house facades. *Journal of Environmental Psychology*, *20*, 5-16.

İzgi, U. (1999). *Mimarlıkta süreç kavramlar ilişkiler*. YEM Yayın, İstanbul.

Kalantari, S., Tripathi, V., Kan, J., Rounds, J., Mostafavi, A., Snell, R., & Cruz Garza, J. (2021). Evaluating the impacts of color, graphics, and architectural features on wayfinding in healthcare settings using EEG data and virtual response testing, *Journal of Environmental Psychology*. *79*. 101744.

Khaleghimoghaddam, N. (2023). Understanding the interplay of light, color, and interior design in helathcare spaces. *Journal of Design for Resilience in Architecture & Planning*, *4*(2), 219-231.

Kocaoğlu Aslanoğlu, R., Ulusoy, B., & Olguntürk, N. (2020). *Color in Hospitals*. Encyclopedia of Color Science and Technology Publisher: Springer, Berlin.

Kuban, D. (2016). *Mimarlık kavramları*. YEM Yayın, İstanbul.

Leibrock, C. (2000). *Design details for health: A guide to making the most of interior design's healing potential*. Wiley, New York.

Leland, R. M. (2006). *Mimarlığın öyküsü, ögeleri ve anlamı*. (Ergün Akça, Çev.). Kabalcı Yayınevi, İstanbul.

Long, R., Shang, X., Cao, H., & Li, J. (2021). *Emotional Experience Design of Medical Working Space Based on Color Semantics*. In: Shin, C.S., Di Bucchianico, G., Fukuda, S., G ve BSim , YG., Montagna, G., Carvalho, C. (eds) Advances in Industrial Design, AHFE 2021, Lecture Notes in Networks and Systems, vol *260*.

Mahnke, F. H. (1996). *Color, enviroment and human response*. New York: Van Nostrand Reinhold.

Marberry, S. O. (1997). Healthcare design. Wiley, New York.

Müezzinoğlu, K., Hidayetoğlu, M.L., & Yıldırım, K. (2021). The The effects of light color temperatures on students' perceptual evaluations in design studios. *Color Research and Application*, *46*(5), 1-13.

Müezzinoğlu, M. K. (2018). *Eğitim mekânlarında kullanılan renk ve ışığın öğrencilerin fonksiyonel ve algısal değerlendirmeleri üzerindeki etkileri*. Doktora Tezi, Fen Bilimleri Enstitüsü, Selçuk Üniversitesi, Konya.

Noraslı, M. (2022). *Şehir hastanelerindeki sirkülasyon sisteminin yön bulmaya etkilerinin mekân dizimi ile incelenmesi: Konya şehir hastanesi örneği*. Doktora Tezi, Lisansüstü Enstitüsü, KTO Karatay Üniversitesi, Konya.

Norberg Schulz, C. (1974). *Existence, space and architecture*. Praeger Paperbacks, Connecticut.

Özdemir, T. (2005). *Renk kavramı ve konut iç mekânında tasarıma etkileri*. Sanatta Yeterlilik Tezi, Fen Bilimleri Enstitüsü, Mimar Sinan Güzel Sanatlar Üniversitesi, İstanbul.

Öztürk Çelebi, G. (2018). Tarih öncesi dönemlerde iletişim. *Etkileşim*, *1*(2), 142-157.

Pallasmaa, J. (2018). *Tenin gözleri: mimarlık ve duyular*. (Aziz Ufuk, Çev.). YEM Yayın, İstanbul.

Roth, L. (2006). *Mimarlığın öyküsü: öğeleri, tarihi ve anlamı*. Kabalcı Yayıncılık, İstanbul.

Sema, T. (2006). *Mimarlık ve renk kavramı*. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Mimar Sinan Güzel Sanatlar Üniversitesi, İstanbul.

Siegel, S. (2006). *Which properties are represented in perception?* (T. Gendler, J. Hawthorne, Ed.). Perceptual Experience. Oxford University Press, Oxford.

Smith, A.D. (2002). *The problem of perception*. Harvard University Press, Cambridge.

Stoufer, J. (2000). Integrating human centered design principles in progressive health facilities. *Design & Health*, 258-292.

Sungur Ergenoğlu, A., & Tanrıtanır, A. (2013). Genel hastanelerde kullanıcı memnuniyeti açısından hasta odalarında mimari mekân kalitesinin irdelenmesi: Gaziantep ilinde bir alan çalışması. *Megaron*, *8*(2), 61-75.

Tağrikulu, R. (2022). *Yeniden işlevlendirilen mekanlarda katmanlaşan belleğin örnekler üzerinden incelenmesi.* Yüksek Lisans Tezi, Lisansüstü Eğitim Enstitüsü, İstanbul Kültür Üniversitesi, İstanbul.

Tavşancıl, E. (2005). *Tutumların ölçülmesi ve spss ile veri analizi*. Nobel Yayınları, Ankara.

Tepecik, A. (2002). *Grafik sanatlar, tarih, tasarım, teknoloji*. Detay Yayınları, Ankara.

Tipi, Ç. B. (2007). *Tıp fakültesi hastanelerinin erişebilirlik, kullanışlılık ve kullanıcı memnuniyeti kapsamında değerlendirilmesine yönelik bir yöntem önerisi*. Doktora Tezi, Fen Bilimleri Enstitüsü, Gazi Üniversitesi, Ankara.

Ulaş, B.G. (2002). *İç mekân renk düzenlemeleri*. Yüksek Lisans Tezi, Fen Bilimleri Enstitüsü, Mimar Sinan Güzel Sanatlar Üniversitesi, İstanbul.

Von Meiss, P. (2013). *Elements of architecture: from form to place tectonics*. EPFL Press, Lozan.

Wang, J., Zhu, Q., & Mao, Q. (2007). *The three-dimensional extension of space syntax*. 6th International Space Syntax Symposium içinde (ss.1-16). İstanbul, Türkiye.

Yıldırım, K., Akalın Başkaya, A., & Celebi, M. (2007). The effects of window proximity, partition height, and gender on perceptions of open-plan offices, *Journal of Environmental Psychology*, *27*(2), 154-165.

Zevi, B. (1990). *Mimariyi görmeyi öğrenmek*. (Demir Divanoğlu, Çev.). Birsen Yayınevi, İstanbul.

Resume

Mehmet Noraslı received his degree from the Interior Architecture and Environmental Design Department of Selçuk University's Faculty of Fine Arts. After completing his master's degree at Selçuk University and Hacettepe University Joint Master's Program, he completed his doctorate in the Department of Architecture at Karatay University. At Selçuk University's Faculty of Architecture and Design's Department of Interior Architecture, he holds the position of Assistant Professor. His specialties include wayfinding, circulation areas, interior colour and texture, and health buildings. He has conducted research on how people perceive colour and the best ways to teach interior architecture, particularly in the common areas of various structures.