# Science Fiction and Architecture as an Elective Course in Architectural Education

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**ABSTRACT**
The main objective of the research titled "Science Fiction and Architecture as an Elective Course in Architectural Education" is to investigate the course "Science Fiction and Architecture" developed in accordance with the goal stated in the "UNESCO /UIA Charter for Architectural Education" to improve the skills of architecture students to develop solutions for the future. The Science Fiction and Architecture course selection is based primarily on the fact that science fiction directly addresses the future and inevitably deals with the future of space and place. It is hypothesized that the study of science fiction can help develop ideas about the future of space. Students received theoretical explanations of the topic and were recommended written and visual resources to read and view. They were expected to conduct various studies. The corresponding studies were analyzed and compared using a descriptive analysis method. The study and comparison revealed the achievement of the specified learning outcomes. The data obtained suggest that engaging in science fiction enhances and enriches students' abilities to develop ideas about the future of spaces, design, and architecture. To develop architecture students' abilities to think about the future of architecture, buildings, design, spaces, and cities, it is recommended that courses be offered that explore the relationship between science fiction and architecture in architectural education curricula or that the topic be incorporated into other courses. If the topic is not covered in the curricula, students should be encouraged to do their research.

**Keywords**
Architecture, Architectural Education, Elective Courses, Science Fiction, Science Fiction and Architecture

## 1. INTRODUCTION

Architecture is the discipline in which all spaces designed by and for humans have evolved throughout history to adapt to changing needs, advancing technologies, and the discovery of knowledge. It is a discipline that has shaped humanity, influenced by different definitions and perspectives that have evolved over time in relation to architecture (Conrads, 1991; Leach, 1997).

"Architecture must be understood as the endeavor to harmonize, with freedom and great audacity, the environment with man, that is to say, to render the world of things a direct projection of the spirit (Sant'Elia and Marinetti, 1964)."

In Vitruvius' "Ten Books on Architecture," the only extant scholarly work on architecture from antiquity to the present, Vitruvius defines architecture as a combination of strength, commodity, and pleasure (Vitruvius, 1914). Le Corbusier highlights six points in his definition of architecture. "The business of architecture is to establish emotional relationships by means of raw materials. Architecture goes beyond utilitarian needs. Architecture is a plastic thing. The spirit order, a unity of intention. The sense of relationship; architecture deals with quantities. Passion can create drama out of inert stone (Le Corbusier, 1986)." Parcell points out the difficulty of understanding architecture and the boundaries between what is considered architecture and what is not, such as

proportionate - disproportionate, ornate - simple, exaggerated - modest, complex - simple, original - typical, rich-poor, sacred - secular. He also emphasizes that contemporary architecture is often limited to the field of production and its relationship with other fields is neglected. The belief that architects only design buildings simplifies the field of practice and leads to the view that buildings are merely aesthetic objects. When combined with the concepts of teche-mechanical art, art and design, and visual art, architecture expands its domain beyond spatial aspects and becomes not only a physical space but also a reflection of time (Parcell, 2012). Architecture is, above all, the product of a way of thinking (Leach, 1997).

In addition to the definitions that emphasize that architecture is not just about constructing a building, but that it has semantic value and embodies a way of thinking, architecture is also shaped by the demands, changes, and discoveries of the times. Particularly, our modern age is referred to by terms such as post-industrial age, information age, age of information technologies, computer age, and digital age (Bell, 1976; Castells, 2008; Leavitt, 1962; Machlup, 1962; Webster, 2002), has brought significant changes to the field of architecture. With the development of information technologies, architects have gained the opportunity to use intelligent and innovative technologies in the processes of design, production, and construction. These technologies help architects swiftly transition between different design options and obtain more precise and accurate data for detailing and producing designs at a faster pace. With this new era, the nature of space itself is also changing. For example, in his book "Physics of the Future," Michio Kaku examines various aspects of the future under headings such as "The Future of Computer," "The Future of AI", "The Future of Medicine", "Nanotechnology", "The Future of Energy", "The Future of Space Travel", "The Future of Wealth", and "The Future of Humanity". In the final chapter, Kaku explores the life of a human in 2100, describing advances such as DNA and protein receptors in mirrors, toilets, and sinks; controlling the environment through mental activity; connecting to the Internet through contact lenses; life on Mars; the first colonies and settlements; space elevators; and magnetic vehicles. He highlights the changes in the concepts of offices, houses, cities, and space design (Kaku, 2012). From the primitive dwellings that served basic needs for shelter and protection since the dawn of humanity to the present, architecture has undergone changes and developments, and it is expected to continue to evolve beyond the information age.

In this context, it becomes important to discuss the future of architectural education in order to train architects who can respond to the changes and developments of people and space.

The charter (UNESCO-UIA Charter for Architecture Education) developed by UNESCO and UIA in 2017 (International Union of Architects, 2017) defines and establishes the goals of architectural education. Among the goals of architectural education, instructors should guide students to become individuals who seek new solutions for the future (International Union of Architects, 2017). Therefore, architectural education is also striving to adapt to evolving technology and the changing world. When examining the future of architectural education through various indexes (Scopus, Google Scholar, Web of Science, Avery …),, concepts such as sustainability, ecology, information technologies, computer technologies, globalization, global design, accessibility, integrative design, architecture focused on social issues, integrated design, and interdisciplinary approaches emerge. It is noteworthy that curricula that integrate these concepts into architectural education are emphasized in the educational process.

The Bologna Process, which aims to achieve a highly competitive system of international standards in the European higher education system, plays an influential role in the regulation of architectural education. The Bologna Declaration emphasizes the universities' own core values and diversity. The independence of the study programs is in the foreground. The goal is to create a higher education system that is free of uniformity within

the framework of cultural, linguistic, and educational diversity (Confederation of EU Rectors' Conferences and The Association of European Universities, 1999). The least desirable outcome in the field of European higher education is the transformation of member countries' educational systems into a unified system of higher education. The primary aim of European higher education is to strike a balance between diversity and unity. The aim is to ensure that higher education systems retain their unique characteristics while being comparable and compatible with each other (Türkiye Cumhuriyeti Yükseköğretim Kurulu, 2023).

As a result of the Bologna Process, the diversity of elective courses contributes to the move away from uniformity in educational programs. It allows students to acquire knowledge and enrich themselves in their areas of interest (Ertaş et al., 2014). It is also discussed that elective courses in architectural education precede the compulsory ones, which should be learned at the same time (Demirarslan, 2017). This diversity also provides a platform for exploring the concepts that are emerging in research on the future of architectural education. In Turkey, in line with the UIA/UNESCO Charter and the Bologna Declarations, there is an increasing emphasis on diversity and elective courses in architectural education.

In Turkey, there are a total of 108 universities offering undergraduate architecture programs, of which 66 are state universities and 42 are foundation/private universities (Türkiye Yükseköğretim Kurulu (YÖK), 2023). It was found that there are a total of 3,607 elective courses in architecture undergraduate programs.

The Architecture Accreditation Association (MİAK/Mimarlık Eğitimi Akreditasyonu Derneği), whose purpose is to help improve the quality of architecture education through accreditation, external quality assessment, and information activities for architecture education programs, has classified the knowledge and skills that students should acquire in architecture degree programs into five major categories (Mimarlık Eğitimi Akreditasyonu Derneği, 2023). The elective courses can be categorized in these categories as "Architecture-Design/Creative Thinking," "Architecture-History/Theory, Culture/Art," "Architecture-Environment/Urban/Society," "Architecture-Technology," and "Architecture-Professional Environment". The distribution of the courses based on this grouping is shown in Figure 1.

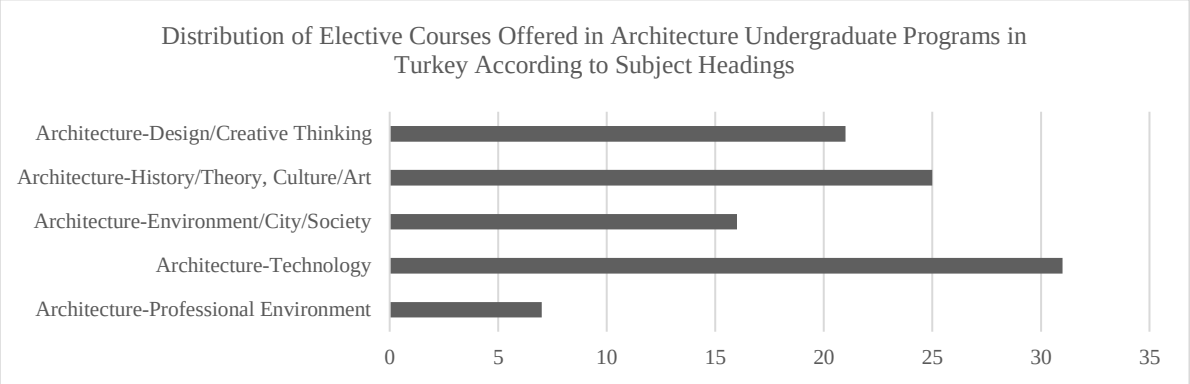


Figure 1: Distribution of Elective Courses Offered in Architecture Undergraduate Programs in Turkey According to Subject Headings

The architectural profession and education are directly influenced by the rapidly developing technology and scientific advances of our time. Architectural education will inevitably include courses that focus on the future. Among the identified 3,607 courses, some courses deal with the future in terms of content. In addition, it is observed that there are courses specifically aimed at the future, such as "science fiction" paired with architecture, and in this context, two such courses have been opened in Eskişehir Osmangazi University Faculty

of Engineering and Architecture (architecture in science fiction literature and animation) and Atilim University Fine Arts, Design and Architecture Faculty (Science fiction and architecture).

In this context, within the scope of this research, examined the course "Science Fiction and Architecture", which aims to improve the skills of creating solutions for the future as part of the architectural design/creative thinking category, as also stated in the documents published by UNESCO and UIA. The elective course was first offered in the fall semester of the 2018-2019 academic year in the Department of Architecture, Faculty of Fine Arts and Design at Atilim University. In this research, the evaluation will be based on the course offered in the spring semester of the 2020-2021 academic year, which has expanded content and includes more examples for comparison.

## 2. METHODOLOGY

Within the scope of the study, the course titled "Science Fiction and Architecture" has been examined, which falls under the category of Architecture- Design/Creative Thinking and aims to create an environment that encourages students to think about the future of architecture, spaces, and designs. The phases of the study are shown in Figure 2.

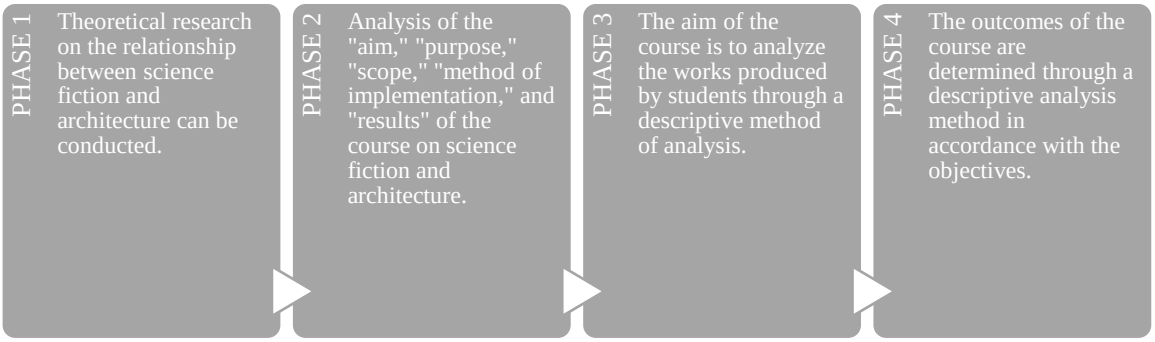


Figure 2: Flowchart of the research.

In the initial phase of the research, the relationship between science fiction and architecture was identified. The contribution of this relationship to creating an environment for discussion on topics such as the future of architecture and future architectural designs was determined. The objectives, scope, teaching methods, and expected outcomes of the "Science Fiction and Architecture" course were examined. The main structure of the course consists of two major components: the information provided by the instructor and the studies conducted by the students.

Within the scope of the course, there are six assignments as part of the course. In order to measure the learning outcomes achieved by the students in relation to the course outcomes, the first and final assignments are given on the same topic.

The descriptive analysis method was used in the analysis and comparison of the tasks. The descriptive analysis method is one of the three common stages in the analysis of qualitative data (Sığrı, 2021), in which the collected data are summarized and described according to predefined themes. It is also the first stage of content analysis (Dey, 1993; Sığrı, 2021). The method consists of four stages: creating the conceptual framework, processing the data according to the thematic framework, identifying the results, and interpreting them (Sığrı, 2021). Based on the analysis, the changes in students' thinking patterns regarding the relationship between the future and architecture and the contribution of the course in this context were identified.

## 3. PHASE 1: SCIENCE FICTION and ARCHITECTURE

Science fiction is always a popular topic worldwide. If we look at the use of the search term "science fiction" on Google Trends from 2004 to today, we can see that interest has always remained at a similar level (Figure 3).


Figure 3: The changing interest in the term "science fiction" over time (Google Trends, 2023).

According to the Oxford English Dictionary, science fiction is defined as " imagined scientific discoveries of the future, and often deals with space travel and life on other planets (The Oxford English Dictionary, 2023)". Sterling, on the other hand, defines science fiction as "science fiction is a form of fiction that deals principally with the impact of actual or imagined science upon society or individuals (Sterling, 2023)". Roberts points out in his book that science fiction, while easy to recognize, becomes more complex upon closer examination (Roberts, 2000). When examining the various definitions of science fiction (Asimov, 1981; Bester et al., 1969; Del Rey, 1980; Le Guin, 1979; Luckhurst, 2005), it can be interpreted as the merging of reality and fantasy in light of science and technology to create a narrative. This narrative can find its place in various media such as literature, cinema, and comic books.

Humankind is experiencing a time of rapid technical and scientific progress. A century ago, architects imagined how the technologies of the Industrial Revolution could impact and transform cities. Today, we can discuss a range of new technologies, including nanotechnology, synthetic biology, artificial intelligence, and virtual reality. Science fiction, on the other hand, seeks to explore these areas. As numerous science fiction critics point out, the importance of science fiction lies in its potential to develop a socially critical perspective on society. Considering the tools of architecture, it can enable the design of outcome-oriented results that consider all possibilities (Clear, 2014). This inevitable relationship between architecture and science fiction also influences the design of structures and city plans in fields such as literature and cinema. However, the impact of science fiction on contemporary or future architecture and its debates is not equally discussed. For example, Neil Spiller's two issues entitled "Architects in Cyberspace " ("Architects in Cyberspace," 1995) in Architectural Design Profile are among the first attempts in a mainstream architectural publication to address these concepts (Clear, 2014).

There is a significant interaction between architecture and fiction, which are integral parts of various utopian or dystopian stories that effectively use imagination. Although science fiction and architecture may appear to be two distinct disciplines, they overlap in several aspects. The first overlap is the effectiveness of imagination and the common actions in developing, exploring, and shaping ideas for the future. Another overlap is the inseparable connection between humans and space, which is also found in science fiction works.

Thomas More's work "Utopia," first published in 1516, is a work of fiction that describes both a society and an urban order and architecture. For example, the capital city described in the book, Amaurote, is surrounded by walls, and the streets and squares are designed to facilitate transportation and provide shelter from the wind. The houses stand along the streets, facing each other and side by side. Behind the houses are large gardens. There

are no locks or keys in the houses. While in the past the houses were built with rudimentary materials and were low huts, today they are three-story buildings with stone or brick walls, well organized and plastered inside. The ceilings are flat and covered with a material that is cheap, fireproof, and more resistant to rain than lead. There are glass windows to protect from the wind (More, 2019).

The film "Metropolis" (1927), one of the first science fiction films directed by Fritz Lang and scripted by Thea von Harbou, with sets by Fritz Lang and architect Erich Kettelhut (Jacobsen and Sudendorf, 2000), has been the subject of various studies in terms of its critique of social structure and modernity, and the relationship between architecture, science fiction, and cinema (Akgün Yüksekli, 2013; Cowan, 2007; Erbalaban Gürbüz, 2017; Huyssen, 1986; Jacobsen and Sudendorf, 2000). In Metropolis, the spatial design is directly related to the plot and the script. The city of Metropolis, characterized by a vertical city, has high-rise buildings, skyscrapers made of glass, steel, and concrete, horizontal traffic axes at different levels, a factory that maintains the city in the form of a machine with an order created by the workers, underground cult spaces, a scientist's house and laboratory trapped between tall buildings that refers to vernacular architecture, and many other remarkable designs (Figure 4).

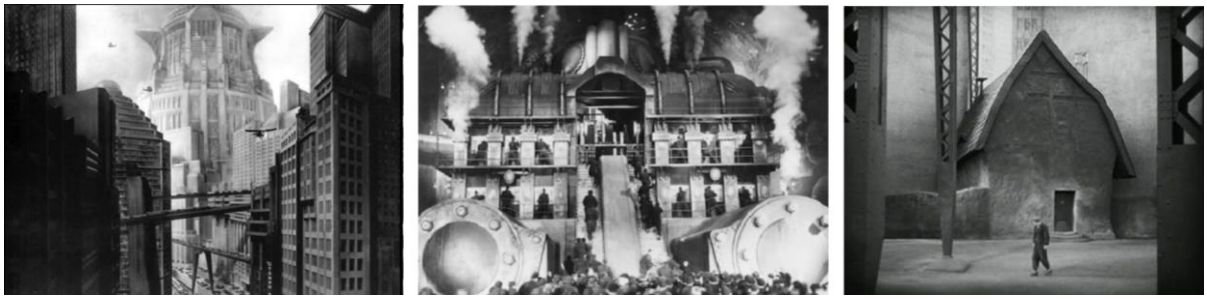

Figure 4: The city of Metropolis; from left to right: Urban skyline, the factory, the scientist’s house (Lang, 1927).

Similarly, it is possible to examine the interaction between space, architecture, and science fiction in many science fiction films and books produced from the film Metropolis to the present.

## 4. PHASE 2: “SCIENCE FICTION and ARCHITECTURE” AS AN ELECTIVE COURSE

The main aim of the course is to examine the spaces that accompany the narratives described in science fiction literature, cinema, and other works, which are characterized by creativity and imagination and revolve around technology and scientific data. The course also aims to make the perspectives of people with architectural training diverse, varied, and rich in relation to future designs.

The expected learning outcomes of the course are as follows:

- To acquire knowledge of scientific and technological changes and developments that will affect the field of architecture in the future.
- To develop the ability to generate ideas about the spaces that will be affected by these changes and developments.
- To enhance the ability to develop ideas about the expected changes and innovations in the spaces affected by these changes and developments.

The course structure developed to improve the aforementioned skills is shown in Figure 5. The course is divided into three main categories: classroom activities conducted by the instructor, reading, and viewing of materials to be studied by the students, and assignments for the students. At the beginning of the course, before any research or presentations are made, students are expected to develop proposals on the impact of

scientific/technological advances on space. The same assignment is repeated at the end of the semester. The initial and final assignments completed by students are evaluated using a descriptive analysis method to determine performance. Other assignments to be completed by students between the initial and final tasks will also be assessed separately to determine their contribution to the final results.

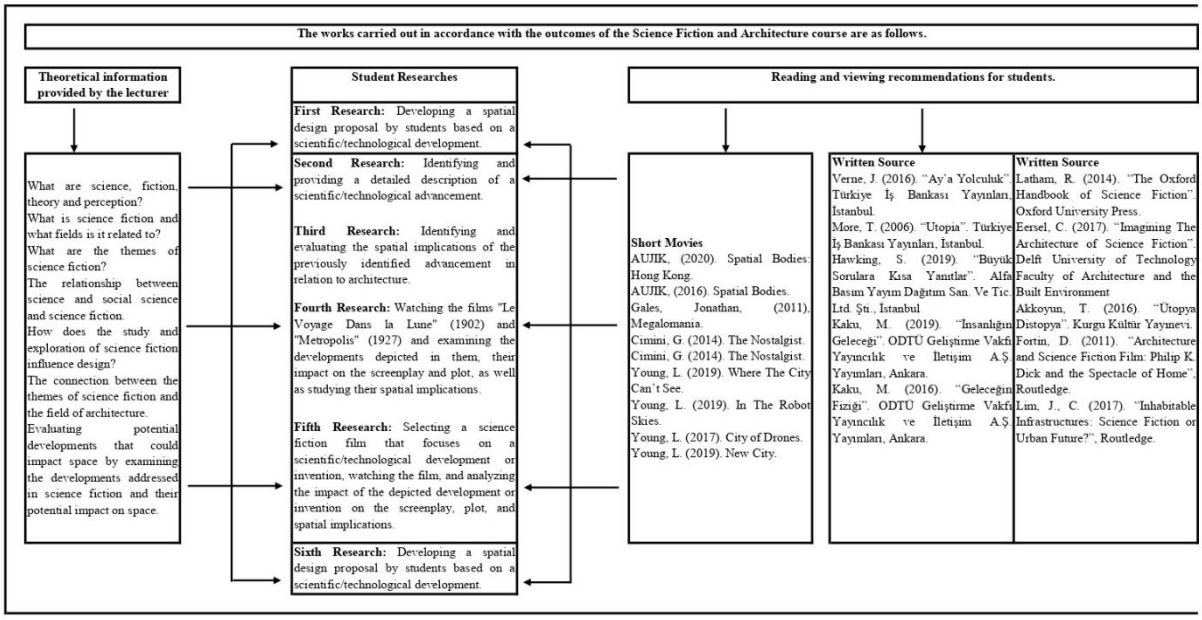

Figure 5: "Science Fiction and Architecture" Course Stages and Editing

The research consists of assignments that were selected as a sample. Those who completed all six required assignments were evaluated. Of the total of 20 students, five (A2, A8, A12, A13, A14) were not included in the evaluation. The students' names were arranged in alphabetical order followed by the letter "A"," and the assignments were coded with the letter "R". The assignments were numbered from 1 to 6.

## 5. PHASE 3: FINDINGS- EXAMINATION OF SCIENCE FICTION AND ARCHITECTURE COURSE STUDENT STUDIES IN THE CONTEXT OF COURSE OUTCOMES

The assignments that students are expected to complete are evaluated separately in this section. And the data obtained are compared with each other.

In the first assignment, students were asked to investigate a scientific/technological development and analyze its spatial impact. In this context, evaluations and analyses were conducted using the descriptive analysis method for the following questions:

Question 1: Which scientific/technological developments were examined in the study?
Question 2: Based on the identified scientific/technological developments, were proposals developed for a new space, lost space, or the modification of existing space?
Question 3: Which specific spaces were identified as being impacted by the scientific/technological developments studied?
Question 4: Under which subcategories of the field of architecture can the impact of the examined scientific/technological developments on spaces be evaluated? [Please provide options]
Question 5: What are the spatial impacts of the scientific/technological developments studied?

In the analysis of Assignment 1, it was found that the scientific/technological advancements studied could be classified into 12 different categories. Among these

developments, the categories of "smart technologies," "food technologies," and "virtual/augmented reality" were each addressed in 13% of the studies. The categories related to smart technologies such as 3D printing, digital banking, automation, new transportation technologies, and artificial intelligence were each covered in 9% of the studies. In addition, the categories related to teleportation, lens technologies, microchips, and robotic technologies were each covered in 4% of the studies. The scientific/technological developments examined were only briefly described in the studies and were not discussed in any further detail (Table 1).

Table1: Scientific/technological advancements discussed in Assignment 1.

| **Scientific/technological advancements discussed in *Assignment* 1.** | | | |
|---|---|---|---|
| **Scientific/technological advancements** | **The Studies** | **Frequency** | **Percent Values** |
| **3D printing** | A17R1, A7R1 | 2 | 9 |
| **Artificial intelligence** | A10R1, A16R1 | 2 | 9 |
| **Automation** | A10R1, A16R1 | 2 | 9 |
| **Digital banking** | A6R1, A10R1 | 2 | 9 |
| **Food technologies** | A1R1, A15R1, A20R1 | 3 | 13 |
| **Lens technologies** | A5R1 | 1 | 4 |
| **Microchips** | A3R1 | 1 | 4 |
| **Robotic technologies** | A16R1 | 1 | 4 |
| **Smart technologies** | A4R1, A7R1, A11R1 | 3 | 13 |
| **Teleportation** | A15R1 | 1 | 4 |
| **New transportation technologies** | A9R1, A11R1 | 2 | 9 |
| **Virtual/augmented reality** | A15R1, A18R1, A19R1 | 3 | 13 |
| **TOTAL:** | | **23** | **100** |

According to the studies, it was predominantly assumed (%43) that the scientific and technological developments studied will lead to a change in the design of existing spaces. The emergence of a "new space (29%)" and the "lost space (29%)" were suggested to a lesser extent than the suggestion of "modification of existing space (43%)".

Table 2: Proposals developed within the framework of Assignment 1 on spaces.

| **Proposals developed within the framework of Assignment 1 on spaces** | | | | |
|---|---|---|---|---|
| **Proposals developed within the framework of Study 1 on spaces** | | | | |
| **The Studies** | **New space** | **Lost space** | **Modification of existing space** | **Total** |
| **A1R1** | - | + | - | 1 |
| **A3R1** | + | - | + | 2 |
| **A4R1** | - | + | + | 1 |
| **A5R1** | + | - | - | 1 |
| **A6R1** | - | - | + | 1 |
| **A7R1** | + | - | - | 1 |
| **A9R1** | - | - | + | 1 |
| **A10R1** | - | + | - | 1 |
| **A11R1** | + | - | + | 2 |
| **A15R1** | + | + | - | 2 |
| **A16R1** | + | - | + | 2 |
| **A17R1** | - | - | + | 1 |
| **A18R1** | - | + | + | 2 |
| **A19R1** | - | + | + | 2 |
| **A20R1** | - | + | - | 1 |
| **Frequency (f)** | **6** | **6** | **9** | **21** |
| **Percent values** | **29** | **29** | **43** | **100** |

The recommended spaces that would be affected by the scientific/technological developments examined in the studies are listed in Table 4. "Dining and food preparation spaces, storage" were the subject of 25% of the studies; "housing, shelter, living capsules, accommodation" were the subject of 21% of the studies; "healthcare facilities and pods", "educational buildings", and "banking," "software installation and service spaces" were the subject of 8% of the studies each; and "urban meeting spaces," "gas/fuel/energy stations," "work and office spaces," "urban transportation networks," and "service spaces" were the subject of 4% of the studies each. It is noteworthy that of the total 15 studies, 6 proposed changes in new spaces, 6 proposed changes in disappearing spaces, and 9 proposed changes in existing spaces.

Table3: Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 1.

| **Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 1.** | | | |
|---|---|---|---|
| **The spaces** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Banking** | A6R1, A10R1 | 2 | 8 |
| **Dining and food preparation spaces, storage** | A1R1, A11R1, A15R1, A16R1x2, A20R1 | 6 | 25 |

| | | | |
|---|---|---|---|
| **Educational buildings** | A18R1, A19R1 | 2 | 8 |
| **Gas/fuel/energy stations** | A9R1 | 1 | 4 |
| **Healthcare facilities and pods** | A3R1, A19R1 | 2 | 8 |
| **Housing, shelter, living capsules, accommodation** | A4R1, A7R1, A11R1, A17R1, A19R1 | 5 | 21 |
| **Service spaces** | A16R1 | 1 | 4 |
| **Software installation spaces** | A11R1 | 2 | 8 |
| **Urban transportation networks** | A11R1 | 1 | 4 |
| **Urban meeting spaces** | A5R1 | 1 | 4 |
| **Workspaces and offices** | A11R1 | 1 | 4 |
| **TOTAL:** | | **24** | **100** |

In the studies conducted, the focus was on architecture-design/creative thinking in 76% of the cases, architecture-environment/urban/community in 12%, architecture-technology in 6%, and architecture-professional environment in 6%. Spaces were not considered from the perspective of architecture-history/theory, culture, or art.

Table 4: Grouping of the spatial proposals developed as part of Assignment 1 under the subheadings of the architecture.

| **Grouping of the spatial proposals developed as part of Assignment 1 under the subheadings of the architecture.** | | | |
|---|---|---|---|
| **The Fields** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Architecture-Design/Creative Thinking** | A3R1, A4R1, A5R1, A6R1, A9R1, A11R1, A15R1, A16R1, A17R1, A18R1, A19R1 | 13 | 76 |
| **Architecture-Technology** | A17R1 | 1 | 6 |
| **Architecture-Environment/Urban/Society** | A3R1, A17R1, | 2 | 12 |
| **Architecture-History/Theory, Culture/Art** | - | 0 | 0 |
| **Architecture-Professional Environment** | A18R1 | 1 | 6 |
| **TOPLAM** | | **17** | **100** |

In assessing the impact on space of the scientific/technological developments considered, it was found that they can be grouped under the headings listed in Table 6. While 27% of the studies have made proposals to " Reduction of building, spatial volumes, and furnishing elements 22% have focused on the idea of "virtual spatial experiences". In addition, 13% of the studies have proposed changes related to "spatial relationships, spatial narratives, organization, and function". In addition, 7% of the studies have developed proposals related to the "the influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design.", "mobility and variability in urban contexts", "the reduction of building density in urban contexts", "the digitization of separating elements between spaces", "the transparency of spaces", and "the portability and mobility of structures".

Table 5: Expected and proposed changes and innovations in the spaces in Assignment 1.

| **Expected and proposed changes and innovations in the spaces in Assignment 1** | | | |
|---|---|---|---|
| **Expected and proposed changes and innovations in the spaces** | **The Studies** | **Frequency (f)** | **Percent value** |
| **Changes in spatial relationships, spatial narrative, organization, and function** | A3R1, A9R1 | 2 | 13 |
| **Mobility and variability in urban contexts** | A17R1 | 1 | 7 |
| **The digitization of separating elements between spaces** | A4R1 | 1 | 7 |
| **The influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design.** | A5R1 | 1 | 7 |
| **The portability and mobility of structures** | A17R1 | 1 | 7 |
| **The reduction of building density in urban contexts** | A3R1 | 1 | 7 |
| **Reduction of building, spatial volumes, and furnishing elements** | A6R1, A9R1, A11R1, A16R1 | 4 | 27 |
| **The transparency of spaces** | A11R1 | 1 | 7 |
| **Virtual spatial experiences** | A4R1, A18R1, A19R1 | 3 | 20 |
| **TOTAL:** | | **15** | **100** |

In Assignment 2, students selected one of the scientific and technological developments that are the subject of current debate and researched it in detail. In Assignment 3, they researched the impact of the scientific/technological development on architecture and architectural design and investigated the area (MİAK's subheadings) in which it might occur.

In examining Assignment 2, the scientific and technological developments addressed can be grouped under 9 headings: "3D printing," "big data," "digital design," "energy technologies," "nanotechnologies," "robotic technologies," "scientific advances in health, medicine, biotechnology, and genetics," "virtual/augmented reality," and " space science, space/interplanetary/interstellar travel, spacecraft and technologies, space communications" Among these developments, the focus was primarily on advances in "scientific advances in health, medicine, biotechnology, and genetics (29%") and "space science, space/interplanetary/interstellar travel, spacecraft and technologies, space communications (21%)".

Table 6: Scientific/technological advancements discussed in Assignment 2.

| Scientific/technological advancements discussed in Assignment 2. | | | |
|---|---|---|---|
| **Scientific/technological advancements** | **The Studies** | **Frequency (f)** | **Percent value** |
| **3D Printing** | A1A5A10R2 | 1 | 7 |
| **Big data** | A1A5A10R2 | 1 | 7 |
| **Digital design** | A1A5A10R2 | 1 | 7 |
| **Energy technologies** | A6A11A13R2 | 1 | 7 |
| **Nanotechnologies** | A3A4A15R2 | 1 | 7 |
| **Robotic technologies** | A1A5A10R2 | 1 | 7 |
| **Scientific advances in health, medicine, biotechnology, and genetics.** | A7A2, A9A12A2, A18A2, A20A2 | 4 | 29 |
| **Space science, space/interplanetary/interstellar travel, spacecraft and technologies, space communications** | A16R2, A17R2, A19R2 | 3 | 21 |
| **Virtual/augmented reality** | A1A5A10ÇR2 | 1 | 7 |
| **Total:** | | **14** | **100** |

The spatial impact of the selected scientific and technological developments was examined in Assignment 3. It was found that there was equal emphasis on proposals for design changes in new and existing spaces.

Tablo7: Proposals developed within the framework of assignment 3 on spaces

| Proposals developed within the framework of Assignment 3 on spaces | | | | |
|---|---|---|---|---|
| **The Studies** | **New space** | **Lost space** | **Changes in the existing space** | **Total** |
| **A1-A5-A10R3** | - | - | + | 1 |
| **A3-A4-A15R3** | - | - | + | 1 |
| **A6-A11-A13R3** | - | - | + | 1 |
| **A7R3** | + | + | + | 3 |
| **A9-A12R3** | + | + | + | 3 |
| **A16R3** | + | - | - | 1 |
| **A17R3** | + | - | - | 1 |
| **A18R3** | + | + | + | 3 |
| **A19R3** | + | - | - | 1 |
| **A20R3** | + | + | + | 3 |
| **Frequency (f)** | **7** | **4** | **7** | **18** |
| **Percent value (%)** | **39%** | **22%** | **39%** | **100%** |

When analyzing the possibility that the scientific and technological developments examined in Assignment 2 affect different types of spaces, it was found that 46% of the studies had a focus on healthcare facilities and pods. In addition, 19% of the studies addressed "urban planning, and architectural structures", while 12% of the studies focused on "housing, shelter, living capsules, accommodation", as well as gas/fuel/energy stations and space stations/ships/elevators. The proposals developed primarily emphasized the impact of the scientific developments studied on healthcare facilities and pods.

Tablo 8: Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 3.

| Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 3. | | | |
|---|---|---|---|
| **The spaces** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Gas/fuel/energy stations** | A16R3, A17R3, A19R3 | 3 | 12 |
| **Healthcare facilities and pods** | A7R3x3, A9A12R3x3, A16R3, A17R3, A18R3x2, A19R3, A20R3 | 12 | 46 |
| **Housing, shelter, living capsules, accommodation** | A16Ç3, A17Ç3, A19Ç3 | 3 | 12 |
| **Space stations/ships/elevators** | A16R3, A17R3, A19R3 | 3 | 12 |
| **Urban planning, and architectural structures** | A1A5A10R3, A3A4A15R3, A6A11A13R3, A17R3, A19R3 | 5 | 19 |
| **Total:** | | **26** | **100** |

It has been observed that most spatial proposals were developed in the fields of architecture-design/creative thinking and architecture-technology categories, while fewer ideas were presented in the category of architecture-environment/urban/community. It is also observed that no proposals were suggested under the fields of architecture-history/theory, culture, art, and architecture-professional environment.

Tablo 9: Grouping of the spatial proposals developed as part of Assignment 3 under the subheadings of the architecture.

| Grouping of the spatial proposals developed as part of Assignment 3 under the subheadings of the architecture. | | | |
|---|---|---|---|
| **The Fields** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Architecture-Design/Creative Thinking** | A1A5A10R3, A3A4A15R3, A7R3, A9A12Ç2A16R3, A17R3, A18R3, A19R3, A20R3 | 8 | 57 |
| **Architecture-Technology** | A1A5A10R3, A3A4A15R3, A6A11A13R3, A16R3, A17R3 | 5 | 36 |
| **Architecture-Environment/Urban/Society** | A6A11A13R3 | 1 | 7 |
| **Architecture-History/Theory, Culture/Art** | - | 0 | 0 |
| **Architecture-Professional Environment** | - | 0 | 0 |
| **Total:** | | **14** | **100** |

When examining expected and proposed changes and innovations in spaces, the most frequent recommendations relate to "changes in spatial relationships, spatial narratives, and functions (24%)". This is closely followed by "digitization of space (14%)", "urbanization in space, development of construction technologies (14%), and "sustainability, energy-efficient building design (10%)". Ideas were also developed in the following areas; "smart cities"," "biological structures, cities, materials"," "the influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design."," "interaction between people, structures, spaces, surfaces"," "virtual spatial experiences"," "parametric design"," "reduction of building, spatial volumes, and furnishing elements" and "process control in construction management"," with each category accounting for 5% of the proposals.

Tablo 10: Expected and proposed changes and innovations in the spaces in Assignment 3.

| Expected and proposed changes and innovations in the spaces in Assignment 3. | | | |
|---|---|---|---|
| **Expected and proposed changes and innovations in the spaces** | **The Studies** | **Frequency (f)** | **Percent value** |
| **Biological structures, cities, materials** | | 1 | 5 |
| **Changes in spatial relationships, spatial narratives, and functions** | A1A5A10R3, A7R3, A9A12R3, A18R3, A20R3 | 5 | 24 |
| **Digitization of space** | A1A5A10R3, A18R3, A20R3 | 3 | 14 |
| **Interaction between people, structures, spaces, surfaces** | | 1 | 5 |
| **Parametric design** | A1A5A10R3 | 1 | 5 |
| **Process control in construction management** | A1A5A10R3 | 1 | 5 |
| **Smart cities** | A1A5A10R3 | 1 | 5 |
| **Sustainability, energy-efficient building design.** | A6A11A13R3, A19R3 | 2 | 10 |
| **The influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design.** | A3A4A15R3 | 1 | 5 |
| **Reduction of building, spatial volumes, and furnishing elements** | A7R3 | 1 | 5 |
| **Urbanization in space, development of construction technologies** | A16R3, A17R3, A18R3 | 3 | 14 |
| **Virtual spatial experiences** | A1A5A10R3 | 1 | 5 |
| **TOTAL:** | | **21** | **100** |

Assignment 4 was expected to include the screening of two films, "Le Voyage dans la Lune" by Georges Méliès from 1902 and "Metropolis" by Fritz Lang from 1927. The course included an oral discussion of the scientific and technological advances thematized in both films, their impact on the script and plot, and their spatial reflections. It was pointed out that the futuristic settings proposed in the 1902 and 1927 films are widely used in modern times.

In Assignment 5, students were asked to watch a science fiction film and examine the scientific/technological advances and spatial effects depicted in the film.

After reviewing Assignment 5, the scientific/technological advances addressed can be summarized under 14 main headings; "space science, space/interplanetary/interstellar travel, spacecraft and technologies, space communications (20%)," "artificial intelligence

(18%)," "robotic technologies (10%)," " scientific advances in health, medicine, biotechnology, and genetics. (10%)," "consciousness transfer, thought transfer, digitization of the human brain (8%)," "automation (8%)," "energy technologies (5%)," "human-machine interaction (5%)," "social stratification, class inequality, and future resource allocation (5%)," "industrialization (3%)," "advanced weapons technologies (3%)," "unmanned vehicles (3%)," "simulation technologies (3%)," and "new transportation technologies (3%)."

Table 11: Scientific/technological advancements discussed in Assignment 5.

| Scientific/technological advancements discussed in Assignment 5. | | | |
|---|---|---|---|
| **Scientific/technological advancements** | **The Studies** | **Frequency (f)** | **Percent value** |
| **Advanced Weapons Technologies** | A17R5 | 1 | 5 |
| **Artificial intelligence** | A3R5, A5R5, A6R5, A10R5, A16R5, A17R5, A18R5 | 7 | 18 |
| **Automation** | A10R5, A18R5, A19R5 | 3 | 3 |
| **Consciousness transfer, thought transfer, Digitization of the Human Brain** | A5R5, A10R5 | 2 | 5 |
| **Energy Technologies** | A16R5, A17R5 | 2 | 3 |
| **Future Transportation Technologies** | A9R5 | 1 | 3 |
| **Human-Machine Interaction** | A3R5, A18R5 | 2 | 3 |
| **Industrialization** | A11R5 | 1 | 11 |
| **Robotic technologies** | A6R5, A16R5, A17R5, A18R5, | 4 | 8 |
| **Scientific advances in health, medicine, biotechnology, and genetics.** | A3R5, A10R5, A17R5, A20R5 | 4 | 11 |
| **Simulation Technologies** | A16R5, | 1 | 3 |
| **Social Stratification, Class Inequality, and Future Resource Allocation** | A1R5, A11R5 | 2 | 5 |
| **Space science, space/interplanetary/interstellar travel, spacecraft and technologies, space communications** | A4R5, A6R5, A7R5, A15R5, A16R5, A17R5, A20R5 | 7 | 18 |
| **Unmanned Vehicles** | A16R5 | 1 | 5 |
| **TOTAL:** | | **38** | **100** |

It has been observed that spatial proposals are predominantly developed under the headings of architecture-design/creative thinking, followed by architecture-technology, architecture-history/theory, culture, art, and architecture-environment/urban/society. However, it has been noted that there is a lack of idea proposals specifically within the professional architectural context.

Table 12: Grouping of the spatial proposals developed as part of Assignment 5 under the subheadings of the architecture.

| Grouping of the spatial proposals developed as part of Assignment 5 under the subheadings of the architecture. | | | |
|---|---|---|---|
| **The Fields** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Architecture -Design/Creative Thinking** | A1R5, A3R5, A4R5, A5R5, A6R5, A7R5, A9R5, A10R5, A11R5, A15R5, A16R5, A17R5, A18R5, A19R5, A20R5 | 15 | 44 |
| **Architecture-Technology** | A3R5, A5R5, A6R6, A9R5, A10R5, A11R5, A15R5, A16R5, A17R5, A18R5, | 10 | 29 |
| **Architecture-Environment/Urban/Society** | A3R5, A5R5, A11R5, A17R5, | 4 | 12 |
| **Architecture-History/Theory, Culture/Art** | A3R5, A11R5, A15R5, A18R5, A19R5 | 5 | 15 |
| **Architecture-Professional Environment** | - | 0 | 0 |
| **Total:** | | **34** | **100** |

When analyzing the potential impact on spatial environments of the scientific and technological advancements examined within the scope of Assignment 5, it is observed that most of them have to do with "housing, shelter, living capsules, accommodation (23%)", followed by "urban planning and architectural structures (20%)". In addition, topics such as "space stations, ships, elevators (11%)," "space cities, settlements (11%)," "healthcare facilities and pods (9%)," and "temples, religious buildings, houses of worship (6%)" are also addressed. The categories "prisons," "city administration buildings," "industrial structures, factories," "educational spaces," "laboratories," "labyrinths," and "research stations" each account for 3% of the Assignment.

Tablo 13: Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 5.

| Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 5. | | | |
|---|---|---|---|
| **The spaces** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **City administration buildings** | A11R5 | 1 | 3 |
| **Educational building** | A4R5 | 1 | 3 |

| | | | |
|---|---|---|---|
| **Healthcare facilities and pods** | A3R5, A4R5, A17R5 | 3 | 9 |
| **Housing, shelter, living capsules, accommodation** | A3R5, A4R5, A5R5, A6R5, A10R5, A11R5, A16R5, A17R5, A18R5 | 9 | 23 |
| **Industrial structures, factories** | A11R5 | 1 | 3 |
| **Laboratories** | A10R5 | 1 | 3 |
| **Labyrinths** | A19R5 | 1 | 3 |
| **Prison** | A1R5 | 1 | 3 |
| **Research stations** | A4R5 | 1 | 3 |
| **Space cities, settlements** | A7R5, A16R5, A17R5, A20Ç5 | 4 | 11 |
| **Space stations/ships/elevators** | A4R5, A7R5, A15R5, A20R5 | 4 | 11 |
| **Temples, religious buildings, houses of worship** | A11R5, A20R5 | 2 | 6 |
| **Urban planning and architectural structures** | A3R5, A5R5, A9R5, A11R5, A16R5, A17R5, A18R5 | 7 | 20 |
| **TOTAL:** | | **35** | 100 |

When examining the reflections on the developments in the field of architecture and design processes, the most important proposals, with a percentage of 14%, refer to "the influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design." and "contrast in spaces (integrated spaces with technology-with nature, old-new structures, underground-overground spaces, etc.)", This is followed by proposals on "perceptual, semantic, individual, and social dimensions of space (12%)," " relationship between designs and architectural/art movements (12%)," "designs that integrate technology into vehicles, spaces, and urban planning (12%)." "the effects of light, shadow, and illumination in space design (8%)," "the destruction of urban order and space (8%)," " the effects of color usage in space design (8%)," "the semantic and formal relationship between the subject of the film and the main setting (6%)," "new building typologies (6%)," and "modulation (2%)."

Table 14: Expected and proposed changes and innovations in the spaces in Assignment 5.

| **Expected and proposed changes and innovations in the spaces in Assignment 5.** | | | |
|---|---|---|---|
| **Expected and proposed changes and innovations in the spaces** | **The Studies** | **Frequency (f)** | **Percent value** |
| **Contrast in spaces (integrated spaces with technology, spaces interacting with nature, old-new structures, underground-overground spaces, etc.)** | A4R5, A6R5, A10R5, A15R5, A16R5, A17R5, A18R5 | 7 | 14 |
| **Designs that integrate technology into vehicles, spaces, and urban planning** | A3R5, A6R5, A10R5, A11R5, A15R5, A16R5 | 6 | 12 |
| **Modulation** | A4Ç5 | 1 | 2 |
| **New building typologies** | A3R5, A11R5, A17R5 | 3 | 6 |
| **Perceptual, semantic, individual, and social dimensions of space** | A3R5, A5R5, A6R5, A7R5, A9R5, A20R5 | 6 | 12 |
| **Relationship between designs and architectural/art movements** | A3Ç5, A6R5, A11R5, A15R5, A18R5, A20R5 | 6 | 12 |
| **The destruction of urban order and space** | A5R5, A9R5, A16R5, A17R5 | 4 | 8 |
| **The effects of color usage in space design** | A3R5, A10R5, A17R5, A18R5 | 4 | 8 |
| **The effects of light, shadow, and illumination in space design** | A3R5, A4R5, A10R5, A18R5 | 4 | 8 |
| **The influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design.** | A3R5, A11R5, A15R5, A16R5, A18R5, A19R5, A20R5 | 7 | 14 |
| **The semantic and formal relationship between the subject of the film and the main setting** | A1R5, A3R5, A4R5 | 3 | 6 |
| **TOTAL:** | | **51** | **100** |

Assignment 6 revisited the topic addressed in assignment 1. The aim was to determine the positive and/or negative impact on students of other studies conducted during the course, in accordance with the results of the course. In this context, the issues raised in assignment 1 were also addressed in assignment 6.

When grouped together, the scientific/technological advances addressed in the final assignment resulted in the following 21 different headings, based on their respective percentages; "virtual/augmented reality (12%)," "smart technologies (10%)," "new transportation technologies (9%)," "food technologies (9%)," "robotic technologies (9%)," "living and building technologies underwater, underground, in the sky (7%)." "human-machine interaction (6%)," "space science, space/interplanetary/interstellar travel, space vehicles and technologies, space communications (6%)," "new construction technologies integrated with digital technologies (4%)," "unmanned vehicles (4%)." "social stratification, class inequality, and future resource allocation (4%)," "dynamic kinetic structural design and construction technologies (3%)," "microchips (3%)," "simulation technologies (3%)," "artificial intelligence (3%)," "digitization (1%)." "energy technologies

(1%)," "hologram technologies (1%)," "human body modification (1%)," "gaming technologies (1%)," and "scientific advances in health, medicine, biotechnology, and genetics (1%)."

In assignment 1, a total of 12 scientific/technological advances were addressed and investigated, while in assignment 6 the number of developments addressed increased to 19. The information obtained from assignment 2 and 5 contributes to a total of 7 proposed headings in Study 6. However, 7 unique headings are suggested in assignment 6.

Table 15: Scientific/technological advancements discussed in Assignment 6.

| Scientific/technological advancements are discussed in Assignment 6. | | | |
|---|---|---|---|
| **Scientific/technological advancements** | **Scientific/technological advancements** | **Scientific/technological advancements** | **Scientific/technological advancements** |
| **Smart Technologies** | A3R6, A5R6, A9R6, A11R6, A16R6, A19R6, A20R6 | 7 | 10 |
| **New Construction Technologies Integrated With Digital Technologies** | A6R6, A7R6, A9R6 | 3 | 4 |
| **Digitization** | A19R6 | 1 | 1 |
| **Dynamic Kinetic Structural Design And Construction Technologies** | A3R6, A18R6 | 2 | 3 |
| **Energy Technologies** | A10R6 | 1 | 1 |
| **New Transportation Technologies** | A4R6, A5R6, A7R6, A16R6, A18R6, A20R6 | 6 | 9 |
| **Food Technologies** | A1R6, A3R6, A4R6, A11R6, A16R6, A19R6 | 6 | 9 |
| **Hologram Technologies** | A16R6 | 1 | 1 |
| **Human Body Modification** | A20R6 | 1 | 1 |
| **Human-Machine Interaction** | A5R6, A7R6, A11R6, A19R6 | 4 | 6 |
| **Unmanned Vehicles** | A3R6, A17R6, A20R6 | 3 | 4 |
| **Microchips** | A3R6, A18R6 | 2 | 3 |
| **Gaming Technologies** | A18R6 | 1 | 1 |
| **Robotic Technologies** | A1R6, A7R6, A15R6, A17R6, A19R6, A20R6 | 6 | 9 |
| **Scientific Advances In Health, Medicine, Biotechnology, And Genetics.** | A16R6 | 1 | 1 |
| **Virtual/Augmented Reality** | A4R6, A6R6, A9R6, A11R6, A15R6, A16R6, A18R6, A19R6 | 8 | 12 |
| **Simulation Technologies** | A6R6, A15R6 | 2 | 3 |
| **Social Stratification, Class Inequality, And Future Resource Allocation** | A7R6, A19R6 | 2 | 3 |
| **Living And Building Technologies Underwater, Underground, In The Sky** | A6R6, A9R6, A10R6, A16R6, A20R6 | 5 | 7 |
| **Space Science, Space/Interplanetary/Interstellar Travel, Spacecraft And Technologies, Space Communications** | A16R6, A16R6, A17R6, A20R6 | 4 | 6 |
| **Artificial Intelligence** | A15R6, A20R6 | 2 | 3 |
| **Total:** | | **69** | **100** |

Within the research, the idea that scientific/technological developments would lead to the creation of new space (42%) and the design of existing spaces (42%) were equally addressed. The concept of spaces being eliminated was mentioned in 15% of the studies.

In the first research, there was a greater preference for proposals to change existing spaces, while in the last research, the concepts of creating a new space and changing an existing space were equally addressed. The proportion of the idea of eliminating a space decreased. In both assignment 1 and 6, the same students mostly tried different alternatives. For example, in A1R1, there is no suggestion for a new space, a suggestion for an eliminated space, and a suggestion for changes to an existing space, while in A1R6, there is a suggestion for a new space, no suggestion for an eliminated space, and a suggestion for changes to an existing space. A similar situation occurred in assignment 3, where only the proportion of proposals for an eliminated space was 7% higher.

Table 16: Proposals developed within the framework of Assignment 6 on spaces

| Proposals developed within the framework of Assignment 6 on spaces | | | | |
|---|---|---|---|---|
| **The Studies** | **New space** | **Lost space** | **Changes in the existing space** | **Total** |
| **A1R6** | + | - | + | 2 |
| **A3R6** | + | + | + | 3 |
| **A4R6** | + | - | + | 2 |
| **A5R6** | - | + | + | 2 |
| **A6R6** | + | - | + | 2 |
| **A7R6** | + | - | + | 2 |
| **A9R6** | - | - | + | 1 |
| **A10R6** | - | - | + | 1 |

| | | | | |
|---|---|---|---|---|
| **A11R6** | + | + | - | 2 |
| **A15R6** | + | - | + | 2 |
| **A16R6** | + | - | - | 1 |
| **A17R6** | - | - | + | 1 |
| **A18R6** | + | - | + | 2 |
| **A19R6** | + | - | - | 1 |
| **A20R6** | + | + | + | 2 |
| **Frequency (f)** | **11** | **4** | **11** | **26** |
| **Percent value** | **42** | **15** | **42** | **100** |

The proposed spaces that will be affected by the scientific/technological developments addressed in the studies are listed in Table 18. These relevant spaces, in order of presentation, are as follows; "urban planning, and architectural structures (13%)", "housing, shelter, living capsules, accommodation (9%)", " healthcare facilities and pods (9%)", "dining and food preparation spaces, storage (7%)", "intelligent transport capsules, vehicles (4%)", "security structures (4%)," "gaming capsules, rooms, spaces (4%)," "transportation vehicles, stops (4%)," "underground, underwater, air spaces, cities (4%)," "shopping malls (2%)," "r&d buildings (2%)," "gas/fuel/energy stations (2%)." "maternity hospitals (2%)," "educational buildings (2%)," "mobile work pods (2%)," "urban transportation networks (2%)," "city skyline (2%)," "coastal design (2%)," "library structures (2%)," "the profession and practice of architecture (2%)" "virtual spaces (2%)", "exhibition spaces (2%)", "space stations, ships, elevators (2%)", "space cities, settlements (2%)", "artificial islands (2%)", "artificial agriculture and production facilities (2%)", "settlement energy, security, control centers (2%)".

In the first research, a total of 11 proposals for affected spaces were developed, while in the last research, 26 different spaces were proposed. There are a total of 5 spaces that are common to both studies. These are listed as "educational buildings", "urban transportation networks", " housing, shelter, living capsules, accommodation ", "healthcare facilities and pods," and "dining and food preparation spaces, storage". The 18 headings covered only in assignment 6 include "intelligent transportation capsules," "shopping malls, spaces," "R&D buildings," "maternity hospitals, child production facilities," "old-fashioned transportation vehicles and stops," "security structures," "mobile work capsules," "city skyline," "coastal design," "library structures," "profession and practice of architecture," "game capsules, spaces, rooms," "virtual spaces," "artificial islands," "artificial agricultural and production facilities," "underground, underwater, air spaces, cities," and "settlement energy, security, control centers." The headings "urban planning, architectural structures" and "space stations, ships, elevators" are treated together in studies 3, 5 and 6.

Table 17: Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 6.

| **Proposed spaces that will be affected by the scientific/technological developments discussed within the scope of Assignment 6.** | | | |
|---|---|---|---|
| **The spaces** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Artificial agriculture and production facilities** | A16R6 | 1 | 2 |
| **Artificial islands** | A3R6 | 1 | 2 |
| **City skyline** | A7R6 | 1 | 2 |
| **Coastal design** | A3R6 | 1 | 2 |
| **Dining and food preparation spaces, storage** | A1R6x2, A4R6 | 3 | 6 |
| **Educational buildings** | A16R6 | 1 | 2 |
| **Exhibition spaces** | A4R6 | 1 | 2 |
| **Gaming capsules, rooms, spaces** | A18R6, A19R6 | 2 | 4 |
| **Gas/fuel/energy stations** | A10R6 | 1 | 2 |
| **Healthcare facilities and pods** | A7R6, A16R6x2, A20R6 | 4 | 8 |
| **Housing, shelter, living capsules, accommodation** | A3R6, A7R6, A11ÇR, A20R6 | 4 | 8 |
| **Intelligent transport capsules, vehicles** | A4R6, A7R6 | 2 | 4 |
| **Library** | A18R6 | 1 | 2 |
| **Maternity hospitals** | A7R6 | 1 | 2 |
| **Mobile work pods** | A18R6 | 1 | 2 |
| | | | |
| **R&D buildings** | A16R6 | 1 | 2 |
| **Security structures** | A7R6, A16R6 | 2 | 4 |
| **Settlement energy, security, control centers** | A16R6 | 1 | 2 |
| **Shopping malls** | A17R6 | 1 | 2 |
| **Space cities, settlements** | A16R6 | 1 | 2 |
| **Space stations, ships, elevators** | A15R6 | 1 | 2 |
| **The profession and practice of architecture** | A10R6 | 1 | 2 |
| | | | |
| **Transportation vehicles, stops** | A3R6, A5R6 | 2 | 4 |
| **Underground, underwater, air spaces, cities** | A6R6, A9R6, A10R6, A16R6, A20R6 | 5 | 10 |
| **Urban planning, and architectural structures** | A3R6, A6R6, A7R6, A9R6, A10R6, A11R6 | 6 | 13 |

| | | | |
|---|---|---|---|
| **Urban transportation networks** | A20R6 | 1 | 2 |
| **Virtual spaces** | A18R6 | 1 | 2 |
| **TOTAL:** | | **48** | **100** |

In assignment 6, spatial proposals can be evaluated under the following headings; 48% under architecture-design/creative thinking, 28% under architecture-technology, 14% under architecture-environment/urban/community, 2% under architecture-history/theory/culture, art, and 3% under architecture-professional environment.

In the first research, the spaces addressed and the expected changes in these spaces can be predominantly evaluated under the architecture-design/creative thinking category. However, assignment 6 found that proposals were also developed in the areas of architecture-technology, architecture-environment/urban/community, architecture-history/theory/culture, art, and architecture-professional environment as well.

Table 18: Grouping of the spatial proposals developed as part of assignment 6 under the subheadings of the architecture.

| **Grouping of the spatial proposals developed as part of Assignment 6 under the subheadings of the architecture.** | | | |
|---|---|---|---|
| **The spaces** | **The studies** | **Frequency (f)** | **Percent value (%)** |
| **Architecture - Design/Creative Thinking** | A1R6, A3R6, A4R6, A5R6, A6R6, A7R6, A9R6, A10R6, A11R6, A15R6, A16R6, A18R6, A19R6, A20R6 | 14 | 48 |
| **Architecture- Technology** | A6R6, A7R6, A9R6, A10R6, A11R6, A16R6, A18R6, A20R6 | 8 | 28 |
| **Architecture-Environment/Urban/Society** | A7R6, A9R6, A11R6, A16R6 | 4 | 14 |
| **Architecture-History/Theory, Culture/Art** | A4R6, A6R6 | 2 | 7 |
| **Architecture-Professional Environment** | A10R6 | 1 | 3 |
| **TOTAL:** | | **29** | **100** |

In assessing the impact of scientific and technological developments on space, it was found that they can be grouped under the headings listed in Table 20. These headings are as follows: " contrast in spaces (integrated spaces with technology-with nature, old-new structures, underground-overground spaces, etc.) (10%)", "integrated technology in transport, space, urban design (10%)", "the influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design. (8%)", "perceptual, semantic, individual, social dimensions of space (8%)", "changes spatial relationships, spatial narrative, organization and function (6%)", "proposals for underground, underwater and aerial settlements and structures (6%)", "The effects of light, shadow, and illumination in space design
(5%)", " The effects of color usage in space design (5%)", "virtual experience of space (5%)", "simplicity, minimalism in design (4%)", "transparency in facades, spatial design (3%)", "building on other planets (3%)", "vertical building (3%)", "digitization of space (3%)", "relationship between designs and architectural/artistic movements (3%)", "dynamic, kinetic structural designs (1%)", "spatial reflections of nostalgia for past spaces (1%)," "elimination of real and virtual space concepts (1%)," "impact of functional differences on space (1%)," "design of security structures at urban entrances and exits (1%)," "formation of cities through the fusion of masses (1%)," "the destruction of urban order and space (1%)," "digital designs to ensure privacy in space (1%)." "influence of sound in the perception of space (1%)", "spatial dimensions and their relationship to human scale (1%)", "use of intelligent technologies in architecture (1%)", "design of recreational areas outside urban areas (1%)", "living, building, vernacular architecture in natural areas remote from technology (1%)", "reduction of building, spatial volumes and furnishing elements (1%)", "design of horizontal and vertical development elements (1%)", "new building typologies (1%)". in total, 32 different headings stand out.

Regarding the expected and proposed changes of the addressed spaces in the context of innovations, a total of 9 headings were developed in the first research, while 32 different headings were developed in the latest research. There are 4 common headings between the two studies. While the final assignment introduces 17 new headings, 11 headings were shared between studies 3, 5, and 6.

Table 19: Expected and proposed changes and innovations in the spaces in Assignment 6.

| Expected and proposed changes and innovations in the spaces in Assignment 6. | | | |
|---|---|---|---|
| **Expected and proposed changes and innovations in the spaces** | **The Studies** | **Frequency (f)** | **Percent value** |
| **Changes in spatial relationships, spatial narrative, organization, and function** | A1R6, A4R6, A7R6, A9R6, A10R6 | 5 | 6 |
| **Construction on other planets** | A16R6, A20R6 | 2 | 2 |
| **Contrast in spaces (integrated spaces with technology, spaces interacting with nature, old-new structures, underground-overground spaces, etc.)** | A1R6, A3R6, A6R6, A7R6, A11R6, A15R6, A16R6, A20R6 | 8 | 10 |
| **Design of horizontal and vertical circulation elements** | A18R6 | 1 | 1 |
| **Design of recreational areas outside urban areas** | A20R6 | 1 | 1 |
| **Digital designs for ensuring privacy in space** | A18R6 | 1 | 1 |
| **Digitization of space** | A7R6, A19R6 | 2 | 2 |
| **Dynamic, kinetic structure designs** | A3R6, A18R6 | 2 | 2 |
| **Effects of functional differences on space** | A7R6 | 1 | 1 |
| **Elimination of real and virtual space concepts** | A19R6 | 1 | 1 |
| **Formation of cities through the merging of masses** | A11R6 | 1 | 1 |
| **Influence of sound in the perception of space** | A7R6 | 1 | 1 |
| **Integrated technology in transportation, space, urban design** | A3R6, A4R6, A5R6, A11R6, A16R6, A17R6, A18R6, A19R6 | 8 | 10 |
| **Life, construction, vernacular architecture in natural areas away from technology** | A20R6 | 1 | 1 |
| **New building typologies** | A7R6 | 1 | 1 |
| **Perceptual, semantic, individual, social dimensions of space** | A4R6, A5R6, A6R6, A7R6, A11R6, A19R6 | 6 | 7 |
| **Proposals for underground, underwater, and aerial settlements and structures** | A6R6, A9R6, A10R6, A16R6, A20R6 | 5 | 6 |
| **Reduction of building, spatial volumes, and furnishing elements** | A1R6 | 1 | 1 |
| **Relationship between designs and architectural/art movements** | A6R6, A11R6 | 2 | 2 |
| **Security structure design at urban entrances-exits** | A7R6 | 1 | 1 |
| **Simplicity, minimalism in design** | A4R6, A6R6, A18R6 | 3 | 4 |
| **Spatial dimensions and their relationship to human scale** | A19R6 | 1 | 1 |
| **Spatial reflections of nostalgia for past spaces** | A20R6 | 1 | 1 |
| **The destruction of urban order and space** | A17R6 | 1 | 1 |
| **The effects of color usage in space design** | A7R6, A16R6, A18R6, A19R6 | 4 | 5 |
| **The effects of light, shadow, and illumination in space design** | A7R6, A16R6, A18R6, A19R6 | 4 | 5 |
| **The influence of two and three-dimensional geometric forms on mass designs; new experiments in mass design.** | A4R6, A7R6, A9R6, A11R6, A16R6, A18R6, A20R6 | 7 | 8 |
| **Transparency in facades, space design** | A7R6, A16R6 | 2 | 2 |
| **Urbanization in space, development of construction technologies** | A15R6, A16R6 | 2 | 2 |
| **Use of smart technologies in the architectural profession** | A9R6 | 1 | 1 |
| **Vertical construction** | A16R6, A20R6 | 2 | 2 |
| **Virtual experience of space** | A4R6, A15R6, A18R6, A19R6 | 4 | 5 |
| **TOTAL:** | | **83** | **100** |

## 6. CONCLUSION AND RECOMMENDATIONS

This research aims to examine the outcomes of the course "Science Fiction and Architecture" in the context of developing architecture students' problem-solving skills for the future.

In order to assess the students' development of "problem-solving skills for the future in the field of architecture and design," a total of six kinds of research were to be solved. The first research was completed without any prior knowledge of the course. The topic of the final research is the same as the first. The aim is to compare the results obtained before the knowledge transfer or work with the results obtained after the completion of the research in the course. In this way, the progress and changes in the development of the students will be identified and the following results were obtained:

- Students' awareness of scientific and technological developments increased.

  The first research covered a total of 12 developments, while the last research covered 19. Of the scientific developments covered in the last, 7 were also covered in the second and fifth, although by different people. This can be interpreted as a result of possible influence among students or from other sources they read and short videos they watched. In addition, the sixth suggested a total of 7 topics that were not addressed in the other research. These topics could be the result of further investigation and research conducted without an assignment or the result of students' own exploration.

- It was observed that students began to develop richer ideas related to spaces that are likely to be influenced by future scientific/technological developments.

In the first assignment, 11 different space proposals were developed, while in the final assignment, 26 different proposals were developed. Five topics were the same in the first and final assignments, while 18 topics were only addressed in the final assignment. In addition, three topics were revisited in the final assignment based on the results of the third and fifth assignments. A total of 69% of spaces assumed to be influenced by scientific/technological developments were proposed for the first time in the final assignment. This could be due to the cross-influence of the students' presentations, or to further investigation and research conducted without an assignment.

- It was recognized that all fields of architecture are interconnected and that changes and developments in spaces and designs in the future will affect not only design/creative thinking but also other areas.

  In both the first and final assignments, it was assumed that changes in spaces and designs would occur primarily in the design/creative thinking domain. However, in the first assignment, there was less emphasis on technology, environment/urbanity/society, history/theory, culture, art, and the professional environment than in the final assignment. This shift is mainly due to the effectiveness of the activities in class. The observed increase parallels the proportions of topics covered in the other assignments.

- Enrichment was noted in both the subthemes in which spatial changes and developments could occur and in the proposed design ideas.
  In the first assignment, 9 different proposals were developed, while in the final assignment, 32 different proposals were developed. Four of these topics were the same in the first and final assignments, and 11 were the same in the third, fifth, and final assignments. The remaining 17 topics were only in the final assignment.

  In the first assignment, the proposals were presented in less detail than in the final assignment, where they were described in more detail. In addition, spatial details such as light, shadow, color, and sound were emphasized in the last task. Spaces were considered not only in terms of their formal characteristics but also from the point of view of perception. Various urban components such as urban areas, recreational spaces, and waterfronts were discussed. Comparisons were made between opposites, such as spaces integrated with technology/nature and spaces above ground/below ground, and concepts such as nostalgia for old, historic spaces were addressed.

Considering the results obtained, we can conclude that the following results were obtained:

- To acquire knowledge of scientific and technological changes and developments that will affect the field of architecture in the future.
- To develop the ability to generate ideas about the spaces that will be affected by these changes and developments.
- To enhance the ability to develop ideas about the expected changes and innovations in the spaces affected by these changes and developments.

The data obtained show that exposure to science fiction enhances students' ability to develop ideas about the future of spaces, design, and architecture. In this context, it is recommended that courses that interrogate the relationship between science fiction and architecture be included in the architectural education curriculum or that related content be integrated into other courses. If such courses are not currently included in the curriculum, students should be encouraged to conduct their own research to develop their thinking skills regarding the future of architecture, buildings, designs, spaces, and cities.

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