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INTERNATIONAL STUDIES  
*in*  
ARCHITECTURE,  
PLANNING *and* DESIGN

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# Chapter 1

## A SYSTEMATIC LITERATURE REVIEW ON SUSTAINABLE DEVELOPMENT GOALS IN ARCHITECTURE

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## INTRODUCTION

Global sustainable development is the common goal of human society (Yu & Huang, 2021). However, as a concept that has attracted attention in recent years, sustainable development has been analysed by policymakers (Sneddon et al., 2006). From this point of view, the United Nations and its partners put forward 17 interrelated “Sustainable Development Goals” in 2015 within the scope of Agenda 2030 to target the solution of the problems people face (Figure 1). It attempts to take measures against the climate crisis, protect the environment, end poverty, and ensure fair wealth distribution and peace (URL-1). Concrete targets and corresponding measurable indicators support each of the “sustainable development goals”. Over 200 indicators and 169 targets that can be shared across different nations, regions, or municipalities have been achieved.



**Figure 1.** “UN Sustainable Development Goals (United Nations. Sustainable Development Goals)”

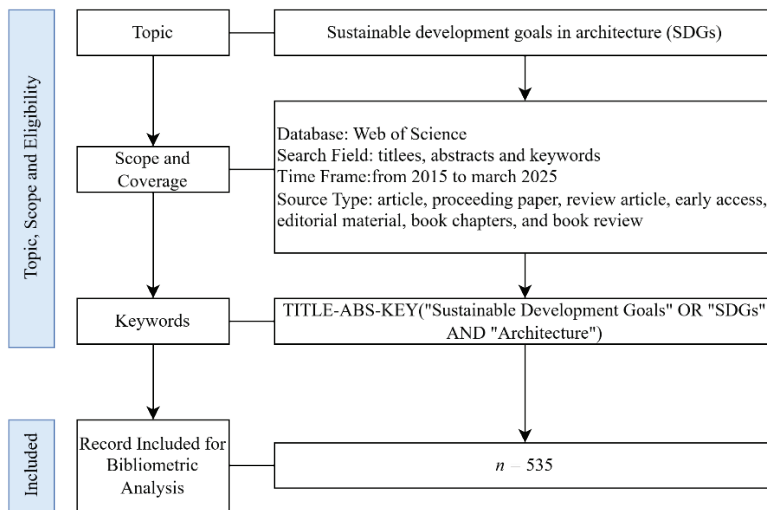
It is acknowledged that scientific investigation on this subject is crucial for fulfilling the United Nations’ 2030 Agenda (Trane et al., 2023). The rationale behind this is that academic literature creates a broad communication network across diverse fields of knowledge in multiple countries, collaborating to advance the development of human history and science. The connection between knowledge areas, various theoretical approaches, and axes provides input for constructing bibliometric indices. This enables the understanding and improvement of scientific production, focussing on applicability (Pereira et al., 2019). The literature has a large number of bibliometric analysis studies on the “Sustainable Development



Goals". One study examined the research on "sustainable development goals" conducted by higher education institutions (Cottafava et al., 2022). There is a special edition of "Archnet-IJAR: International Journal of Architectural Research" that focusses on a few United Nations SDGs related to the education of architects and urbanists (Burton and Salama, 2023). According to several studies, understanding sustainability requires a global perspective (Datey, 2023), and investigating the SDGs to incorporate them into architectural curricula is crucial (Zhu et al., 2023). Diksha and Chakravarty (2022) conducted a bibliometric analysis of global trends in research outputs on sustainable development goals. Belmonte-Ureña et al. (2021) used bibliometric methodologies with the keywords "circular economy, degrowth, and green growth" in order to quantify the contribution of current academic research to the UN "Sustainable Development Goals". A comprehensive literature assessment of the most common and recently created methods by academic research to help the EU accomplish the SDGs is presented by Trane et al. (2023). A bibliometric analysis of a subset of SDG-related papers from the WoS database covering the years 2013–2022 was conducted in a distinct study by Yeh et al. (2022). The SDGs and the labour sector were the subject of a bibliometric analysis by Pizzi et al. (2020), and education was the subject of a similar analysis by Prieto-Jiménez et al. (2021). A bibliometric review of the literature on SDGs in a variety of sectors from 2015 to 2022 was carried out by Yamaguchi et al. (2023). As a result of the research, no article that made a bibliometric analysis of architecture and SDG was found in the literature. For citation data and other academic impact information, academics regularly turn to WoS, a trustworthy database (Akyol and Kocyigit, 2021). This study aims to systematically collect and clarify information about academic studies on sustainable development goals in architecture from 2015 to 2025. In this context, the study reveals how this field has progressed and developed from a bibliometric perspective.

## 1. Method

This research extracted a list of academic publications related to SDGs and architecture from the WoS database. In order to perform bibliometric analysis using the WoS online database as a data source, a science mapping strategy was taken into consideration as part of the study's systematic methodology. The methodological process framework of the research is given in Figure 2.



**Figure 2.** Flow diagram used to identify, screen, and include articles in the study

Studies that attempt to extract data and text and analyse the citations of other studies mostly use bibliometric analysis methods. These methods provide a comprehensive and complete analysis of information accumulated over time (Nerur et al., 2008; Zupic & Čater, 2015). Research environment exploration, category identification, and quantitative validation of subjectively determined categories in published reviews are all made possible by bibliometric methods (Zupic & Čater, 2015). In addition, these analyses provide a direction for scientists to expand their interests in the field, and finally, they provide areas for improvement. Integrating previous research outcomes is essential for progressing in a specific field of study (Zupic & Čater, 2015).

In this sense, bibliometric analysis is crucial for studying literature trends and the state of knowledge across fields (Echchakoui, 2020). As a scientific discipline, bibliometrics is thus defined as a method that

seeks to quantify scientific activity on particular topics and, additionally, forecast trends by examining, evaluating, and categorising literature that more accurately reflects the state of the art in scientific instruments. Ellegaard and Wallin (2015) state that bibliometric analysis categorises a number of scientific components, such as the top authors, journals, organisations, universities, and countries. In scientific and applied domains, bibliometric analysis has become a crucial component of research evaluation methods (Ellegaard and Wallin, 2015).

A program called VOSviewer is used to create and display bibliometric networks (Van Eck & Waltman, 2010). This research aims to determine the status and development of scientific research on SDGs in the field of architecture, to identify relevant research gaps in the field of architecture on SDGs, and to provide guidance on what future research can be conducted. From this point of view, it is to present a bibliometric analysis of the literature research on “Sustainable Development Goals” (SDGs) conducted in architecture and construction building technology from 2015 to 2025 in the context of these specific goals. The study considered publications with the term “Sustainable Development Goals” or “SDGs” in “Construction Building Technology” and “Architecture”. The selected publications were analysed according to publication and citation years, research areas, document types, publication titles, number of publications by country, authorship and co-authorship patterns, number of publications, citation analysis by universities, and keywords.

A total of 535 publications focusing on “Sustainable Development Goals” or “SDGs” were filtered from the WoS database in the subject areas of “Construction Building Technology” and “Architecture.” WoS provides comprehensive results in journals, articles, and cited references (Norris & Oppenheim, 2007). Citation sources are used to measure the impact of a study and its contribution to knowledge (Adriaanse & Rensleigh, 2013).

The VOSViewer software, developed by Van Eck & Waltman (2010) and described as a text mining tool, was used to analyse and visualize bibliometric networks. This in-depth qualitative research summarised the main SDG research topics in architecture, identified research gaps, and explored how to address this topic.

## **2. Findings**

The first step in this study is to filter the publications from the WoS database that contain the keywords “Sustainable Development Goals” or “SDGs” and fall within the subject areas of “Construction Building Technology” and “Architecture.” A total of 535 publications were selected for analysis.

## 2.1. “Number Of Publications and Citations by Years”

Figure 3 shows the publication and citation trends of 535 publications over the years. Figure 3 shows the graphical distribution of scientific production outputs from 2015 to 2025 related to “Sustainable Development Goals” in Architecture. It is seen that scientific publications have increased over the years. With 163 publications overall, 2024 is the year with the most publications from 2015 to 2025. After 2024, the highest number of publications was in 2023, with 112 publications. The period with the fastest increase in publications is between 2018-2019. The number of articles shows a steady upward trend in research activities. In the research conducted as of March 2025, there are 26 publications in 2025. When Figure 3 is analyzed, it is seen that there has been an increase in citations to publications since 2015. The fastest increase was experienced between 2021-2022. According to Figure 3, 2024 was the most cited year, with 2349 citations.

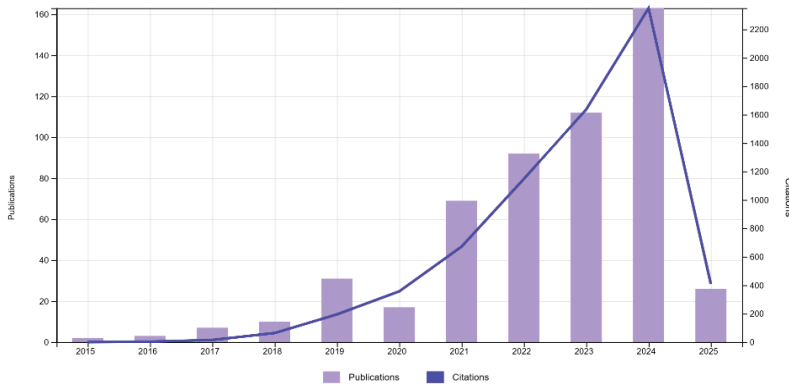


Figure 3. Output of the number of publications and citations

## 2.2. Research Fields

In this study, all publications were filtered to focus on “Construction Building Technology” and “Architecture.” Table 1 provides a breakdown of these additional fields, which include “Construction Building Technology”, “Engineering Civil”, “Green Sustainable Science Technology”, “Energy Fuels”, “Architecture”, “Materials Science Multidisciplinary”, “Engineering Environmental”, “Environmental Studies”, “Urban Studies and Development Studies”, which are in the top 10 out of 31 research areas. In the table, the research areas are presented with the number of records and percentages as follows: Construction Building Technology 436 publications (81.955%), Engineering Civil 262 publications (49.248%), Green

Sustainable Science Technology 164 publications (30.827%), Energy Fuels 132 publications (24.812%), Architecture 115 publications (21.617%), Materials Science Multidisciplinary 44 publications (8.271%), Engineering Environmental 28 publications (5.263%), Environmental Studies 15 publications (2.820%), Urban Studies 12 publications (2.256%) and Development Studies 10 publications (1.880%).

**Table 1.** *Research fields of publications and number and percentages of record*

| Research Fields                      | Record Count | % of 535 |
|--------------------------------------|--------------|----------|
| Construction Building Technology     | 436          | 81.955   |
| Engineering Civil                    | 262          | 49.248   |
| Green Sustainable Science Technology | 164          | 30.827   |
| Energy Fuels                         | 132          | 24.812   |
| Architecture                         | 115          | 21.617   |
| Materials Science Multidisciplinary  | 44           | 8.271    |
| Engineering Environmental            | 28           | 5.263    |
| Environmental Studies                | 15           | 2.820    |
| Urban Studies                        | 12           | 2.256    |
| Development Studies                  | 10           | 1.880    |

### 2.3. Document Types

The document types found in the WoS database are divided into seven sub-headings: book review, proceeding paper, book chapters, article, editorial material, early access, and review article. According to Table 2, the most prominent document type among 535 publications as scientific production output in the research was “articles” (77.009% rate, 412 articles). In addition, there are 73 proceedings articles, 38 review articles, 24 early access publications, 13 book chapters, 11 editorial materials, and a book review among the analyzed publications.

**Table 2.** *Document types of publications and number and percentage of publications*

| Document Types     | Record Count | % of 535 |
|--------------------|--------------|----------|
| Article            | 412          | 77.009   |
| Proceeding Paper   | 73           | 13.645   |
| Review Article     | 38           | 7.103    |
| Early Access       | 24           | 4.486    |
| Book Chapters      | 13           | 2.430    |
| Editorial Material | 11           | 2.056    |
| Book Review        | 1            | 0.187    |

## 2.4. Publication Titles

As can be seen from the document type analysis, most of the publications are articles. This observation is supported by Table 3, which lists the top 10 publication titles out of 134 publication titles according to the number of records. Among the publications on “Sustainable Development Goals” or “SDGs” related to “Construction Building Technology” and “Architecture,” Sustainable Cities and Society ranks first with 109 publications (20.374%) and publishes the most articles in this research. Other prominent publication titles include Buildings (68 publications, 12.710%), Journal Of Building Engineering (25 publications, 4.673%), Building And Environment (24 publications, 4.486%), Construction And Building Materials (24 publications, 4.486%), Smart And Sustainable Built Environment (22 publications, 4.112%), Energy And Buildings (18 publications, 3.364%), Archnet Ijar (15 publications, 2.804%), Case Studies In Construction Materials (10 publications, 1.869%), and Springer Proceedings In Business And Economics (10 publications, 1.869%). The journals listed are among the ten publication titles that have the greatest number of entries in the dataset that was analyzed.

**Table 3.** Top ten publication titles with the highest number of records

| Publication Titles   | Record Count | % Of 535 |
|--|--------------|----------|
| Sustainable Cities And Society                                 | 109          | 20.374   |
| Buildings  | 68           | 12.710   |
| Journal Of Building Engineering                                | 25           | 4.673    |
| Building And Environment                                       | 24           | 4.486    |
| Construction And Building Materials                            | 24           | 4.486    |
| Smart And Sustainable Built Environment                        | 22           | 4.112    |
| Energy And Buildings   | 18           | 3.364    |
| “Archnet Ijar International Journal Of Architectural Research” | 15           | 2.804    |
| Case Studies In Construction Materials                         | 10           | 1.869    |
| Springer Proceedings In Business And Economics                 | 10           | 1.869    |

## 2.5. Author Analysis

As can be seen in Table 4, the 10 authors”with the highest number of publications”in the study are Kawakubo S and Küfeoglu S with 9 publications. Ikaga T and Murakami S are in second place with 8 publications, Kamata T is in third place with 6 publications.

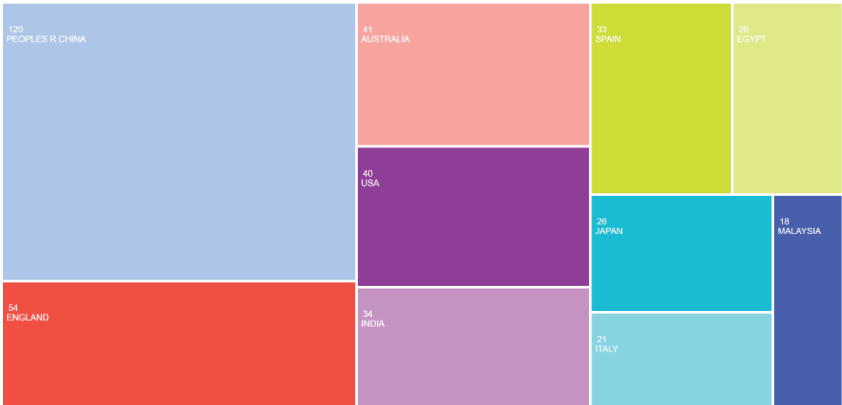
**Table 4.** *Top ten publication titles "with the highest number of records"*

| Authors    | Record Count | % of 535 |
|------------|--------------|----------|
| Kawakubo S | 9            | 1.682    |
| Küfeoglu S | 9            | 1.682    |
| Ikaga T    | 8            | 1.495    |
| Murakami S | 8            | 1.495    |
| Kamata T   | 6            | 1.121    |
| Nakano J   | 5            | 0.935    |
| Pearson A  | 5            | 0.935    |
| Zhang L    | 5            | 0.935    |
| Li X       | 4            | 0.748    |
| Liu Z      | 4            | 0.748    |

**2.6. Number of Publications by Country**

The place of scientific output analysed by nation or area covers 81 countries from all continents to illustrate the significance“of SDG review production by the most prolific countries based on the relevant authors’ country of affiliation.”

With 22.430% (120 publications) of the review papers,“the People’s Republic of China”was the most productive region, followed by England (10.093%; 54 publications) and Australia (7.664%; 41 publications), as Figure 4 illustrates.



**Figure 4.** *Number of publications by countries*

## 2.7. Keyword Analysis

In this study, the content of 535 publications was analyzed using the co-occurrence option in the VOSviewer program, and keywords were extracted. In this study, it was determined that keyword repetition was repeated at least 10 times. Out of a total of 8742 words, 120 keywords met this threshold. These 120 keywords were then classified into 6 different clusters by the VOSviewer program according to their relationship within the publications. “The number of occurrences (weights) of each keyword in the dataset is represented by the circle size.” In Figure 6, a distinct colour is used to represent each cluster. Cluster 1 is shown in red in Figure 5. The cluster contains 34 keywords including “addition, application, blend, carbon emission, cement, CO<sub>2</sub>, combination, compressive strength, concrete, construction sector, cost, day, degrees c, emission, environmental impact, energy consumption, energy demand, energy efficiency, energy saving, green building, green roof, increase, line, performance, possibility, production, reduction, renewable energy, resource, soil, structure, waste, weight”. This cluster is summarised under the title of performance.

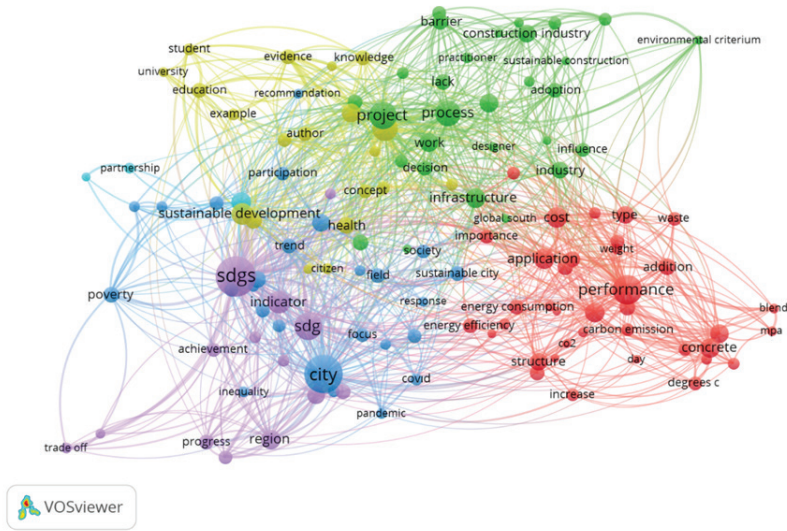
24 keywords in green color represent cluster 2. These keywords are adaption, barrier, BIM, case, construction industry, construction project, decision, designer, environmental criterium, industry, influence, information, infrastructure, process, project, questionnaire, questionnaire survey, safety, stakeholder, sustainable construction, work, and worker. Cluster 2 is named as a project.

Cluster 3, shown in blue, has 27 keywords. These keywords are accessibility, attention, city, covid, degree, dimension, field, focus, housing, inequality, pandemic, participation, person, place, poverty, principle, public space, quality, recommendation, response, society, trend, urban planning, urban sustainability, user, vision. Cluster 3 is named a city.

Cluster 4 is identified in yellow with 18 keywords. The cluster with the keywords agenda, architecture, awareness, citizen, concept, education, evidence, example, health, knowledge, nature, practice, smart city, student, sustainable development, topic, United Nations sustainable development, and university is summarized under sustainable development.

Cluster 5 is shown in purple. The cluster contains 14 keywords: achievement, indicator, interaction, life, population, progress, region, SDG, SDGs, service, synergy, trade-off, UN SDGs, and urbanization. This cluster could be called SDGs. Cluster 6 is shown in light blue. The cluster has 3 keywords: local government, partnership, and role. The cluster could be named a partnership.





**Figure 5.** *Keyword network analysis*

“Figure 6 shows the evolution of the most frequently used keywords in publications.” The visualization is divided into four groups, indicated by the color groups purple, blue, green, and yellow. These color groups serve as reference points for the categorization process. Accordingly, the first category of keywords from the past to the present includes energy efficiency, infrastructure, sustainable city, and structure in purple. The second category, blue, includes words like industry, barrier, project, trend, focus, and waste partnership. The third category in green includes keywords such as SDGs, city, process, region, poverty, lack, and weight. The keywords of the newest publications include industry, performance, concrete, BIM, and vision.



A horizontal timeline bar with a color gradient from dark blue to yellow. It has tick marks and labels for 2021.0, 2021.5, 2022.0, and 2022.5.

## 2.8. The 10 Most Cited Publications

The study analyzed “the 10 most cited publications between 2015 and 2025.” Table 5 shows that 6 of the 10 publications were published in Sustainable Cities and Society. Table 5 shows the content analysis of the 10 most cited documents between 2015-2025. 9 of the 10 most cited articles are related to SDG 11. When the most cited articles are analyzed, it can be said that these articles can be categorized into 3 main groups. The first group focuses on intelligent building and city issues. The most cited articles in this group are (Bibri & Krogstie, 2017) and (Jia et al., 2019). The second group focuses on technology and SDG 11. This group includes (Jia et al., 2019) (Sharif & Hammad, 2019). The third group focuses on waste and energy. This group includes (Pour et al., 2020), (Sharif & Hammad, 2019), (Ghadami et al., 2021) and (Mastrucci et al., 2019).

**Table 5.** *The 10 Most Cited Publications*

| N | Content analysis of studies  | References  |
|---|--|---|
| 1 | <b>Purposes/Problem</b>  | Bibri, S. E., & Krogstie, J. (2017)   |
|   | Many critical issues regarding smart sustainable cities remain unresolved, therefore, numerous research opportunities exist and are worth exploring.   |   |
|   | <b>Importance</b>  |   |
|   | This research is significant for examining potential research avenues and planning practices for the future in the area of smart and sustainable cities.   |   |
|   | <b>Methods</b>   |   |
|   | Literature review, comparison  |   |
| 2 | <b>Findings</b>  | Jia, M., Komeily, A., Wang, Y., & Srinivasan, R. S. (2019).                     |
|   | Consequently, a cohesive strategy built on current challenges and remedies is suggested for upcoming smart sustainable urban planning and development initiatives.   |   |
|   | <b>SDGs</b>  |   |
|   | SDG 11   |   |
|   | <b>Citations</b>   |   |
|   | 784  |   |
| 3 | <b>Purposes/Problem</b>  | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
|   | Research on the use of IoT in the construction sector is relatively scarce. This article explores recent projects and applications that utilize cutting-edge IoT technology for the advancement of smart buildings.  |   |
|   | <b>Importance</b>  |   |
|   | Domains in which the IoT will significantly influence include the construction, operation, and management of buildings, enabling top-tier services, ensuring effective functionality, and progressing towards sustainability objectives.                               |   |
|   | <b>Methods</b>   |   |
|   | Literature review, comparison  |   |
| 3 | <b>Findings</b>  | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
|   | The study discusses the priorities and issues of effectively integrating IoT for smart buildings.  |   |
|   | <b>SDGs</b>  |   |
|   | SDG 9, SDG 11  |   |
|   | <b>Citations</b>   |   |
|   | 283  |   |
| 3 | <b>Purposes/Problem</b>  | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
|   | Sustainable management of urban stormwater through low-impact development (LID) strategies can be utilized to lessen the flood effects caused by climate change. This study aims to determine how effective LIDs are in reducing urban flooding and their limitations. |   |
|   | <b>Importance</b>  |   |
|   | Enhancements in these areas will facilitate more cost-efficient strategies for mitigating urban flooding caused by climate change and will also assist in meeting the sustainable development goals for urban areas.   |   |
|   | <b>Methods</b>   |   |
|   | Literature review, Conceptual framework  |   |
| 3 | <b>Findings</b>  | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
|   | The study showed that LIDs can be an effective tool in reducing the effects of urban flooding.   |   |
|   | <b>SDGs</b>  |   |
|   | SDG 11, SDG 13   |   |
| 3 | <b>Citations</b>   | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
|   | 237  |   |

|                           |  |   |
|---------------------------|--|---|
| <b>4 Purposes/Problem</b> | Investigating the complex connections between building materials and the “Sustainable Development Goals (SDGs)” is the goal of this project in order to create a decision support tool that will help stakeholders in the construction industry, designers, and policymakers carry out the 2030 agenda.        |   |
| <b>Importance</b>         | The research indicates that construction materials significantly contribute to fulfilling various Sustainable Development Goals (SDGs) and their associated targets.   | Omer, M. A., & Noguchi, T. (2020).  |
| <b>Methods</b>            | Literature review, Conceptual framework  |   |
| <b>Findings</b>           | The outcome of the study both prioritizes improved educational mechanisms and validates engineering curricula to raise awareness of the “Sustainable Development Goals” among staff and students in Egyptian universities.   |   |
| <b>SDGs</b>               | SDG 9, SDG 11  |   |
| <b>Citations</b>          | 166  |   |
| <b>5 Purposes/Problem</b> | The study aims to answer the following questions: (1) How may biophilic design be defined, and where did it come from? (2) In what ways does biophilic design contribute to the advancement of sustainable architecture goals? (3) In biophilic design, which basic design techniques are applied?             |   |
| <b>Importance</b>         | In the study, an examination of current literature was conducted to investigate biophilic design as a foundational concept for comprehending nature in architecture. The fundamental frameworks of biophilic design were recognized, contrasted, and their key components were elaborated upon.                | Pour, S. H., Abd Wahab, A. K., Shahid, S., Asaduzzaman, M., & Dewan, A. (2020). |
| <b>Methods</b>            | Literature review  |   |
| <b>Findings</b>           | The findings reveal that biophilic design involves more intricacies than merely incorporating plants into structures. The research indicates that biophilic design techniques enhance diversity by including various forms of nature: physical, sensory, metaphorical, morphological, material, and spiritual. |   |
| <b>SDGs</b>               | SDG 3, SDG 11  |   |
| <b>Citations</b>          | 106  |   |

|          |                         |   |  |
|----------|-------------------------|---|--|
| <b>6</b> | <b>Purposes/Problem</b> | The model introduced in this research aims to provide insights into estimating “Total Energy Consumption” (TEC), “Life Cycle Cost” (LCC), and “Life Cycle Assessment” (LCA), as well as to identify the best scenario for various replacement options.  |  |
|          | <b>Importance</b>       | Updating the cladding and systems of current structures offers substantial potential to decrease the Life Cycle Cost (LCC) and lessen negative environmental effects.   | Sharif, S. A., & Hammad, A. (2019).                          |
|          | <b>Methods</b>          | Literature review, Case Study   |  |
|          | <b>Findings</b>         | The findings indicate that models developed with Artificial Neural Networks (ANNs) require considerably less time compared to conventional Building Energy Models (BEM) while still attaining adequate accuracy.  |  |
|          | <b>SDGs</b>             | SDG 11, SDG 12  |  |
|          | <b>Citations</b>        | 106   |  |
| <b>7</b> | <b>Purposes/Problem</b> | The research utilizes the “variable degree days” (VDD) approach on a worldwide grid to calculate the energy demand necessary to satisfy cooling requirements, considering the climate variability across regions, different housing types, availability of electricity, and ownership of air conditioning units.  |  |
|          | <b>Importance</b>       | As temperatures rise in the Global South, the associated health risks are growing, making the absence of adequate indoor cooling a significant aspect of energy poverty and overall human well-being. Addressing the fundamental cooling deficit identified in the study could play a crucial role in advancing several “Sustainable Development Goals” (SDGs). | Mastrucci, A., Byers, E., Pachauri, S., & Rao, N. D. (2019). |
|          | <b>Methods</b>          | Case study  |  |
|          | <b>Findings</b>         | The results show notable differences in availability to basic cooling, particularly in sub-Saharan Africa, India, and Southeast Asia. The demand for electricity in this region exceeds the energy poverty gap as defined by Sustainable Development Goal (SDG7).   |  |
|          | <b>SDGs</b>             | SDG 7   |  |
|          | <b>Citations</b>        | 97  |  |

|                           |   |  |
|---------------------------|---|--|
| <b>8 Purposes/Problem</b> | This study aims to evaluate the electricity consumption in Mashhad, Iran, through the application of machine learning methods, and to suggest adaptive approaches that boost residents' enthusiasm for renewable energy generation based on expert opinions.                                    |  |
| <b>Importance</b>         | This study presents a new method for providing energy to an urban region by combining goals of sustainable development, the smart city framework, renewable energy sources such as "artificial intelligence" (AI), "photovoltaic" (PV) technologies, and "Transformational Participation" (TP). | G h a d a m i ,<br>N., Gheibi,<br>M., Kian, Z.,<br>Faramarz, M.<br>G., Naghedi,<br>R., Eftekhari,<br>M., ... & Tian,<br>G. (2021). |
| <b>Methods</b>            | Literature review, Case study   |  |
| <b>Findings</b>           | According to the study's findings, the "Artificial Neural Network" (ANN) model can accurately predict electrical energy consumption with a 99% accuracy rate in both the summer and winter.   |  |
| <b>SDGs</b>               | SDG 7, SDG 11   |  |
| <b>Citations</b>          | 94  |  |
| <b>9 Purposes/Problem</b> | The purpose of this study is to investigate how urban scaling and SDG11 are related, as well as how the scaling exponents relate to the SDG indicators.   |  |
| <b>Importance</b>         | This study is important in terms of providing complementary information for urban scaling and Sustainable Development Goals 11.3.1, 11.6.2 and 11.7.1.  | Akuraju, V.,<br>Pradhan, P.,<br>Haase, D.,<br>Kropp, J. P.,<br>& Rybski, D.<br>(2020).   |
| <b>Methods</b>            | Case study  |  |
| <b>Findings</b>           | In the study, the areas of "easy access to public transportation", "urban area growth rate and population growth rate", "particulate matter levels" and "green space" were investigated and results were obtained about cities of different scales.   |  |
| <b>SDGs</b>               | SDG 11  |  |
| <b>Citations</b>          | 91  |  |

|                            |   |  |
|----------------------------|---|--|
| <b>10 Purposes/Problem</b> | Social sustainability's aims and objectives are seen as essential to humanity's current situation. This article evaluates the social sustainability performance of seven developed countries that are members of the Group of Seven (G7), a major intergovernmental economic organisation.  |  |
| <b>Importance</b>          | According to the research, nations consistently assess their effectiveness to tackle current social issues and enhance the overall satisfaction of their populace. A new integrated data-driven weighting technique that combines the "CoCoSo" method with the CRITIC and Shannon's Entropy approaches is used to evaluate the participating countries. | Torkayesh, AE., Ecer, F., Pamucar, D.,& Karamasa, Ç. (2021). |
| <b>Methods</b>             | Case study  |  |
| <b>Findings</b>            | In the research, nations were assessed in a comparative manner and ranked through "CoCoSo". France performs the best in terms of social sustainability criteria, according to the results of the proposed model.  |  |
| <b>SDGs</b>                | SDG 11, SDG 17  |  |
| <b>Citations</b>           | 87  |  |

2.9. Relation of Publications with the SDGs

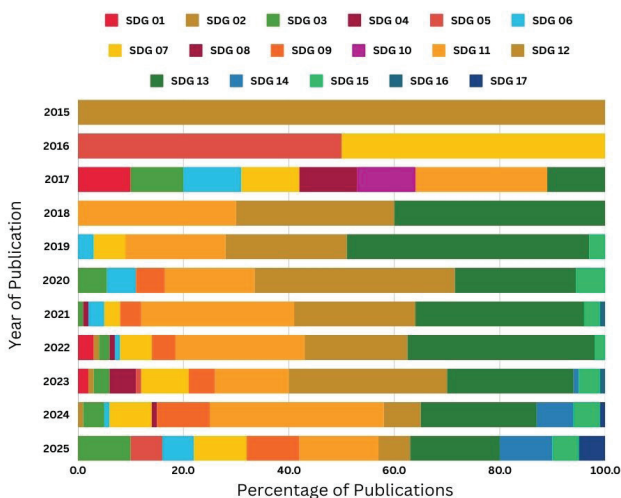
Finally, among all the sources examined in the study, the relationship between the publications between 2015-2025 and the "SDGs" was analyzed. This analysis quantitatively expressed the relationship between architecture and "sustainable development goals". In Graph 1, the SDGs that the publications between 2015 and 2025 are related to are expressed in percentages.

In 2015, the publication was associated with SDG 12 (100% rate). In 2016, the publication was associated with SDG 05 (50,000% rate), SDG 07 (50,000% rate). In 2017, the publication was associated with SDG 11 (28,571% rate), SDG 01 (14,286% rate), SDG 03 (14,286% rate), SDG 06 (14,286% rate), SDG 07 (14,286% rate), SDG 08 (14,286% rate), SDG 10 (14,286% rate) and SDG 13 (14,286% rate).In 2019, publications were associated with SDG 13 (42.424% rate), SDG 12 (21.212% rate), SDG 11 (18.182% rate), SDG 07 (6.061% rate), SDG 06 (3.030% rate) and SDG 15 (3.030% rate). In 2020, publications were associated with SDG 12 (46.667% rate), SDG 13 (33.333% rate), SDG 11 (26.667% rate), SDG 06 (6.667% rate), SDG 09 (6.667% rate), SDG 03 (6.667% rate) and SDG 15 (6.667% rate). In 2021, publications related to SDG 13 (36.538% rate), SDG 11 (30.769% rate), SDG 12 (23.077% rate), SDG 15 (9.615% rate),

SDG 09 (5.769%), SDG 06 (3.846%), SDG 07 (3.846%), SDG 03 (1.923%), SDG 04 (1.923%) and SDG 16 (1.923%).

In 2022, publications are associated with SDG 13 (36.782% rate), SDG 11 (26.437% rate), SDG 12 (21.839% rate), SDG 07 (8.046% rate), SDG 09 (6.897% rate), SDG 01 (4.598%), SDG 15 (4.598%), SDG 03 (3.448%), SDG 06 (2.299%), SDG 02 (1.149%) and SDG 04 (1.149%). In 2023, publications were associated with SDG 12 (32,000% rate), SDG 13 (28,000% rate), SDG 11 (18,000% rate), SDG 07 (9,000% rate), SDG 04 (5,000% rate), SDG 09 (5,000% rate), SDG 15 (4,000%), SDG 03 (3,000%), SDG 01 (2,000%), SDG 06 (2,000%), SDG 02 (1,000%), SDG 05 (1,000%), SDG 14 (1,000%), SDG 16 (1,000%).

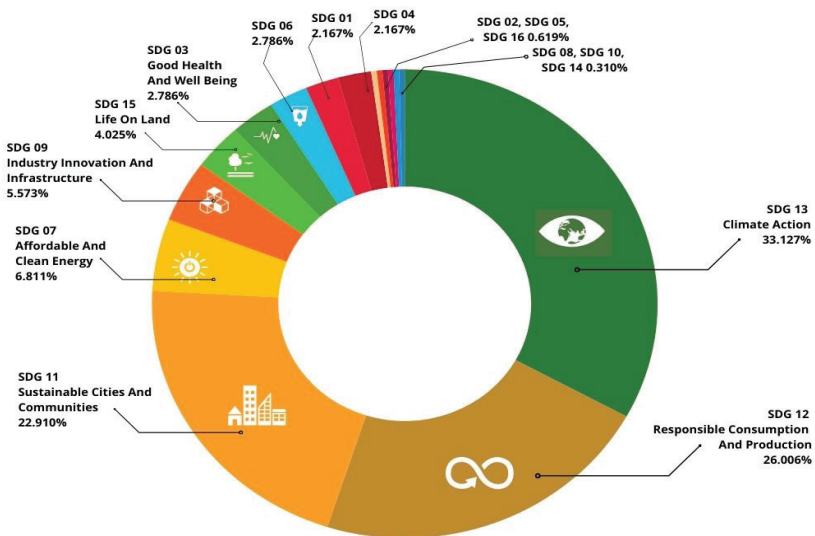
In 2024, publications were associated with SDG 11 (42.945% rate), SDG 13 (37.423% rate), SDG 09 (28.221% rate), SDG 07 (25.767% rate), SDG 12 (25.767% rate), SDG 14 (18.405% rate), SDG 15 (6.564% rate), SDG 03 (15.337% rate), SDG 06 (13.497% rate), SDG 17 (6.135% rate), SDG 02 (5.521% rate), SDG 08 (5.521% rate), SDG 05 (1.840% rate), SDG 04 (1.227% rate), SDG 10 (1.227% rate). In publications up to March 2025, it has been associated with SDG 13 (33.333% rate), SDG 11 (29.630% rate), SDG 07 (22.222% rate), SDG 12 (22.222% rate), SDG 14 (22.222% rate), SDG 15 (18.519% rate), SDG 06 (14.815% rate), SDG 09 (14.815% rate), SDG 02 (3.704% rate), SDG 03 (3.704% rate), SDG 04 (3.704% rate) and SDG 17 (3.704% rate). Since 2018, the connection between SDG 11, SDG 12, and SDG 13 and architecture-related publications has been steadily rising.



**Graph 1.** Ratios of publications to the SDGs they are related to over the years



Graph 2 shows the relationship between the 535 publications identified within the scope of the study and the SDGs. Graphic 2 shows the graphical distribution of the relationship between SDGs and scientific production outputs from 2015 to 2025 related to Sustainable Development Goals in Architecture. Between 2015 and 2025, the highest number of publications were published on SDG 13, with 33.127%. SDG 12 follows with 26.006%. 3rd most publications are related to SDG 11, with 22.910%. Then SDG 07 (6.811% rate), SDG 09 (5.573% rate), SDG 15 (4.025% rate), SDG 03 (2.786% rate), SDG 06 (2.786% rate), SDG 01 (2.167%), SDG 04 (2.167%) and finally SDG 02; SDG 05; SDG 16 (0.619%) and SDG 08; SDG 10; SDG 14 (0.310%) with equal percentages.



**Graph 2.** Percentages of publications about SDGs

### 3. Conclusions and Future Remarks

The bibliometric analysis focused primarily on construction building technology and architecture publications containing “Sustainable Development Goals” or “SDGs.” These selected publications provide a comprehensive analysis of the 10 most cited publications as well as various criteria such as publication and citation years, most frequently used keywords, research areas, document types, publication titles, number of publications by country, authorship and co-authorship patterns, and the relationship of publications with the SDGs they are related to. This study

provides insights into the development and research trends since 2015 and includes “a bibliometric analysis of sustainable development goals in architecture”. This information sheds light on trends and advances in the discipline. The findings indicate that the year with the most publications from 2015 to 2025 is 2024, and the time frame that saw the most rapid increase in publications is between 2021 and 2022.

While there are fluctuations in the number of publications in the timeline, it is seen that there has been a consistent increase in research efforts regarding this subject, particularly from 2020 to 2022. There has also been an increase in citations to publications since 2015. The fastest increase was experienced between 2021 and 2022. 2024 was the most cited year, with 2349 citations. In this study, all publications were filtered to focus on “Construction Building Technology” and “Architecture.” In addition to “Construction Building Technology” and “Architecture”, publications include research in “Engineering Civil”, “Green Sustainable Science Technology”, “Energy Fuels”, “Materials Science Multidisciplinary”, “Engineering Environmental”, “Environmental Studies”, “Urban Studies” and “Development Studies”. “The People’s Republic of China”, Australia and England are the most productive countries in terms of publications reviewed.

For keyword analysis, 120 keywords were classified into 6 clusters by the VOSviewer program according to their relationship within publications: performance, project, city, sustainable development, SDGs, and partnership. Performance (SDG 12), construction, cities (SDG 11), climate change (SDG 13), and energy efficiency (SDG 7) were the terms with the highest keyword values. The most significant Sustainable Development Goal 11 appears to be linked to the documents with the most citations and significant sources, according to the normalised citation analysis.

With the expansion of study disciplines, there has been a noticeable increase in the number of SDGs literature reviews published. Most of the review documents concentrate on broad aspects of sustainability. In addition, the most pertinent references were linked to energy, urban issues, and overall sustainability aspects. The findings from the bibliographic compilation revealed a deficiency in the integration of research, even among studies within the same field.

Sustainable Development Goal 11 is quite intricate because of its various targets and interdisciplinary dimensions. Hence, upcoming studies should focus on closing this gap by creating more efficient and dependable approaches to assess the advancement of this SDG across different research fields. As a result of the study, intelligent buildings and cities,

energy, waste, and AI-integrated sustainable methods are potential areas for academic study. However, there is a lack of academic studies on approaches to this field, and there is a need for studies on these issues. Another opportunity for the future is to establish more direct links between SDG 11 and practical applications.

Despite this study's valuable contributions, some limitations must be acknowledged. The analysis is based on a dataset extracted from WoS. This may be affected by the inherent limitations of the platform's publication coverage. In addition, the literature review was limited to two key research areas. To overcome these limitations, future research studies could explore data from different sources and use a range of indicators to assess impact, quality, and interconnections in the literature.

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# Chapter 2

## THE IMPACT OF TEACHING METHODS ON ARCHITECTURE STUDENTS' CLIMATE-ORIENTED DESIGN PROCESSES

*Ebru KILIÇ BAKIRHAN<sup>1</sup>*

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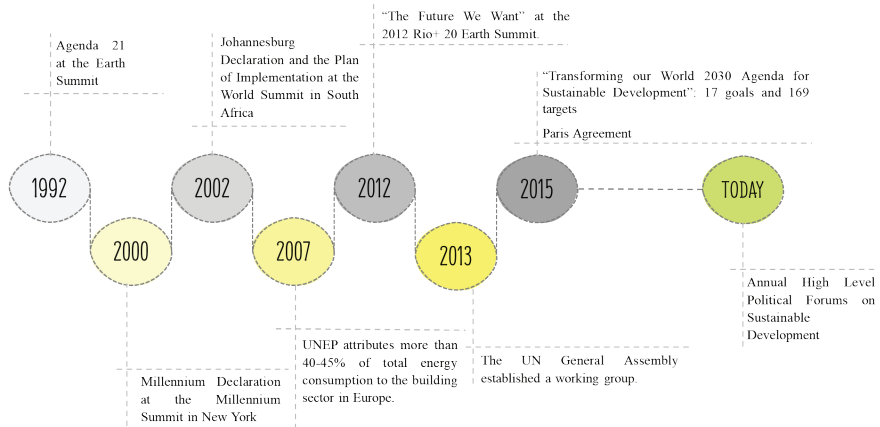
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## I. Introduction

Sustainable development aims to raise awareness by confronting environmental, social and economic challenges. Sustainable development goals were announced as an international call in 2015 and adopted by the member states of the United Nations as principles to be achieved by the end of 2030 [1]. The historical background of these sustainable goals can be briefly summarized as follows:

- In 1992, a comprehensive plan to improve human life and protect the planet, called Agenda 21, was adopted by more than 178 countries at the Earth Summit [1].
- In 2000, UN member states unanimously accepted the Millennium Declaration at the Millennium Summit in New York [1].
- At the World Summit on Sustainable Development in South Africa, the Johannesburg Declaration on Sustainable Development and the Plan of Implementation were adopted in 2002 [1].
- The United Nations Environment Program (UNEP) attributes more than 40-45% of total energy consumption and total greenhouse gas emissions to the building sector in Europe [2].
- In 2012, the document, published under the title “The Future We Want”, was adopted by UN member states [1]. At the 2012 Rio+ 20 Earth Summit, world leaders paved the way for the development of future Sustainable Development Goals [3], [4].
- The UN General Assembly established a working group to develop the Sustainable Development Goals in 2013 [1].
- In 2015, the working group started negotiations on the post-2015 development agenda and the process resulted in the adoption of 17 development principles [1]. Many of the new goals defined as “Transforming our World 2030 Agenda for Sustainable Development” are closely related to architecture and the built environment [3]. The Paris Agreement on climate change was signed in 2015 [1].
- Today, these principles of sustainable development are monitored and assessed on a country-by-country basis at the annual High Level Political Forum on Sustainable Development [1] (Fig. 1).





*Fig. 1 Historical background of sustainable development*

While the measures taken to address the climate crisis in the world are increasing day by day, it is seen that architectural education is falling behind these measures [5]. To overcome this problem, it is necessary to examine the curriculum, teaching methodologies, student experiences and knowledge acquisition, as well as other factors affecting the process and their interrelationships [6].

### **A. The Role of the Instructor**

In architectural education, there is a need to train course instructors in pedagogical theories and methods, especially in designing for climate change [5]. The term pedagogy used here refers to the teaching-learning relationship [7]. Teachers' personal skills and motivation to follow the sustainability agenda are effective in managing the learning process [5]. Part-time architects who are experienced in the field and share their experiences in the courses are of particular importance for students to master the subject [5].

In educational institutions, the skills and attitude of the instructor affect the learning process. In addition to being knowledgeable, the educator should have a grasp of ecological literature, be able to use and encourage the digital platform. It is also within the role of the educator to prepare the learning infrastructure by drawing a proper framework for students and providing the motivation they need [5].

### **B. Curriculum Management**

In architectural education, not only the role of the educators but also what and how they teach is important. Platforms such as the European

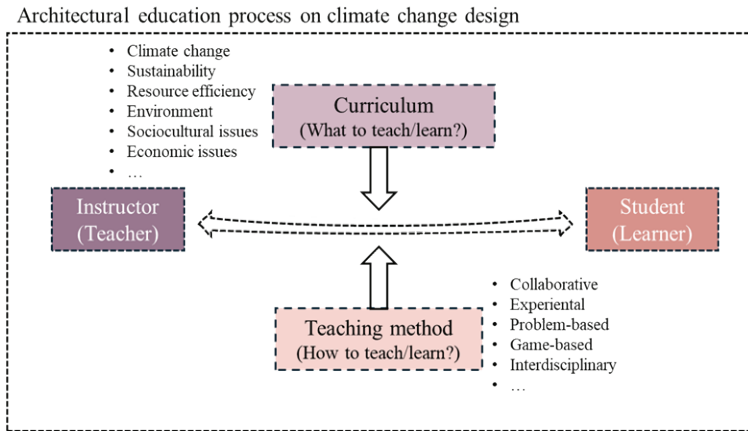
Council of Architects (ACE), the Royal Institute of British Architects (RIBA) and current developments should be closely followed and integrated into the architectural education process. These decisions should be followed and transferred in order to increase the competence, knowledge and skills of architects in the design of resilient and sustainable built environment against climate change and to implement the mandatory European Directives [8].

Various researchers have suggested adding topics such as “sustainability and resilience, disaster risk, climate change adoption” [9]; “urban planning, emergency evacuation, adaptive façade” [10]; “indoor environmental quality, eco-friendly materials, waste minimization” [11] and “energy efficiency, green architecture, conservation of natural and built heritage” [6] to the architectural curriculum.

### **C. Teaching Methods**

In architectural education, various teaching styles such as design-oriented and science-oriented coexist. Examples of design-oriented learning include design studios and science-oriented learning includes vocational/technical courses [12]. Successful pedagogical methods are mentioned in a study on climate change curricula and carbon neutralization, which consists of a review of 87 publications [5]. Accordingly, it has been observed that more effective learning process is realized when student-oriented, collaborative and interdisciplinary working principles are handled together with digital tools in the adaptation of sustainable design to architectural education. In the student-oriented education approach, the student's self-awareness, self-evaluation and self-management are at the forefront instead of transferring information from the teacher to the student [5].

The interrelation of the parameters related to the architectural education process is indicated below (Fig. 2)



*Fig. 2 The inclusion of climate-resilient design in architectural education*

Review studies [3], [13] and case studies [4], [15] addressing the course contents, teaching techniques, and student-instructor perceptions regarding the dissemination of sustainability in higher education institutions are available in the literature. The aim of this study is to examine different teaching methods from different perspectives in transferring indispensable issues of today's architecture such as climate change and sustainability into practice.

## II. Materials and Method

Within the scope of the study, articles from the last 10 years obtained from Web of Science and Google Scholar databases were analyzed. The keywords searched were “climate” and “education\*” and “architect\*” and “practic\*” and ‘teaching’ or “pedagogy”. Educational sciences and architecture disciplines were focused on as the research areas. In line with the information obtained, teaching methods were categorized under 5 headings and the literature review was continued under each heading. Subsequently, the definition, potentials, limits and/or gaps of each learning style were discussed. At the end of the study, these methods were summarized and recommendations were presented (Fig. 3).

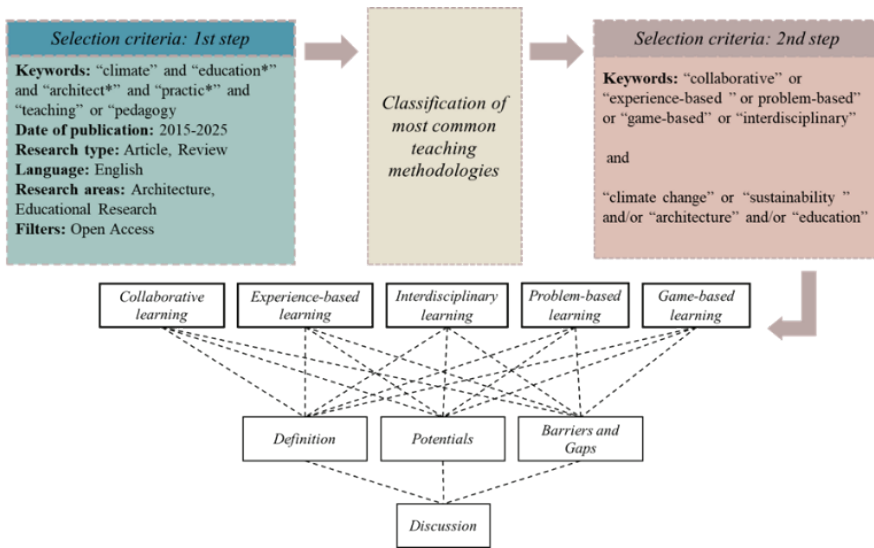


Fig. 3 Workflow chart

### III. Results

#### A. Collaborative Learning

##### -Definition

Collaborative learning is a learning process in which students work together in small groups towards a common goal [16]. Co-production nurtures decision-making process while addressing sociocultural issues [9].

##### -Potentials

The involvement of students in a group increases motivation to learn and individual effort in the educational process. In addition, the assistance of technology supports the collaborative working environment and facilitates the learning process [17].

Collaboration not only between students but also between teacher and student contributes to the learning process. The design studio represents the real practice space, and the collaboration of like-minded individuals working together in the studio facilitates the development of sustainable design concepts and the exchange of ideas. Students and teachers contribute to the development of design concepts together by participating in critical discussions [12].

Digital platforms such as Metaverse bring together even individuals who are far away from each other, allowing them to work together and making the process fun. Such platforms have gained popularity especially during the pandemic period [18].

#### *-Gaps and Barriers*

Group work is one of the active learning methods that focuses on the student. However, according to studies, this method cannot be applied today, especially in science-based courses, and traditional instructor-oriented methods are still valid [16].

In this learning technique, in-group dynamics may be unpredictable by the teacher, and this may negatively affect the learning process. The lack of equal individual effort by group members is an important problematic of this learning method. The fact that students are not prone to group work and their skills in this area are not developed may cause lack of communication between group members [19].

### **B. Experience-based Learning**

#### *-Definition*

Experiential learning is a form of learning in which knowledge is transformed into experience. This type of learning triggers a student-oriented learning process that encourages questioning knowledge through various application techniques and raises awareness by experiencing multiple parameters of sustainability together. Experiential learning can be supported by experimental and evidence-based learning techniques [9].

#### *-Potentials*

Especially in architectural education, experiential learning method can be successfully applied to address complex and multidimensional parameters. Methods such as live projects, inquiry-based learning, design-and-build, design studios, intensive workshops, and field research can be followed in applying this model [9]. In addition, the field experience approach, which is an application of this teaching technique, is an effective method in which the instructor shares his/her own experiences [9]. Experiential learning increases the interaction between students, teachers and social groups. It offers the opportunity to extend the decision-making process to the local community, stakeholders and various decision-makers [9].

Blended and distance learning methods can be utilized in architectural design studios to adapt to the social and technological needs of our age. When design studios, which are seen as the core of architectural educa-

tion, are reconsidered to include these methods, a participatory learning space can be created [20].

Constructivism is the structuring of new knowledge by associating it with previous knowledge and experiences and is unique for everyone [21]. Experiential learning method supports the current learning process by combining the most advantageous aspects of other learning theories such as constructivism [20].

#### *-Gaps and Barriers*

The learning-by-doing technique is a widely used experiential learning method in architectural design studios [22]. However, this method alone is not sufficient. The lack of regular inspections in the process of ensuring that students are adequately equipped in technical matters makes it difficult for students to practice in their professional lives. In addition, ignoring socioeconomic aspects and students' inability to digest what they have learned in the process by focusing too much on the end product are other points that should be emphasized [22].

Blended learning techniques can also be integrated into the experience-based learning process. However, delayed screen, audio problems, and internet connection lost may prevent the learning process temporarily [23].

### **C. Interdisciplinary Learning**

#### *-Definition*

Interdisciplinary learning refers to deepening learning by developing a holistic perspective on nature, society and real life [24].

#### *-Potentials*

Interdisciplinary education of architects supports creative processes on a global and local scale and contributes to the understanding of complexity [25]. Architecture and engineering are inherently intertwined. Therefore, it is inevitable that different disciplines feed on each other [21].

In interdisciplinary learning, the creation of non-hierarchical, small groups and the application of peer-to-peer learning promotes positive learning and enriches the student's learning experience [25]. Interdisciplinary education has a great impact on the maturity and dissemination of sustainability-related architecture courses. Because through this teaching method, it will be possible to develop multiple and holistic perspectives on the various challenges encountered. Interdisciplinary education plays an important role in training graduate architects who are competent

enough to find answers to environmental sustainability problems with their designs [3].

#### *-Barriers and Gaps*

The syllabus and management of the course need to support the learning phases [25]. In addition, the course instructor should have in-depth knowledge of the concepts and should not confuse the concept of sustainability with other concepts such as “green washing” [3].

### **D. Problem-based Learning**

#### *-Definition*

A problem-based learning method starts with a real problem scenario given to the students. Students work together to develop a set of scenarios in which they can practice their learning. At this stage the teacher acts as a catalyst facilitating the process. He/she asks questions to guide the group members as they discuss the problem. What is essential in problem-based learning is that students identify their existing knowledge, reveal the gaps in their experience and knowledge, and search for new knowledge to fill these gaps. In this way, a holistic approach in which students take an active role in learning is adopted [26].

#### *-Potentials*

Problem-based learning enables the development of a holistic and systematic approach (Boarin 2022). It triggers creative thinking and improves students’ drawing, conceptual and critical thinking skills during the design process [27]. Sustainability education that focuses on problem solving and group work is realized through experience, inquiry and reflection. Thus, theory is associated with experience [27].

Critical thinking is a cognitive system that is frequently used in problem-based learning, where the decision-making process is carried out by thinking about reasons and analyzing data. In this method, the decision maker checks himself/herself and makes judgments for the purpose [28].

Critical and creative thinking skills strengthen students’ ability to make the right decision and lead to ideal solutions in the design process [28]. This is a kind of active learning method and improves an individual’s problem-solving skills. Critical thinking skills can be developed later [29].

#### *-Barriers and Gaps*

In the implementation of this learning method, the role of the educator and the learner as well as factors such as equipment and environment need

to be well prepared. The process can be undermined if the academic staff is not skilled in conducting the problem-based learning process or is weak in using this skill to achieve the learning outcomes of the course. Therefore, the teaching staff should be trained and familiar with these issues [30].

Students' lack of experience, knowledge and questioning skills are among the obstacles to critical thinking. In addition to these, a number of cognitive, environmental, psychological and social barriers can also pose a problem for this way of thinking [31].

Individually, parameters such as fatigue, genetic factors, inability to be objective, memory problems, intelligence, and stress negatively affect critical thinking, while socially, parameters such as inadequate materials, crowded classroom environment, classroom layout, classroom atmosphere, traditional education method, course content, and educator's attitude can be effective on the learning process. Examples of environmental barriers include culture, expectations, prohibitions, beliefs, economic power, and loyalty to authority [31].

## E. Game-based Learning

### *-Definition*

One of the most important outcomes of play is that it enables learning. It does this through fantasy, imagination and creativity [12]. The game-like playful nature of architectural design makes it easy to reinforce its theoretical narrative with game-based learning techniques [12].

### *-Potentials*

Develops cognitive development towards philosophical thinking and symbolic thinking skills inherent in architecture [12]. It also helps to gain motivation, attention and awareness of sustainable development by following and using new technological developments. Augmented reality applications are known to contribute positively to architectural sustainability education [3]. Online group work provides students with additional skills to support distance learning and peer-to-peer learning [3]. Blended learning has the potential to bridge the gap between academia and practice [20]. In this method, face-to-face communication is combined with the flexibility of computer-assisted learning.

### *-Barriers and Gaps*

Game-based learning has limitations such as lack of resources such as time, financial support, lack of interest in students, lack of knowledge, in-class dynamics, inappropriateness of the subject to the game environment [32].



#### IV. DISCUSSION

Sustainability and climate change in architecture are issues that need to be addressed in a multifaceted manner and involve many parameters. Students are expected to establish a close relationship with these issues in the process of understanding the nature of architecture. However, it is known that the outputs of architecture students in the application stages are insufficient.

In architectural education, examining all factors together, from the attitude of the course instructors to the content of the subjects delivered and the method of delivery, will be effective in eliminating this deficiency. The strengths and gaps for improvement of the five different teaching techniques examined in this study are discussed within this framework.

According to the results, working in collaborative groups improves students' willingness to work and decision-making skills. This teaching method can be shaped in line with design studios, distance learning and critical thinking skills. However, lack of communication, compromise and equal distribution of tasks within the group can jeopardize the process.

Experiential learning supports participatory learning, increases students' attention and can be supported by various techniques such as workshops, field studies, evidence-based learning. However, handicaps such as lack of supervision, ignoring socio-economic aspects, and focusing on the outcome rather than the process may be encountered.

Interdisciplinary learning is closely related to multidimensional thinking and holistic approach. It is a form of learning inherent in architectural education and is conducive to practices such as deep learning, collaboration, project-based study. However, course content and management, adherence to the subject matter, efficient use of time and the ability of the instructor to manage the course should be at the forefront.

Problem-based learning emphasizes critical thinking, questioning, creative and conceptual thinking. It can be associated with the constructivist approach or collaborative work groups. In the process, it is important to ensure that the equipment is provided, the knowledge and skills of the facilitators are developed, and the psychological, environmental and social limitations of the students are eliminated.

Game-based learning is effective in increasing motivation, awareness and attention. In sustainable architecture, game-like approaches are exhibited in the design projects. Therefore, the subject and teaching style

are quite compatible with each other. However, time, financial resources, the level of desire in students and other environmental factors should be recognized.

As a result, all learning styles are influenced by everyone, from the teacher to the students, to those who prepare the curriculum and are responsible for the classroom environment. Therefore, these criteria should be recognized in advance and necessary precautions should be taken to implement appropriate teaching styles for the subject matter (Table 1).

*Table 1. Teaching methods, potentials and barriers*

| Teaching method   | Advantages   | Instructor's role  | Student's role   | Curriculum limitations  | Others   |
|-------------------|--|--|--|---|--|
| Collaborative     | <ul style="list-style-type: none"> <li>•Entertaining</li> </ul>  | <ul style="list-style-type: none"> <li>•Sufficient knowledge and skills</li> <li>•Equal task sharing</li> <li>•Sufficient inspection</li> </ul>  | <ul style="list-style-type: none"> <li>•Motivation</li> <li>•Group work ability</li> <li>•Communication skills</li> </ul>                                  | <ul style="list-style-type: none"> <li>•Not suitable for theoretical topics</li> </ul>        | <ul style="list-style-type: none"> <li>•Equipment</li> </ul>                   |
| Experiential      | <ul style="list-style-type: none"> <li>•Learning by doing</li> <li>•Participatory</li> </ul>             | <ul style="list-style-type: none"> <li>•Sufficient knowledge and skills</li> <li>•Sufficient inspection</li> <li>•Consolidating with case studies, workshops, field studies</li> </ul> | <ul style="list-style-type: none"> <li>•Broad decision-making process</li> <li>•Overlooking the process</li> <li>•Focusing on the final product</li> </ul> | <ul style="list-style-type: none"> <li>•Time</li> </ul>                                       | <ul style="list-style-type: none"> <li>•Equipment</li> <li>•Finance</li> </ul> |
| Interdisciplinary | <ul style="list-style-type: none"> <li>•Holistic</li> <li>•Multiple perspectives</li> </ul>              | <ul style="list-style-type: none"> <li>•Sufficient knowledge and skills</li> <li>•Course management</li> <li>•Wide concept knowledge</li> </ul>  | <ul style="list-style-type: none"> <li>•Versatile thinking</li> </ul>  | <ul style="list-style-type: none"> <li>•Time</li> <li>•Compliance with the content</li> </ul> | <ul style="list-style-type: none"> <li>•Equipment</li> <li>•Finance</li> </ul> |
| Problem-based     | <ul style="list-style-type: none"> <li>•Holistic</li> <li>•Systematic</li> <li>•Inquiry-based</li> </ul> | <ul style="list-style-type: none"> <li>•Sufficient knowledge and skills</li> <li>•Course management</li> </ul>   | <ul style="list-style-type: none"> <li>•Psychological, environmental and social competence</li> <li>•Critical and creative thinking</li> </ul>             | <ul style="list-style-type: none"> <li>•Time</li> </ul>                                       | <ul style="list-style-type: none"> <li>•Equipment</li> </ul>                   |
| Game-based        | <ul style="list-style-type: none"> <li>•Entertaining</li> <li>•Compatible with architecture</li> </ul>   | <ul style="list-style-type: none"> <li>•Sufficient knowledge and skills</li> <li>•Course management</li> </ul>   | <ul style="list-style-type: none"> <li>•Motivation and aspiration</li> <li>•Awareness</li> <li>•Attention</li> <li>•Cognitive skills</li> </ul>            | <ul style="list-style-type: none"> <li>•Time</li> <li>•Compliance with the content</li> </ul> | <ul style="list-style-type: none"> <li>•Equipment</li> <li>•Finance</li> </ul> |

## V. CONCLUSION

Sustainable development is a form of progress to which everyone, from officials to students, from city users to decision-makers, must contribute. The role of education in this cannot be denied. The discipline of architecture has the power to reduce the negative impacts of the construction sector. However, architects need to gain awareness and have education on the subject starting from the lowest level.

Studies have shown that various teaching methods are effective in providing students with design skills for climate change. In this study, the five teaching methods most frequently mentioned in the studies analyzed in the last 10 years are discussed through their strengths and weaknesses. In the architectural education process, the instructor, student, curriculum and teaching method should be examined holistically. Therefore, the characteristics of each teaching method are discussed within these components.

Collaborative learning, experiential learning, interdisciplinary learning, problem-based learning and game-based learning are among the methods discussed. Such methods can facilitate the process of transferring multi-disciplinary issues such as sustainability and climate change to architecture students. Increasing the student's motivation, developing the ability to make the right decision, developing critical thinking skills, thinking from different perspectives, being creative, thinking symbolically and developing a holistic approach are among the advantages that these methods add to education.

On the other hand, the knowledge and skills of course instructors, the relationship between process and outcome, the impact of social and economic parameters, the conduct of audits, the requirements of the classroom environment, the social, individual and psychological competencies of students, time management and the availability of financial resources are among the parameters that affect these teaching methods.

In future studies, different learning styles and their interrelationships can be examined. Differences in the delivery of the same subject through different teaching styles and the issues to be considered can be shared through case studies. The factors that stand out in the training of the teacher and the student can be evaluated. Findings from workshops organized with other disciplines related to the discipline of architecture can be shared. All kinds of parameters that facilitate the architectural education process and improve the sustainable practice skills of graduates should be focused on.

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# Chapter 3

## AN ANALYSIS OF THE NINETEENTH-CENTURY ORIENTALIST FRENCH PAINTING REGARDING POWER RELATIONS AND SPACE

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## 1. Introduction

The Orient is usually regarded as the unknown to be discovered by the West. In time, this assumed mysteriousness attracted many people. However, mixed with positive and negative reactions, the Orient has always been the “Other” for the West, as Edward Said stated in his renowned *Orientalism* (1979). Referring to the ideas of Michel Foucault, Said elaborated on the dynamic relationship between power and knowledge while elaborating on how the discourse of Orientalism emerged in the Western world. For him, Western people regarded themselves as superior and powerful, constituting the core of the Orientalist thought (Said, 1979). Orientalism directed how Western people saw the people of the Orient over time. However, it mainly caused altered views of the Orient, based on how the conception of Orientalism emerged. Inevitably, the idea of Orientalism became a decisive factor in many aspects, including the arts. In this case, nineteenth-century French art has the most appropriate examples of how artists, especially painters, used Orientalism in their artwork. Napoleon invaded Egypt in 1798, and the region’s colonization also shaped French artists’ perceptions and depictions of the East. This study aims at evaluating how 19th-century French painters, Eugène Delacroix, Jean-Leon Gérôme, and Jean-Auguste-Dominique Ingres, demonstrated Orientalist ideas that could be interpreted regarding power relations and space.

## 2. The Invasion of Egypt by France in the Nineteenth Century and Orientalism

Driven by imperialistic ideas, Napoleon left France to invade Egypt in 1798. His primary aim was to free the Egyptians from the Mamelukes; however, besides his army, he also took people who represented the current intellectual life in France, including scientists and artists, to Egypt (Strathern, 2009). Apart from gaining political power, Napoleon wanted Egypt to be explored fully and became open to Europe as part of his project. In this process, Egypt served as a learning place for the French intellectuals during their stay.

Although Napoleon’s invasion resulted in a military failure; according to Said (1979), it constituted the fundamentals of the modern experience of the Orient, forming its own discourse there, based on dominance and dissemination. This also emphasized the place of the concept of power in comprehending Orientalism.



### **3. Power Relations and Space**

#### **3.1. Discourse of Power**

Michel Foucault is among the most prominent philosophers who wrote on power. He focused on the term of discourse and defined them as groups of statements which were “formulated, distributed, divided and characterized.” In fact, he preferred to name discourses as “discursive formations.” (Foucault, 2011).

In a similar way, he wrote on the discourse of power. Foucault believed that power belonged to institutions, not the individuals. Prisons and schools are the most important examples of this. He used Jeremy Bentham’s idea of the Panopticon to symbolize power. For Bentham, this model of prison referred to how the new society must function. To provide the democratical administration, individuals should believe that anyone could be subject to being surveilled at any time. (Foucault, 1977).

Foucault argued that “something called Power, with or without a capital letter, which is assumed to exist universally in a concentrated or diffused form, does not exist. Power exists only when it is put into action.” For him, a power relationship can only be created when two parts are present and one exercise power over the other (Foucault, 1982). With all these features, power constitutes its own discourse.

#### **3.2. Power in View of Orientalism**

For Said (1979), the Western conception and Orientalism analysis should be derived from Foucault’s ideas. Foucault (1977) argued that discursive formations, rather than discourses, appear while controlling the individuals, disciplining them. In this case, the authority to generate knowledge and to use power belong to one party. Referring to these ideas, Said (1979) defined Orientalism as a constructed thing, “almost a European tradition.” He also stated that such constructions or depictions of the Orient was transformed into “the Orient” today and shaped how the West perceived it in time. This also prepared the background of the imperialist view.

In the core of Orientalism was the sense and idea that Western people regard themselves as superior to the East; therefore, the conception of power and how it is represented contributed to understanding and interpreting the Orientalist view.

### 3.3. Space

Space regarding power relations in the course of Orientalism has been a significant issue in the representations of the East in art. Following the idea of the Panopticon put forward by Bentham and elaborated on by Foucault, the organization and presentation of spaces constitute the core of Orientalist painting of the Nineteenth Century, especially in France. The scene on canvas, the selection of the specific place, and how the figures are depicted on the canvas indicate an Orientalist approach related to power relations. To show and analyze how power relations and space are understood or interpreted in Nineteenth-Century French Painting in the course of Orientalism, works of Eugène Delacroix, Jean-Leon Gérôme, and Jean-Auguste-Dominique Ingres will be analyzed.

## 4. Analyses of Selected Paintings

### 4.1. *The Death of Sardanapalus*, by Eugène Delacroix

*The Death of Sardanapalus* by Eugène Delacroix (Figure 1) depicts the Assyrian king Sardanapalus's bedroom, where violence, sex and nudity are present simultaneously. The artist obviously was inspired by Orientalist images and items, such as dark-skinned people, men with scarves, snakes, and fanciness all around. The painting seems to represent how a hidden bedroom in the Orient would look like as the Europeans would imagine it. Noone seems to look at the painter's direction and rather, he looks like he is gazing at them, which would bring the sense and idea of feeling superior in coherence with the Orientalist thought, depending on the ideas of Said and Foucault. Architecturally speaking, bedroom is one of the most secluded spaces of a residence; therefore, being able to see inside of it also refers to the superiority and curiosity. The painting also depicts an exotic and interesting scene from the European perspective at that time.



**Figure 1.** *The Death of Sardanapalus*, Eugène Delacroix, 1827.

(Source: <https://www.open.edu/>)

#### **4.2. *A Jewish Wedding in Morocco*, by Eugène Delacroix**

Here in *A Jewish Wedding in Morocco* by Eugène Delacroix (Figure 2,) there is a wedding held in the courtyard of a house. People, males and females mixed in their traditional clothes, are dancing and having fun during the event. Delacroix represents the scene as if he was there and looking at them. Interestingly, none of them turns and looks at him again. In this case, Delacroix can be said to almost “spy” on them, which can be explained by the Panopticon concept invented by Bentham and interpreted in this way by Foucault. Furthermore, courtyard is a common architectural component in buildings located at hot climates like Morocco, and the painter sets it as the frame for his painting.



**Figure 2.** *A Jewish Wedding in Morocco*, Eugène Delacroix, 1839.

(Source: <https://www.useum.org/artwork/Jewish-Wedding-in-Morocco-Eugene-Delacroix-1839>)

#### **4.3. *The Snake Charmer*, by Jean-Leon Gérôme**

In *The Snake Charmer*, Jean-Leon Gérôme (Figure 3), we see the interior of a mosque, which is a building typology of Islamic architecture and unknown to the West at those times. There are men sitting and watching a naked boy who is doing a show with the snake that is wrapped around his neck. The artist again seems like imaging himself in the same space with the other people and gazing at them. We do not know whether these people are aware of his presence in the scene. Furthermore, the boy is standing fully naked on the praying cloth and other men are watching him, which is an inappropriate and disrespectful image for Islam. However, based on the Orientalist view, the artist can imagine such a scene and prefers to depict it in this way without any moral or religious concerns. This attitude also indicates the feeling of superiority of the painter to the people who are demonstrated in the painting.



**Figure 3.** *The Snake Charmer*, Jean-Léon Gérôme, 1870.

(Source: <https://www.artsy.net/artwork/jean-leon-gerome-the-snake-charmer>)

#### **4.4. *Prayer in the Mosque*, by Jean-Léon Gérôme**

Showing us the interior architecture of a mosque again, Gérôme captured a scene during a prayer in *Prayer in the Mosque* (Figure 4). In the painting, he seems to stand close to three people who preferred to stay away far from the bigger crowd in front. Thanks to the perspective in the painting, we become aware that it is a large mosque. However, there is a half-naked woman who is standing behind the large crowd in front. Based on Islam belief, for a half-naked woman to stand among men who are praying in the mosque would be forbidden; therefore, the painter seems to make fun of the praying people whom he is painting there, being disrespectful to the religion. As a part of feeling superior in terms of Orientalist ideas, this can also be a reflection of how men usually see women as inferior to them from a feminist perspective, considering them only as objects for pleasure, not as individuals.





**Figure 4.** *Prayer in the Mosque*, J  an-Leon G  r  me, 1871.

(Source: <https://www.metmuseum.org/art/collection/search/436482>)

#### **4.5. *Odalisque and Slave*, by Jean-Auguste-Dominique Ingres**

In *Odalisque and Slave* (Figure 5), there is a depiction of an odalisque who is laying naked and listening to music. Such a scene can be regarded as a representation of how the European people imagined the mysterious Orient in their minds, again based on female nudity and pleasure. The place where they are located looks like rather a private residence and the painter seems to observe them in a secret way again, to feed his curiosity. Like the other paintings, no one in the room looks at the painter. Furthermore, with the focus on nudity, it is possible to claim that woman is represented as a sexual object.



**Figure 5.** *Odalisque and Slave*, Jean-Auguste-Dominique Ingres, 1839.  
(Source: <https://harvardartmuseums.org/collections/object/299806>)

#### **4.6. *The Turkish Bath*, by Jean-Auguste-Dominique Ingres**

Ingres's *The Turkish Bath* (Figure 6) represents the inside of a traditional Turkish bath. All the women in the bath are fully naked and they seem to enjoy themselves, playing music, drinking coffee and having homosexual experiences. Being one of the most hidden parts of a household, depicting a bath with multiple people in it corresponds to the Orientalist approach that is centered around curiosity. Like the other Orientalist paintings, there is also an obvious sense of being superior and powerful upon the others. However, in this painting, the artist is not standing in the same space with them, and he seems to be watching through a small keyhole, which also corresponds to the circular edging of the painting.



**Figure 6.** *The Turkish Bath*, Jean-Auguste-Dominique Ingres, 1862.

(Source: [https://museoteca.com/r/en/work/2119/ingres\\_jean\\_auguste\\_dominique/the\\_turkish\\_bath/!/](https://museoteca.com/r/en/work/2119/ingres_jean_auguste_dominique/the_turkish_bath/!/))

## 5. Conclusion

In conclusion, the idea of Orientalism has shaped how the Europeans imagined or regarded the East, the Orient. The impact has been visible in many aspects, including arts. In terms of painting, artwork of artists like Eugène Delacroix, Jéan-Leon Gérôme and Jean-Auguste-Dominique Ingres represents the view of the Europeans of the Orient, which could be associated with the power relations and space as described by Said and Foucault regarding the idea of Orientalism. Feeling superior and powerful to the “Other” is in the core of the Orientalist thought and it shows itself in those selected and analyzed paintings in different ways especially with reference to representation of spaces.



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