ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8

International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

http://TuEngr.com

Water Elements in Islamic Architectures

Ahmed Abdulwahid Dhannoon[1*]

[1] *Department of Architecture Engineering, College of Engineering, University of Mosul, Mosul, IRAQ.*
**Corresponding Author (Email: Dhannoon@gmail.com).*

Paper ID: 12A11A

Volume 12 Issue 11

Received 15 March 2021
Received in revised form 19 July 2021
Accepted 28 July 2021
Available online 16 August 2021

Keywords:
Arab architecture; Feng shui; Architecture of water; Water element in courtyards; Islamic Gardens; Salsabeel; Muslim architecture; Water element in mosque; Decorative water element.

Abstract

Islamic-Architecture is characterized by the distinctive employment of the water element in buildings. This essential element, which is used for sustaining life in the desert, the home of the first Muslims, has profound impacts on the design of Islamic houses and buildings, especially those that are related to performing religious rituals such as ablution in mosques and schools in addition to climatic, design, aesthetic, and symbolic functions. This research aims to identify the variables of employing the water element in the buildings of Islamic-Architecture and to discover the variation of this employing between them. This study employed secondary data by reviewing previous studies and identify the main variables that were used in designing the visual observation sheet of the cases. The cases are selected from various functional types in Islamic-Architecture. The results show the importance of the function, location, type, shape, frequency, and decorative addition to use the water element in the Islamic building. This study confirms that the water element is one of the essential elements in Islamic architecture, which reflects the functional, religious, and aesthetic aspects.

Disciplinary: Architecture (Islamic-Architecture, Traditional Architecture).

Cite This Article:

Dhannoon, A. A. (2021). Water Elements in Islamic Architectures. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 12*(11), 12A11A, 1-13. http://TUENGR.COM/V12/12A11A.pdf DOI: 10.14456/ITJEMAST.2021.211

1 Introduction

This paper reviews previous studies regarding the employment of water as a distinctive element in Islamic architecture (Siddiqui, 2020). The paper presents the statement of the problem, the research objectives, and the hypotheses of the study. This paper provides and discusses the implemented methodology to achieve the objectives. Moreover, a theoretical framework was proposed to investigate the use of the water element in Islamic-Architecture buildings, which provided detailed components. In this research, the proposed framework is applied to a selection of samples of Islamic-Architecture to analyze the results to provide the conclusion. Accordingly,

several conclusions and recommendations are advanced in this paper concerning water employment as a significantly used element in Islamic-Architecture

2 Review of Related Studies

El Shakhs& Ezzat (2018) pointed out that water played a fundamental role on two axes, the first being symbolic in the process of ablution physical and psychological purity and the second functional being an effective element in tempering the climate inside and outside the buildings. The study talked only about the water Dispensary(SABIL), an Islamic-Architecture building that has been functionally used in the water distribution of housing or passers-by in the past. The building was matured in terms of design in the Mamluk period in Eygpt and became an independent building topped by the Kuttab (Quranic School for boys). The study discussed the functional, aesthetic, and symbolic aspects of the SABIL building which fall under the charity facilities, through the descriptive-analytical approach (El Shakhs & Ezzat, 2018).

Jah (2014) highlighted the importance of water in the mosques of Andalusia when Muslims perform ablution 'wudu' in water basins, the locations and numbers of these basins, as well as the methods of providing these basins with water. The visual impression is essential in perceiving the decorative effects of the Islamic art in addition to the role of water reflections that completes the game of the lights and its reflections between 'muqarnasat', leaf inscriptions, and mosaic cubes. The study also refers that Water in Islamic decoration is a multi-functional decoration element with multiple objectives as it creates spaces with greater dimensions than reality. Water incorporates living and moving nature within the closed architectural frames. It also increases light in space and generates a unique rhythm. Water is a multi-image element that takes the shape of the vessel, which contains it or is in the form of a trickling waterfall or water that rises to the sky and falls again in the form of pieces. Water has a function that symbolizes the Paradise Gardens flowing through four streamlets within the court from the sides towards the four quarters connected to a fountain or a central basin. Further, the basins have several functions such as humidifying the atmosphere and providing a comfortable temperature (Jah, 2014).

Clark (2014) stressed the role of water and its use within gardens and the courtyards of buildings and palaces, in addition to the role of water and shade in creating a strong integration between architecture and nature. The basic ideas are derived from the Persian term "Jharabagh" in the sense of a quadrilateral garden, which was built around a central pond or fountain, from which, four streamlets flow towards the four directions of the symbolic place. The flow of water is sometimes designed from the central fountain "outward" and "inward' flowing from the four fountains placed in the "four corners" towards the center as in the lions Square at Alhambra Palace. Water represents a direct symbol of God's mercy in hot and dry environments. It also listed many references to fountains, flowing water, and the mild ideal climate in the description of Paradise mentioned in the Holy Quran. The courtyard in the Arab Islamic house often guarantees the existence of water, even in the form of a small fountain in the middle for climatic reasons. The fountains remind us of the abundant springs of water in Paradise as in 'al-kauther', which is a river

in Paradise. The study discussed the human scale of water use in Alhambra Palace. The sizes of the fountains used in the pavements are small sizes, as well as the heights they reach, and the sounds that are resulting from the movement of the water in it are tranquil and pleasant (Clark, 2011).

Yousif (2001) investigated the courtyard theme in Arab architecture, which served different functional requirements, The use of the water element within these courtyards or garden highlighted water is the source of every living thing. Four types of water mentioned in the Holy Quran refer to the four rivers of Paradise, water springs, rivers, al-salsabeel, al-kauther, and tasnim. The study also showed a variety of forms in which the water element existed in courtyards and gardens including the quadrangular and octahedral basins, perpendicular, axial or decorative canals, waterfalls like fountains in addition to forms of circular and lobed fountains, which take the form of animal statues pouring water from their mouths (Yousef, 2001).

Tayib (1989) mentioned the use of water within different Islamic-Architecture buildings to perform religious rituals in mosques or schools. The study discussed in detail the shapes and locations of the ablution basins in mosques, see Figure 1.

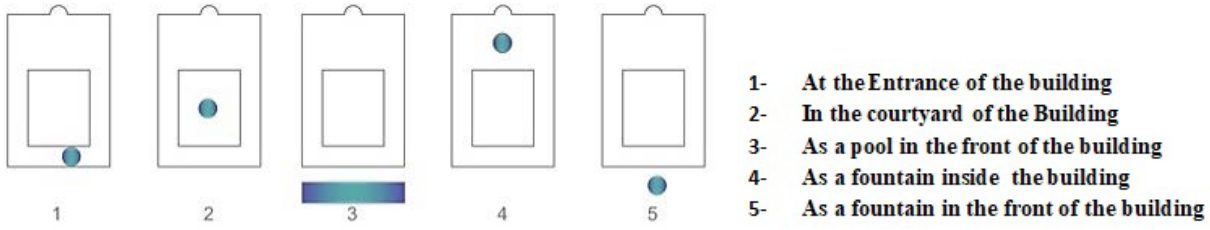

Figure 1: Forms and locations of the (Almayda'a) in mosques Adapted from (Tayib, 1989, p. 106)

Tayib (1989) discussed the use of the water element for decoration, especially the palaces because water gives the place another dimension through its refreshing coolness in addition to the beautiful sound of water, fountains, basins, and canals. The study discussed the importance of water in buildings, particularly in hot, dry, dusty, and sand-filled desert climates because evaporated water increases humidity and reduces the temperature inside the space. Moreover, the study showed a variety of forms of water within the buildings of Islamic-Architecture (Figure 2) (Tayib, 1989). The study also highlighted the employment of the water element within Islamic gardens and funerary buildings for various functional, aesthetic, climatic, and intellectual reasons.

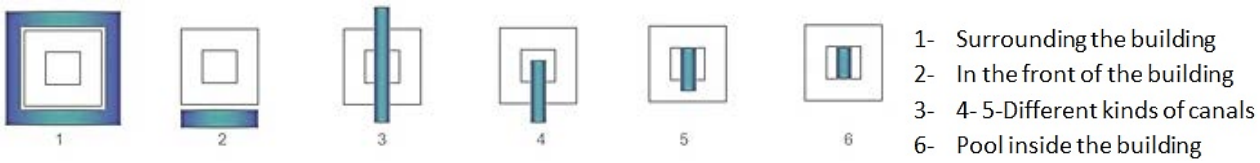

Figure 2: Forms of employment of the water element, such as fountains, canals and ponds, and its forms and sites within the buildings of Islamic-Architecture Adapted from (Tayib, 1989, p. 178).

Jones (1978) explained the linking of water to wealth, fertility, and coldness. Canals and basins were important elements in Islamic gardens, necessary for irrigation, and detailed architectural drawings and sketches were derived from these gardens because of their visual beauty. The study highlighted benefits of using water in buildings of Islamic-Architecture such as giving

them a sense of comfort and openness within the enclosed courtyards, The integration of the water element with the space formation as in the lion's Courtyard (Al-Saba') at Alhambra Palace in Granada. Another benefit of the water component emphasizes the building axes, linking the different areas in a directional sequence as in Alhambra. Moreover, the role of the water element in creating a monumental effect of the buildings in Islamic-Architecture through the surfaces of water that are used as mirrors to multiply the patterns and extend them beyond the physical limits. This effect is achieved whether water is in an open or closed space. In the case of the closed space like Ibn Youssef school in Marrakech, the decorations that are reflected on the water surface increased the space of the place (Dalu, 1978).

Based on reviewing the previous studies, it was found that the water element role is emphasized, and its different functional types of Islamic-Architecture are highlighted. Despite such emphasis, these studies have not provided detailed Variables about the employment of the water element because of their comprehensiveness. These studies contributed to providing valuable information, which can be used to propose a theoretical framework for studying this subject in Islamic-Architecture. Accordingly, knowledge about the employment of the water element in various Islamic-Architecture buildings is insufficient and limited in addition to the differences in such employment according to the functional type of each building.

Research Questions

1-What is the specificity of employing the water element in the buildings of Islamic-Architecture?

2- How does this employment vary based on the functional type of each building?

3 Methodology

This research adopted the qualitative and quantitative approach in the collecting and analysis of the visual data. With a checklist sheet designed to measure the samples, the selected case study uses purposeful sampling according to the criteria of the existence of the water elements in the Islamic building. This study included three steps:

1-To propose a theoretical framework.

2-To apply the proposed theoretical framework in an analytical study to highlight the specificity of employing the water element in the selected buildings of Islamic-Architecture and identify the variation in the methods of employing water in various functional types of Islamic-Architecture buildings.

3-To analyze the results of the conducted analytical study, provide conclusions, and put forward recommendations.

4 Theoretical Framework

Based on the previous studies, a theoretical framework is proposed to highlight the specificity of employing the element of water in Islamic-Architecture buildings by identifying several detailed Variables that were emphasized in previous studies. Previous studies have generally emphasized several detailed Variables that are related to the use of water in Islamic-Architecture buildings as follows:

4.1 Function/Objective based on the Use of Water Element

Water elements in Islamic buildings are employed for many functions based on the building type as in mosques and schools that used the water element in the functions related to the religious aspect such as the process of ablution using the ablution basin (almayda'a), which is found in many mosques and schools (Prochazka, 1986; El Shakhs & Ezzat, 2018; Rizk, 2000; Tayib, 1989; Thwaini, 2005), as well as climatic functions by using water to humidify the internal atmosphere of the building and reduce the temperature in different ways including the water basin or fountain in the building's courtyard (Jah, 2014) or by using the windcatcher (al-malqaf), Add to that the use of water to achieve design-related goals and functions such as emphasizing the axis of the building and linking various areas, elements, and components in a directional sequence (Dalu, 1978) as in the case of Al-Qarawiyyin Mosque, which used the water element in a canal between three of its components (two shazeruans and one ablution basin) in its court (Alrihawi, 2000; Stirerlin, 2009).

The water element is used as a means of connecting the internal and external spaces with each other within the building as in Alhambra Palace and Lions Square, where the water starts to pour into four canals, which are perpendicular to each other towards the palace halls (Migeon, 2009; Okan, 2009; Alrihawi, 2000).

Water functions through its reflective properties like a multi-purpose decorative element. It creates the huge impact of buildings in Islamic-Architecture through the water surfaces like mirrors, which multiply and increase patterns as in the Haroun Manar building near Lahore, or reflect the image of some parts of the building as in the forty-column palace in the city of Isfahan, Iran, where the water reflects and multiply the twenty pillars of the palace to a picture of forty columns symbolically known as Forty-Column Palace (Zarghami et al., 2015; Alrihawi, 2000; Clark, 2011). Such a reflective effect of water is achieved in both spaces, whether in an open space or in a closed space. In the case of a closed space as Ibn Yusuf School in Marrakech, the decorations that are reflected on the water surface increase the space of the place (Dalu, 1978). The water also serves as a symbol of the Paradise Gardens flowing through four streams running through the courtyard from the sides towards the four sides and are connected to a fountain or a central basin as in Lions Square at the Alhambra Palace in Granada (Zarghami et al., 2015; Jah, 2014; Clark, 2011). The water element is employed to achieve aesthetic and psychological functions by giving a sense of comfort and openness within the closed courtyard; the integration of the water element with the formation of space creates tranquilizing sounds and patterns through the transparent movement of water flowing from room to room in canals to fill the basins, then sliding in a waterfall in one level to another in some Islamic palaces as in the Red Fort building in Delhi (Dalu, 1978). In addition to the above functions, the basic function of water involves irrigation of plants, Drinking for humans by using al-Sabeel element in the Islamic buildings and for plants and plantations in the gardens of royal buildings like palaces (El Shakhs & Ezzat, 2018; Jah, 2014). It is worth mentioning that water has another function in architecture; it is a source of poetic inspiration for poets (Jah, 2014).

4.2 Location of Water Element within Building

The water element is employed within the courtyard of the building as in mosques, schools, or khans (Clark, 2011; Tayib, 1989) as in the case of Shah Mosque in Isfahan within the two wings at the ends of the prayer hall, which are composed of two rectangles consisting of two courtyards in the middle of which are water canals and ponds surrounded by arches (Alrihawi, 2000). The water element is employed in the front part of the building or it surrounds the entire building as in Harun Manar near Lahore (Tayib, 1989; Dalu, 1978). However, the water element is most frequently used inside the building as in the traditional Islamic houses, within the entrance, in which we often find a salsabeel in one of the walls made of attractive colored marble (AlRihawi, 1979). The water element can be rarely employed inside the building like Ulu Jame Mosque in Bursa, where there exists a small basin, as well as a small fountain, used to perform 'wudu' inside the building (Tayib, 1989). The water element is sometimes used in unusual places such as stairs like the "water ladder" in the Gardens of Areef of Granada (Maldonaado, 2008). Figure 3 shows several Locations using the water element.

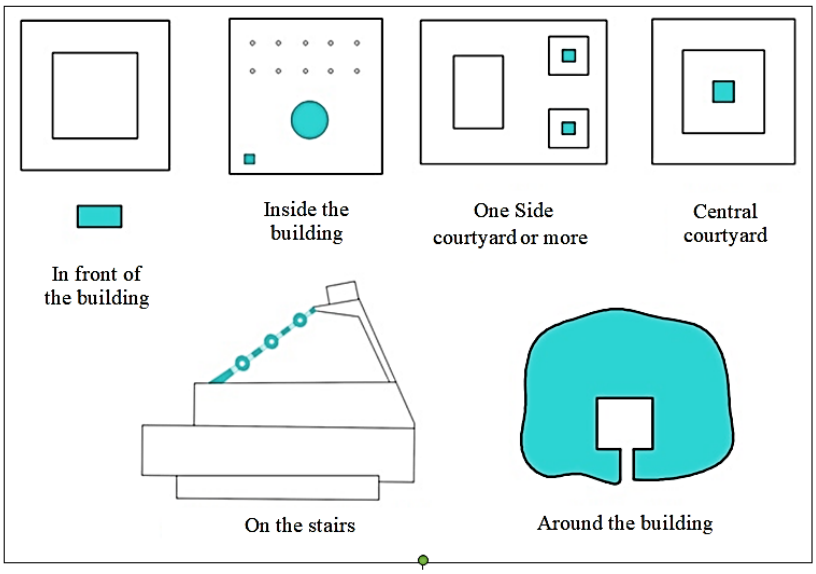

Figure 3: Water Locations within the building in Islamic-Architecture.

4.3 Method and Form of Water Element

This component refers to the method and form in which the water element appears inside or outside the building such as a small basin in an eight, astral, or circular form, or in the shape of waterways and conveyors in the form of motifs from the Arabic calligraphy (Tayib, 1989). It can also be in the form of a canal or a linear waterway connecting more than one geometric form to several water basins or as a central fountain connected to a reservoir or canal (Tayib, 1989; Clark, 2011). The water element is also employed in ponds of different sizes according to the size of the space as in many palaces and mosques, which often take the square and rectangle shapes, and in the form of Sabil (El Shakhs & Ezzat, 2018) or the form of salsabeel within a floridly decorated wall or in a waterfall form (Jah, 2014; Tayib, 1989). It can also be in the form of a river or lake next to the location of the building beside natural water elements as shown in (Figure 4), which shows the method and form of employing the water element.

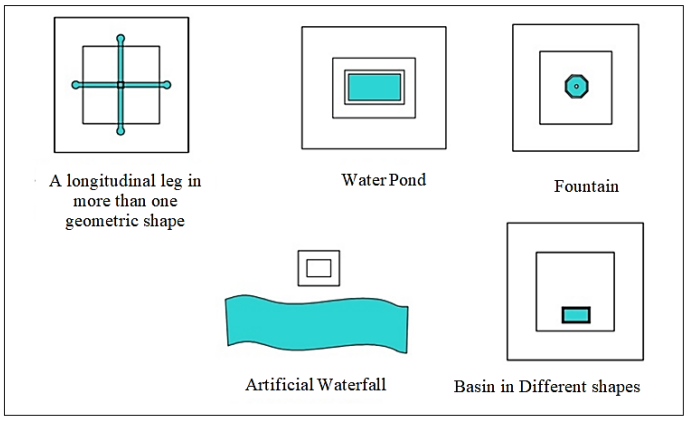

Figure 4: The method and form of the Water Element in Islamic-Architecture.

4.4 Number of Times Using Water Element in Building

This variable represents the number of times the water element is used within the building in its various forms. In most of the buildings, the water element has been employed only once as in mosques and schools, which often included a single ablution basin that took different forms such as a pond or an ablution basin sometimes covered with the shazeruan element. However, the courts of some mosques included more than one water element and sometimes three elements as in al-Qaraweieen mosque, which has three ablution basins linked to a water canal (Alrihawi, 2000). Residential buildings and palaces often have more than one water element such as one water basin or one fountain, which is connected by canals or by the salsabeel element, which works on cooling the air. (El Shakhs & Ezzat, 2018).

4.5 -Decorative Water Element

These additions include natural elements such as stones, plants, flowers, and trees, which integrate the water element with the surroundings and the environment around it. Element of water in the Islamic buildings have plant additions in the same place whether in a house courtyard or palace (Jah, 2014; Clark, 2011). There exist artificial additions such as carvings, basins, stone or marble sculptures, or coverings of ponds, basins, and canals with marble, stone, bricks, and glazed bricks of different colors (Yousef, 2001; Clark, 2011; Al-Omary & Hamodat, 2014). Such additions also include the use of inscriptions in Arabic calligraphy and various geometric and plant motifs, which surround and encapsulate water, whether in the form of basins, fountains, or ablution basins. In this context, it is also possible to refer to other additions, namely the roofing of the water element using the shazeruan (Alrihawi, 2000), a dome, or any other form used to cover the water element within the building. They can be added to the water element in a marquee or a small booth to sit near the pond or fountain (shabotra) like Shalimar Gardens in Lahore (Clark, 2011).

5 Application of the Theoretical Framework

A group of six functional types of buildings [mosques, schools, palaces, dwellings, health and service buildings, shrines, and gardens] was selected to investigate the specificity of the water element employment within these buildings excluding the bathroom building because its function is different from the rest of the functional types of Islamic-Architecture buildings. After that, five buildings were selected to represent each functional type along with excluding the time variable,

which can be investigated in further studies. The samples were selected based on different periods in Islamic Architecture, which dated back to pre-modern times. The samples were selected to ensure that adequate information is provided to investigate the employment of water elements and variations in such employment within the functional types of buildings.

5.1 Application of the Theoretical Framework to the Selected Samples

A specific checklist was prepared, which includes the key variables in the theoretical framework such as the identification of the functions and objectives of the use of the water element. The location and use of the water element and how it is employed within the building, the number of times, and the decorative additions to the water element in the samples of each functional type of building. After that, the obtained information on the samples of each functional type was recorded and included in the checklist, using the information and pictures in previous descriptive studies of Islamic-Architecture. Moreover, the images and information provided by websites on the Internet as illustrated in Table 1 as examples.

Table 1: Visual Observation Sheet Of Mosques Samples

Samples	Name of the building and its history	Great Umayyad Mosque Damascus, Syria 706-715 AD	Sultan Hassan Mosque / Cairo / Egypt 1336-1356AD	Shah Mosque / Isfahan / Iran 1612-1638 AD	Oulu Jamie Bursa/Turkey/ 1399AD	Al - Qaraween Jamie /Fez / Morocco AD 859
Function or objective based on the employment of W.E	Religious function / Ablution	●	●	●	●	●
	Climate function		●	●		●
	Increase the space& create a monumental effect			●		
	Connecting internal and external spaces					
	Emphasize the axes and connect the components					●
	Coding Heaven 1) water channels 2) Fountains	●2	●2	●2	●2	●2
	Create an aesthetic Spiritual nature environment			●	●	●
Location of W.E within the building	Central courtyard	●	●	●		●
	One Side courtyard or more			●		
	In front of the building			●		
	Around the building					
	Inside the building				●	
	On the stairs					
The method and form of the W.E	Fountain	●	●		●	●
	Water Pond			●		
	basin in Different shapes	●	●		●	●
	A longitudinal leg in more than one geometric shape			●		●
	Salsabil					
	artificial waterfall					
	Positioning beside river or lake					
N0. of times W.E used in building	Once	●			●	
	Twice					
	Three times and more		●	●		●
Decorative additions attached to W.E	Nature (stones and plants					
	Artificial(Statues, basins, (bridges, shapotra	●	●		●	●
	Use raw materials and colors for Implementation	●	●		●	●
	Use of inscriptions and ornaments		●		●	●
	Use of Shadrawan	●	●			●

6 Results

This section aims to analyze the data of the empirical study to identify the detailed variables of employing the water element and examine the variation in the specificity of such employment based on the functional type of each building.

6.1 Results of the Function of Water Element

Table 2, the most employed function of all types of buildings was the aesthetic and psychological function by 23.93%, followed by the symbolic function of Paradise with its rivers and springs by 22.22%, the climatic function by 20.5%, followed by the function of increasing the space and creating a monumental impact through the reflection feature of the water by 12.82%, the religious function (ablution) by 9.4%, the function of emphasis on the building axes, linking the components in a directional sequence by 6.83%, and finally the function of connecting the internal and external spaces through water canals by 4.27%. The aesthetic and psychological function represented the most employed function in schools, palaces, dwellings, gardens, and shrines by 17.8% each, and by a less percentage of 10.7% in mosques.

6.2 Results of Location of Water Element

The results Table 2, for all the functional types of buildings, the central courtyard achieved a percentage of 38.4%, inside the building 30.7%, the side courtyard or more than a side courtyard 13.4%, in front of the building or surrounding the building 7.6% each, and finally on the stairs 1.9%. The use of the water element was found in the central courtyard in houses 25%, followed by mosques, schools, and service and health buildings by 20% and a less in shrines and gardens 5%.

Table 2: Results of the function and location of water elements

		Mosques		Madaris		Palaces		Houses		shrines & gardens		service & health buildings		Total	Percentage
Function or objective based on the employment of W.E	Religious function / Ablution	5	45.45 27.7	5	45.45 26.3	0	0 0	0	0 0	1	9.09 4.5	0	0 0	11	9.4
	Climate function	3	12.5 16.6	3	12.5 15.7	5	20.8 20.8	5	20.8 27.7	4	16.6 18.1	4	16.6 25	24	20.5
	Increase the space& create a monumental effect	1	6.6 5.5	2	13.3 10.5	3	20 12.5	2	13.3 11.1	4	26.6 18.1	3	20 18.75	15	12.8
	Connecting internal and external spaces	0	0 0	0	0 0	3	60 12.5	1	20 5.5	1	20 4.5	0	0 0	5	4.27
	Emphasize the axes and connect the components	1	12.5 5.5	0	0 0	4	50 16.6	0	0 0	3	37.5 13.6	0	0 0	8	6.83
	Coding Heaven 1) water channels 2) Fountains	5(2)	19.2 27.7	4(2)	15.3 21.0	4(2) 4(1) 2	15.3 16.6	5(2)	19.2 27.7	4(2) 3(1) 3	15.3 18.1	4(2)	15.3 25	26	22.2
	Create an aesthetic Spiritual nature environment	3	10.7 16.6	5	17.8 26.3	5	17.8 20.8	5	17.8 27.7	5	17.8 22.7	5	17.8 31.25	28	23.9
	Total	18	15.38	19	16.2	24	20.51	18	15.38	22	18.8	16	13.67	117	100
Location of W.E within the building	Central courtyard	4	20 57.1	4	20 57.1	2	10 20	5	25 55.5	1	5 10	4	20 44.4	20	38.4
	Side courtyard or more One	1	14.2 14.2	0	0 0	3	42.8 30	1	14.2 11.1	1	14.2 10		14.2 11.1	7	13.4
	In front of the building	1	25 14.2	0	0 0	1	25 10	0	0 0	2	50 20	0	0 0	4	7.6
	Around the building	0	0 0	0	0 0	0	0 0	0	0 0	4	100 40	0	0 0	4	7.6
	Inside the building	1	6.25 14.2	3	18.7 42.8	3	18.75 30	3	18.7 33.3	2	12.5 20	4	25 44.4	16	30.7
	On the stairs	0	0 0	0	0 0	1	100 10	0	0 0	0	0 0	0	0 0	1	1.9
	Total	7	13.4	7	13.4	10	19.2	9	17.3	10	19.2	9	17.3	52	100

6.3 Results of Method and Form of Water Elements

The results are illustrated in Table 3, As for all the types of buildings, the fountain was used by 33.78%, followed by the basin in different forms by 22.79%, and the water pond by 21.12%. At a lower rate was the long stream that connects more than one geometric form by 10.81%, 'Salsabeel' and the artificial waterfall by 4.05% each, and finally beside the river or lake by 2.7%. From the results, fountain was used more widely in schools, houses, and service buildings and health by 20% each, followed by mosques by 16%, gardens by 12%.

6.4 Results of the Number of Times Using Water Element

The results are illustrated in Table 3. Regarding all the functional types of buildings, the water element was employed three times in the building by 53.33%, one time within the building by 33.33%, and two times of the water element by 13.33%. Multiple times of employment were found in shrines and gardens by 25%, followed by mosques, palaces, and dwellings by 18.75% each, and less for service and health buildings by 12.5%, and finally schools by 6.25%.

6.5 Results of Decorative Water Element

The results in Table 3, for all the functional types of buildings, the addition of artificial decorations (especially ponds and statues) obtained the highest percentage of 32.91%, followed by

Table 3: Results of form, times using, and decorative of water elements.

		Mosques		Madaris		Palaces		Houses		Shrines & gardens		Service & health buildings		Total	Percentage
The method and form of the W.E	Fountain	4	16	5	20	3	12	5	20	3	12	5	20	25	33.78
			36.3		50		18.7		41.6		21.4		45.4		
	Water Pond	1	6.25	2	12.5	5	31.2	2	12.5	3	18.7	3	18.7	16	21.62
			9.09		20		31.2		16.6		21.4		27.2		
	basin in Different shapes	4	23.5	3	17.6	3	17.6	3	17.6	1	5.8	3	17.6	17	22.79
			36.3		30		18.7		25		7.1		27.2		
	A longitudinal leg in more than one geometric shape	2	25	0	0	2	25	1	12.5	3	37.5	0	0	8	10.81
			18.18		0		12.5		8.3		21.4		0		
	Salsabil	0	0	0	0	1	33.3	1	33.3	1	33.3	0	0	3	4.05
			0		0		6.25		8.3		7.1		0		
	artificial waterfall	0	0	0	0	1	33.3	0	0	2	66.6	0	0	3	4.5
			0		0		6.25		0		14.2		0		
	Positioning beside river or lake	0	0	0	0	1	50	0	0	1	50	0	0	2	2.7
			0		0		6.25		0		7.1		0		
	Total	11	14.86	10	13.5	16	21.6	12	16.2	14	18.9	11	14.86	74	100
N0. of times W.E used	Once	2	20	4	40	0	0	1	10	1	10	2	20	10	33.33
			40		80		0		20		20		40		
	Twice	0	0	0	0	2	50	1	25	0	0	1	25	4	13.33
			0		0		40		20		0		20		
	Three times and more	3	18.75	1	6.25	3	18.7	3	18.7	4	25	2	12.5	16	53.33
			60		20		60		60		80		40		
	Total	5	16.6	5	16.6	5	16.6	5	16.6	5	16.6	5	16.6	30	100
Decorative additions attached to W.E	Nature (stones and plants)	0	0	1	6.66	5	33.3	2	13.3	4	26.6	3	20	15	18.98
			0		8.3		29.4		15.3		40		23.07		
	Artificial(Statues, basins, bridges, shapotra	4	15.38	5	19.2	5	19.2	4	15.3	3	11.5	5	19.2	26	32.91
			28.57		41.6		29.4		30.7		30		38.4		
	Use raw materials and colors for implementation	4	18.1	5	22.7	4	18.1	4	18.1	2	9.09	3	13.6	22	27.84
			28.57		41.6		23.5		30.7		20		23.07		
	Use of inscriptions and ornaments	3	25	1	8.3	2	16.6	3	25	1	8.3	2	16.6	12	15.18
			21.42		8.3		11.7		23.07		10		15.3		
	Use of Shadrawan	3	75	0	0	1	25	0	0	0	0	0	0	4	5.06
			21.42		0		5.8		0		0		0		
	Total	14	17.72	12	15.1	17	21.5	13	16.45	10	12.65	13	16.45	79	100

additions using raw materials and colors for execution and covering by 27.84%, and natural additives (stones, plants), inscriptions and decorations by 15.18%, as well as the addition of shazeruan and roofing by 5.06%. The largest concentration of artificial additions was found in schools, palaces, service, and health buildings by 19.2% each, less in mosques and houses by 15.38%, and even less in shrines and gardens by 11.5%.

7 Conclusion

From this study, water has a purifying function. This function is employed in mosques and schools for drinking and ablution purposes. Water is the source of purification for the soul and body. More importantly in this study Water in Islamic-Architecture is a multi-functional and multi-purpose decoration element as it helps to create spaces of greater dimensions than its reality through its work as a mirror and multiplier mirror of the architectural elements in space. And it also performs a symbolic function in religious representation of Paradise rivers and springs that are mentioned in the Koran through the quadruple design or the fountain. As well as water has an environmental function in increase light and humidity in the space and generate a unique rhythm, and water has a psychological and aesthetic function through the inclusion of the living and moving nature within enclosed architectural frameworks. It shows also wealth and status, and It is a source of poetic inspiration

The samples of the study showed that the most common functions of water in Islamic-Architecture, in general, include the following: the aesthetic and psychological function, the symbolic function of Paradise with its rivers and springs, the function of Show the wealth and status, the climatic function, the design function by increasing the space and creating a monumental impact in size, emphasizing the building's axes and connecting the components in a directional sequence in addition to connecting the internal and external spaces.

The samples of the study showed that the most used location for the use of the water element within the buildings of Islamic-Architecture, in general, is in the following sequence: in the central courtyard, inside the building, in the side courtyard, in front of the building, surrounding the building, and on the steps or stairs.

Many methods and forms of using water were employed, the samples of the study showed that most of these methods were repeated in the frequency of use and importance in the following sequence:(In the form of a fountain, water basins of different shapes, ponds (larger than basins), longitudinal canal connecting more than one geometrical shape, Salsabeel, Artificial waterfall, location beside a river or lake).

The samples of the study also showed that The decorative additions that are attached to the water element were identified and used in the following sequence: (Artificial decorative additions (especially basins and statues), The use of different raw materials and colors for covering and execution, Natural additions such as stones and plants, Writings and decorations, as well as shazeruan and roofing).

8 Availability of Data and Material

Data can be made available by contacting the corresponding author.

9 Acknowledgment

The researcher expresses due thankfulness and gratitude to the Department of Architecture, the Faculty of Engineering at the University of Mosul, which is registered within the scientific plan of the Department of Architecture for the academic year 2018-2019 No. 5868, 2nd session college of engineering council minutes meeting. (4s\1543) The University of Mosul. Also, the researcher acknowledges Dr. Oday Q. A. for technical supports.

10 References

Al-Omary, A. Y., & Hamodat, A. A. (2014, December). Water in Landscape Design, its Effect on the Placemaking. *Al-Rafidain Engineering, 22*(2), 97-117.

Al-Rihawi, a. (1979). *Al imara al Arabia al islamia, Khasaesuha wa Aatharuha fi Syria.* Damascus, Syria: Ministry of Culture and National Guidance.

Al-Rihawi, A. (2000). *Qimm Ilamia fi Turath Al hadara al Arabia al islamia al memaree wa al fanee.* Damascus, Syria: Press and Ministry of Culture.

Clark, E. (2011). *The Art of Islamic Gardens* (1 ed.). (O. S. Al-Ayoubi, Trans.) Abu Dhabi,United Arab Emirates: Abu Dhabi Authority for Culture and Heritage (Kalima).

Dalu, J. (1978). *" The Elements of Decoration :Suface, Pattern and Light",from" The Architecture of the Islamic World, Its History and Social Meaning"*. (G. Michell, Ed.) London: Thames and Hudson.

El Shakhs& Ezzat, A. (2018). Water in Islamic Architecture: Study of The Water Dispesary. *Journal of Architecture and Art and Humanistic Science, 1*.

Jah, S. A. (2014). *"Enigma del agua Al-Andalus" Arabic translation "Lughis al-ma' fi al-Andlus"* . Abu Dhabi, United Arab Emirates: Abu Dhabi Authority for Tourism and Culture, Kalima Project.

Maldonaado, B. b. (2008). *Al imara Al andalusia, Amarat al miah* (Vol. 1). (M. H. alhidad, Ed., & A. I. Menoufy, Trans.) Cairo, Egypt: Zahraa El Sharq Library.

Migeon, G. &. (2009). *Art of Islam.* New York, USA: Parkstone Press International.

Okan, B. (2009). *"Treasures of Islam " Arabic translation" kunuz al islam rauaie al fan fi al al alam al islamie".* (N. Nabulsi, Trans.) Lebanon , Beirut: Academia International.

Prochazka, A. (1986). *Mosques.* Zurich: Muslim Architecture Program.

Rizk, A. (2000). *Mujam Mustalahat al imara wa al funoon al islamia.* Cairo: Madbouli.

Siddiqui, T. (2020). Incorporation of Islamic Architectural Features in Nepalese Architecture. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 11*(9), 11A9O, 1-10.

Stirerlin, H. (2009). *Islam from Baghdad to cordoba, Early Architecture From The 7Th To The 13Th Century.* China: Taschen.

Tayib, A. Y. (1989). *"Islamic Architecture", Contribution to the Development of a methodology for the adaptation forms and function to the contemporary architectural concept.* Bucharest: Institute of Architecture, Ion Mincu.

Thwaini, A. (2005). *Mujam Imarat al shoob al islamia.* Baghdad: House of Wisdom.

Yousef, W. H. (2001). Arab Architecture Court Types and its adaptation with Human Requirements. *Journal of Engineering Sciences*.

Dr.Ahmed Abdulwahid Dhannoon Taha is an Associate Professor of Architectural Engineering Department at the University of Mosul. He received his Bachelor's degree from the University of Mosul- Architectural Engineering Department, Mosul, Iraq. He continued his Master's degree in the Center of Urban and Regional Planning- Baghdad University, Baghdad, Iraq. He got a Ph.D. from the University of Technology, Architectural Engineering Department, Baghdad, Iraq in the Islamic-Architecture field. His interests are Heritage and History of Islamic-Architecture.