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Exploring the Characteristics of Islamic Architecture in Educational Buildings: A Study of a Few Selected Muslim Countries

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Abstract. Sustainability is one of the words that can be utilized in various approaches and meanings. This research discusses the sustaining of architectural design styles that are related to Islamic civilization and heritage. Institutional buildings (*i.e.*, educational buildings) those are involved in teaching Islamic education are somewhat following a few special sets of design criteria for their unique architectural design sustainance that lead to permanence to be located in mostly the urban areas. The Islamic Madrasa buildings (*i.e.*, Sunni in particular) from the perspective of architectural design, materials, constructional methods, structural methods, and other approaches adopted solutions express the sustainable capabilities of the Islamic architectural Building types. This research paper intends to highlight the need for a tool for assessing institutional buildings and assembling critical information to understand similarities of architectural design based on several evaluation criteria mostly in an urban setting. In doing so, the researcher has conducted a qualitative research approach for collecting primary and secondary information from several institutional buildings around the world. Furthermore, the researcher has evaluated building plans, designs, and interior facilities of institutional buildings by collecting information from reliable websites. Note that the researcher has explored the existence of building facades, courtyards, staircases, building materials, color, water supply arrangements, and floor designs of the studied educational buildings in common. After summarizing the information, the researcher insinuates that the evaluation method adopted in this study may be useful for understanding and assuring the continuity of Islamic architecture styles of educational buildings (Madrasa) in Islamic countries.

Keywords: Institutional Buildings, Heritage Buildings, Islamic architecture, Tools, Sustainability, Culture.

1. Introduction

Modern architecture poses keen interests in constructing buildings with diverse preferences of use while minimizing conflicts (Kaptan, 2013). These buildings are providing stable life span, accommodating cutting-edge technologies, shaping the built environment, offering aesthetic views, and constructing for serving the present and future needs of the communities mainly located in the urban areas (Adi Ainurzaman Jamaludin, 2012; Akadiri *et al*., 2012; Bantanur *et al*., 2015; Kendall, 1999; Klarin, 2018; Taleb & Sharples, 2011). Scientists in contemporary time have focused three issues of sustainability while integrating the concept into architecture and building design such as: environment, economy, and society (Al-Kodmany, 2018; Jalaei & Jrade, 2014; Klarin, 2018; Taleb & Sharples, 2011). As a result, sustainability is focusing the issues of achieving a cost-effective building and serving the society to its apex possibilities.

Moreover, studies are indicating that the demand of sustainable buildings are increasing because of the minimal environmental footprints into the natural environment (Akadiri *et al*., 2012; Jalaei & Jrade, 2014; Saraiva *et al*., 2018). Consequently, sustainable performance of buildings (*i.e*., institutional buildings in particular) is a critical concern among professionals (e.g., architects, engineers, constructions, etc.) as design and construction guidelines are updating quite frequently so does the technologies (To *et al*., 2018; Zanni *et al*., 2017; Zavadskas *et al*., 2017). Institutional buildings such as: elementary schools, high schools, community colleges, universities, and post-secondary education institutions are capturing attentions from the professionals for achieving sustainability based on design, performance, energy efficiency, and lower carbon foot print for a prolonged time period of 25 to 50 years (Mansour & Radford, 2016; Moscardo, 2016; Owens, 2017). Therefore, educational institutions across the world have been performing efforts in order to implement sustainable development goals within their operational activities with a view to reducing environmental consequences (Coleman & Robinson, 2018; Filho *et al*., 2019; Lambrechts *et al*., 2018).

The concept of sustainability emerged thorugh the Bruntland commision's report in the 90s that highlighted the importance of meeting future needs (Al-Kodmany, 2018; Marshall & Toffel, 2005). Once the notion was introduced, stakeholders around the world started to use the concept in government, industry, and community groups on subjective priorites inclduing the Islamic architecture and planning domain (Jalaei & Jrade, 2014; Latiff *et al*., 2016; Meppem & Gill, 1998). Consequently, the sustainability concept was highly cited in the Islamic countries in order to implicate the criteria in several disciplines including architecture and urban planning (Akadiri *et al*., 2012; Al-Kodmany, 2018; Sherif & Ismaeel, 2016; Taleb & Sharples, 2011). Moreover, the concept of sustainability received immense attention to be introduced in designing and assessing buildings and structures across the Muslim countries.

Before going into detail about the institutional buildings and typical characteristics of Islamic architecture and sustainability, a focus is required to provide the meaning of Islamic architecture. Indeed, wide range of literature suggest that Islamic architechture is a function and form inspired primarilly by Islam (Al Surf *et al*., 2012; Latiff *et al*., 2016; Omer, 2015). The term also fosters and stimulates the activities through worhip, and in turn, represents the religion of Islam by adopting a wide range of identities including but not limited to: (i) history; (ii) culture; (iii) religion; and (iv) innovation (e.g., design and built environment) (Al-Kodmany, 2018; Latiff *et al*., 2016; Mohamad Rasdi & Utaberta, 2010; Sarkawi *et al*., 2016). It is worth noting that many of the Islamic countries across the world are introducing new institutional buildings practicing the religion with ample opportunities for worshiping under the guidelines those are not well-documentd but have similarities. Note that, the sustainability guidelines are somewhat presents inside the builing plans and layout with many clear indications that are essential for the future existence of these institutional buildings .

Many of the majority Muslim countries across the world have considered sustainability features inside the building layouts and desing such as:

• The principles of unity, sense of togetherness, understanding the balance of present and future, and overall responsibilities to maintain an institutional building considering future requirements are highly connected with the environmental sustainability and justice in Malaysia (Adi

Ainurzaman Jamaludin, 2012; Latiff *et al*., 2016; Sarkawi *et al*., 2016). Additionally, the scientists have considered that buildings are playing critical roles in order to deliver quality religious education to the future professionals;

- Few countries like Malaysia and Indonesia have focused their building design by following the criteria of energy performance, natural lights, air ventilation, and open area concept for learning in order to enhance building's sustainability. Moreover, the design criteria should replicate a welcoming concept of a wide range of people for a sustainance of buildings and activities (Adi Ainurzaman Jamaludin, 2012; Baharudin & Ismail, 2014; Owens, 2017; To *et al*., 2018);
- Prophet Muhammad has expemplified the practice on sustainability through his teaching and lifesty as see in most of the muslim majority countries (Latiff *et al*., 2016). In Turkey, research works have demonstrated that the techniques adopted for mosques and religious buildings in order to maintain sustainability is mostly focusig on energy consumption, opennes of the building for enough light during day time, and a comfortable environment (Khattab *et al*., 2005; Moscardo, 2016; Owens, 2017; Rabbat, 2012; Tasc‌ı, 2015);
- In the middle east with specific emphasis on Kingdom of Saudi Arabia (KSA), sustainability and institutional building development have demonstrated the issues of cost of production (e.g., maintenance and running costs, and alteration expenses), harmonization with the culture and essence of needs (*i.e*, similarities with the existing buildings for natural light and ventilation), and availability of quite and calm places inside the building for worshippers (Al Surf *et al*., 2012; Alrashed & Asif, 2014; Baharudin & Ismail, 2014; Mohamad Rasdi & Utaberta, 2010);
- Few studies have revealed that one of the most critical building materials used in Islamic architecture, especially in Egypt, Iraq, and Morcco (few cases wood and stones are visible but less likely in most cases) for ensuring the sustainability in institutional and religious buildings in the aforementioned countries (Cortese, 2003; Finlay & Massey, 2012; Kendall, 1999; Sarkawi *et al*., 2016; Sirryeh, 2018) ;
- Other countries of the Muslim world such as Pakistan, Bangladesh, Sudan, and Morocco, islamic buildings are considered as the place for worshippers and the designs involving ornamentation and styles, acoustics, lighting, and ventilation (Abubakar *et al.*, 2016; Alrashed & Asif, 2014; Baharudin & Ismail, 2014; Jusoff *et al*., 2011; Kiliç & Kuzey, 2013). Moreover, the similar literature have suggested the conservation and preservation techniques that may be adopted to make the buildings more sustainable .

However, an integral form of Islamic guidelines for institutional buildings within the scope of several litearture are always recommending for future studies. In this aspect, the researcher has attempted to study the characteristics of Islamic architectures (i.e., building orientation, lighting, space requirements, type of structures, building materials, and relevant criteria) upon collecting information from several muslim majority countries of the world. After assessing the typical charactertistics of the buildings with a given set of criteria, the researcher has opted to demonstrate the sustainability feature those are present in most of the premises. With a view to

understanding the majority of characteristics present in the structural designs, space allocation, and use of the particular building, the researcher has summarized the information to perceive the typical designs of the buildings those are widely common in diverse geographical locations. Furthermore, this study emphasizes the issues of similarities observed in traditional institutional buildings in the Islamic countries (*i.e*., majority Muslim population in particular) and synthesizes the common characteristics of these buildings in the light of sustainability.

2. Study Area and Data Requirements

In conducting this research, the researcher have selected some cities of Muslim majority countries in Asia. The researcher have ivestigated 52 Islamic institutional buildings (*i.e*., madrasa's) in the urban areas from North Africa to the Central Asia. Many of these madrasa been renovated recently and turned into a sight-seing destinations for the tourists. These buildings deomostrate rich architectural designs and strong susitnability indicators in the urban setting. Institutional educational buildings of Madras's are divided into two types: Madrasas built within or attached to a major project including cemeteries, palaces, and Mosques … *etc*, the other type which is the one this study focuses on is the madrasa standing by itself, and the building famous as an educational property like Madrasa al-Mustansiriyya at Baghdad, Iraq .

Furthermore, the researcher calculated more buildings but these 52 buildings can be found not demolished or disappeared, renovated, or documented in authenticated references. Even if there are more Madrasas standing by themselves and not connected or attached to any other projects one of the main goals of this research is to study the similarities and differences in the madrasas buildings in the Islamic world to assist in deciding whether the building applied the proper criteria and has all the architectural features that lead everyone to certify that this building is part of the IAS.

Interestingly, these criteria of sustainability are somewhat missing in the contemporary literature. Note that, the researcher has planned to collect information from the cities of these selected countries with special focus on institutional building design criteria, type of the structures, building materials used, special ornaments of the buildings, conservation strategies, ventilation, open space, lighting, and in some cases accessibilities to the buildings. Consequently, the researcher has highly relied on information available through internet from reliable sources (e.g., government websites, mosques, Islamic institutions, *etc*.). In few cases, the researcher has to rely on information supplied from research laboratories in the universities of respective cities and countries.

3. Methodology

In composing this research, numerous sets of data and resources were essential. Firstly, the researchers determined to accumulate pertinent items and information from the trustworthy sources such as; (i) Heritage architectural websites (e.g., non-profit architectural organizations, city authority, ministry of Culture and preservation, etc.); (ii) secondary documents (e.g., Islamic architectural authenticated Books, relevant literature, etc.); and (iii) primary sources of information (e.g., photographs and maps, etc.). Secondly, once the diverse and revised data of appropriate and compatible resources of information were identified, the research team began to process, studied, and analyzed the data through employing a suitable method to epitomize the information via producing various graphs, maps, and tables. Finally, we chose to summarize the acquired information in a scientific fashion with few suggestions that

might avail future researchers to comprehend and adopt the methods of Islamic architecture educational building guidelines (IAEBGs). The methods the researchers embraced in this study would be considered in the next part. Therefore, Fig. 1 exemplifies the procedure of data assemblage, assortment, and analysis methods in a concise manner.

The Educational buildings chose from authenticated and genuine websites and books specialized in Islamic architecture and are considered the main database for Islamic architectural heritage. These studies were not visited in person but visited virtually. The methods of Islamic Architecture Educational Building Guidelines (IAEBGs) are outlined in Fig. 1. The IAEBG is divided into three main guidelines which are; (i) components, (ii) functions, and (iii) elevations. The reason of choosing and considering these three components mainly are focusing on typical features of the architectural designs of institutional buildings. The guidelines of Islamic architecture and educational buildings are classified into two main reasons, firstly, eager to recognize the level of that there is a compatibility between Islamic architecture Madrasa buildings (e.g., institutional buildings dedicated to Islamic education including residential opportunities for students in the premises) despite the spatial and temporal difference. Also, what are the aspects of this congruence and clossness from the three guidelines aspects. Secondly, to lead to comprehend some of the sustainability practices of the Islamic architecture created for educational buildings in the Islamic world. The prominent feature of the proposed guideline includes the root and sources of the architectural data bases on their availability. The IAEBGs has not been considered in any previous literature or applications, however, has been recommended in few studies for future scope of studies (Baharudin & Ismail, 2014; Jusoff *et al*., 2011; Kiliç & Kuzey, 2013; Omer, 2015; Taib & Rasdi, 2012; Taleb & Sharples, 2011). The IAEBGs are proposed to instruct various specialists in Architectural, Engineering, and Constrction (AEC) to apply and implement Islamic architecture sustainability when designing solutions that focus on utilize Islamic architecture features in educational buildings. The author method in this research required collecting relevant information, data from reliable books, journals, and authintic architectural websites. The sub-criteria excerpted from ten Islamic architectural madrasa out of the 52 madrasas which are located in different regions and areas extend from the east to west of the Islamic world. Then, classify the information of madrasas according to it os avalibality. After that study the similarities among the various madrasa architectural components and apply the same technique to the functions and elevations guidelines. This stage needs to copmare between three building selected from the ten chosen buildings. Note that, the author have retrieved this method to assure highly authenticated information and reliability of data sources.

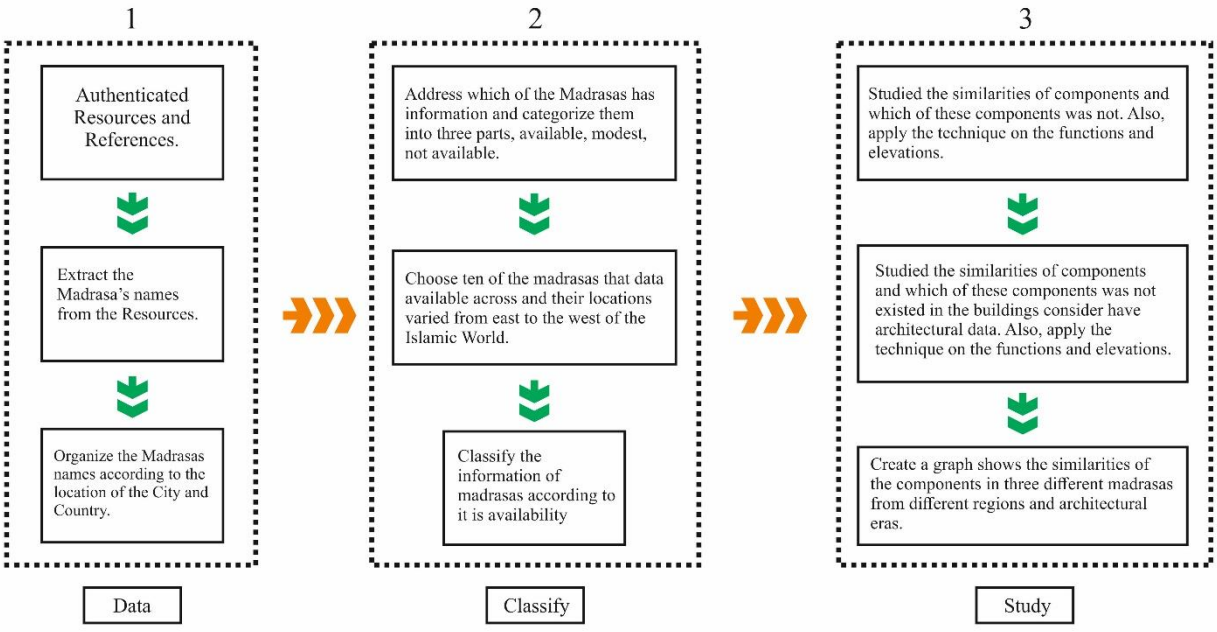

Fig. 1. Schematic diagram of assessing the characteristics of institutional buildings and islamic architecture.

4. Results

There are essentials questions like what is Islamic architecture? What are the main types of Islamic architecture and buildings? The researches may have several answers. However, in most published and unpublished books, scientific reports, and scientific journals have always demanded a clear indication of this critical terminology to be answered in a holistic approach. Moreover, our literature review have suggested that a clear answer to the building's guidelines for madrasa (schools) according to Islamic architecture was somewhat missing (Alshuwaikhat *et al*., 2016; Hojjatollah, 2012; Kendall, 1999; Mohamad Rasdi & Utaberta, 2010; Taib & Rasdi, 2012; Tascı, 2015; Terms, 2005). Among the 1400 years of Islamic Architecture civilizations, many madrasas were built in various eras and served various regions in the Islamic world. The researches did not discuss the similarities and differences between them. They did not study their architectural and constructional details for all of the madrasas to use this information via architect with the people seeking to design the buildings according to Islamic architecture and its implications in educational buildings. Many questions appeared about these buildings' longevity, sustainability, the origin of the design, the architectural design capabilities to be used in our present time or future, and the ability to serve their communities not as just a madrasa building after preserved and maintain.

The need for these guidelines is to overcome the obstacle questions: Is madrasa building (school) design in our eras related to Islamic architecture madrasa (school)? Is the design in Bukhara, Uzbekistan is similar to the madrasa in Cairo, Egypt? These two questions led the author to format three main categories (Components, Functions, and Elevation) to form the Islamic Architecture educational buildings Guidelines. These guidelines assist the architects and interested in architecture to

design or evaluate existing buildings and fulfill the requirements of IA for madrasa.

After observing ten heritage madrasas from the east to the west of the Islamic world, the author found three categories that had to fulfill and implemented to consider a school built in the 21st century under the jurisdiction of sustainability context in the IAMBG's. The number of contries involved in the study are not exceeds eleven countries. Moreover, Because of the limited frame of the study, the author focused only on these ten locations, in a future study will engage in the rest of the 42 buildings. The selection criteria are*:*

1- Available data on building in the authenticated and referenced heritage architectural website, architectural heritage historical books, and research journals:

a) The research has at least 11 different regions. The author finds that there are 14 buildings has the required architectural information and drawings authenticated in various literatures and organizations.

b) The 5 out of 14 buildings are located in Uzbekistan. For that the researcher chose one of the five buildings in Uzbekistan. Those ten buildings are the representative samples to prove the main cause of the research which is the Islamic Architecture Educational Buildings Guidelines.

2- All the architectural components and facades drawings are available in the many literatures and references.

3- The buildings have to be popular in these countries and considered as a reference for other buildings. Also, mentioned in various references.

4- The buildings have to be renovated, documented in authenticated references, and open for Tourism.

5- The Building must not be demolished or neglected without any utilization.

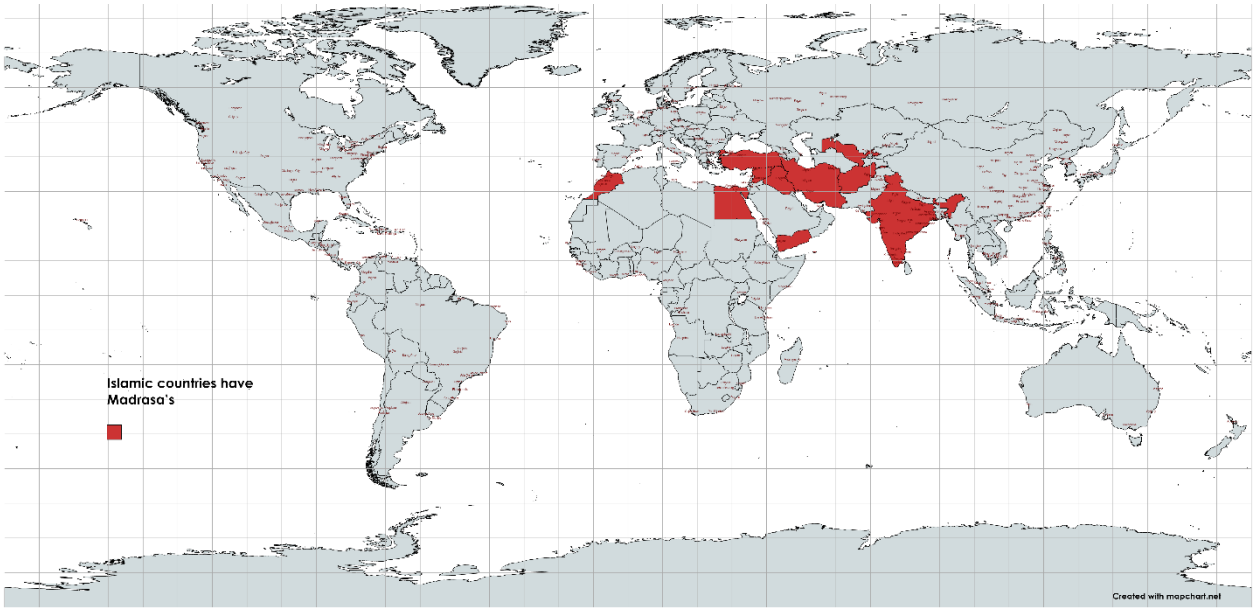

Fig. 2. Islamic countries have Madras's.

Fig. 3. The Location of the selected countries.

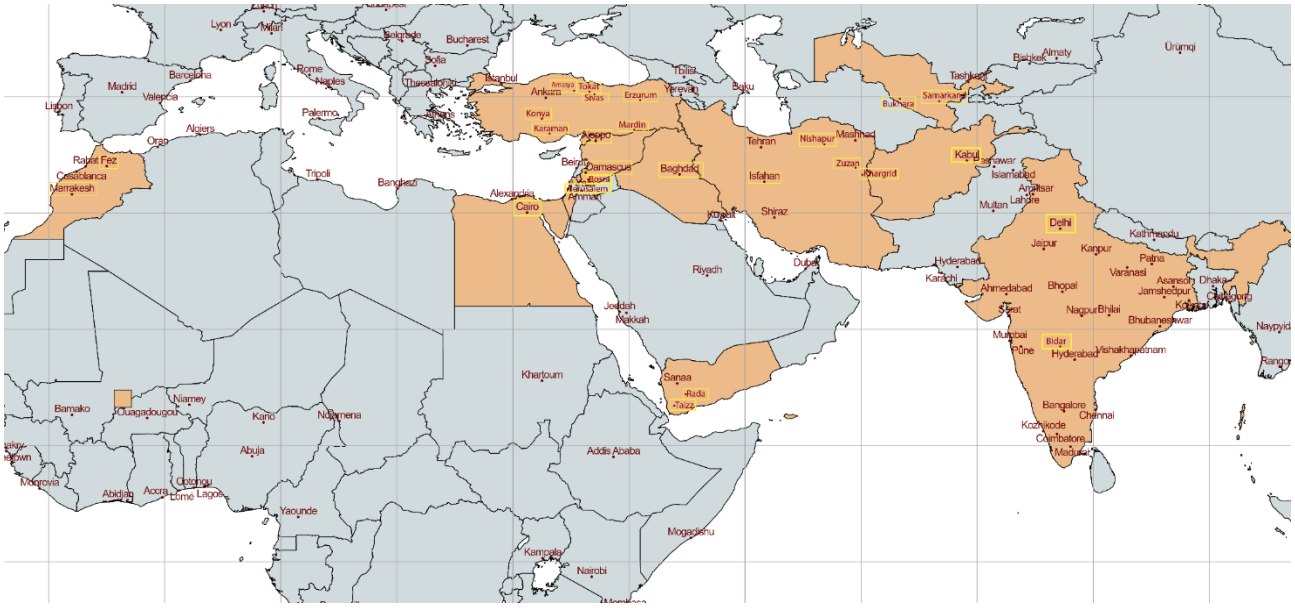

Fig. 4. The location of the selected cases.

Table 1. List of Madrasa's considered in this study to assess the recommended Islamic Architecture Educational Buildings Guidelines index of IAMBGs.

Serial	Madrasa Name	Location	Region	Religious sect: Sunni / Shia	Data Available/ Modest /not available
1	Madrasa al-Mustansiriyya	Baghdad, Iraq	Middle East, Asia	Sunni	Available
2	Madrasa al-Mirjaniyya/ Mirjaniya	Baghdad, Iraq	Middle east, Asia	Sunni	Modest
3	al-Madrasah al-Sharabiyya/ Sharabiya	Baghdad, Iraq	Middle East, Asia	Sunni	Modest
4	Al-Murshidiyya Madrasa	Damascus, Syria	Middle East, Asia	Sunni	Modest
5	Madrasa al-Atabikiyya	Damascus, Syria	Middle East, Asia	Sunni	Modest
6	Madrasa al-Zahiriyya	Damascus, Syria	Middle East, Asia	Sunni	Modest
7	Madrasa al-Jaqmaqiyya	Damascus, Syria	Middle East, Asia	Sunni	Modest
8	madrasa of Gümüshtegin	Bosra, Syria	Middle East, Asia	Sunni	Modest
9	Madrasa al-Kamiliyya	Aleppo, Syria	Middle East, Asia	Sunni	Modest
10	Shadhbakhtiyya Madrasa	Aleppo, Syria	Middle East, Asia	Sunni	Modest
11	Madrasa al-Firdaws	Aleppo, Syria	Middle East, Asia	Sunni	Modest
12	Madrasa al-Sultaniyya	Aleppo, Syria	Middle East, Asia	Sunni	Modest
13	Madrasa al-Zahiriyya	Aleppo, Syria	Middle East, Asia	Sunni	Modest
14	Madrasa al-Ashrafiyya	Taizz, Yemen	Middle East, Asia	Sunni	Modest
15	Amiriya madrasa	Rada, Yemen	Middle east, Asia	Sunni	Available
16	The Madrasa Al-Ashrafiyya	Jerusalem, Palestine	Middle East, Asia	Sunni	Available
17	Qubba Nahawiyya (or Madrasa al-Nahawiyya)	Jerusalem, Palestine	Middle east, Asia	Sunni	Modest
18	Madrasa and Qubbat al-Salih Najm al-Din Ayyub	Cairo, Egypt	Middle East, Africa	Sunni	Modest
19	Madrasa and Qubbat al-Nasir Muhammad ibn Qalawun	Cairo, Egypt	Middle East, Africa	Sunni	Modest
20	Madrasa al-Sultan al-Zahir Baybars	Cairo, Egypt	Middle East, Africa	Sunni	Modest
21	Madrasa al-Amir Mithqal al-Anuqi	Cairo, Egypt	Middle East, Africa	Sunni	Modest
22	Madrasa Sarghatmish,	Cairo, Egypt	Middle East, Africa	Sunni	Modest
23	Sultan Hassan madrasa	Cairo, Egypt	Middle East, Africa	Sunni	Available
24	Bou Inania Madrasa	Fez, Morocco	Middle East, Africa	Sunni	Available
25	Sahrij madrasa,	Fez, Morocco	Middle East, Africa	Sunni	Modest
26	Saffarin madrasa	Fez, Morocco	Middle East, Africa	Sunni	Modest
27	Ben Youssef Madrasa	Marrakech, Morocco	Middle East, Africa	Sunni	Available
28	Madrasah-i Zuzan	Zuzan, Iran	Asia	Shia	Modest
29	Madrasa-i Ghiyathiyya	Khargird, Iran	Asia	Shia	Modest
30	Madrasa Madir-i-Shah,	Isfahan, Iran	Asia	Shia	Modest
31	Madrasa-i Tepe	Nishapur, Iran	Asia	Sunni	Modest
32	Hatuniye Madrasa	Karaman, Turkey	Asia	Sunni	Modest
33	Çukur Madrasa (Yağıbasan Madrasa)	Tokat, Turkey	Asia	Sunni	Modest
34	Ince Minareli Madrasa	Konya, Turkey	Asia	Sunni	Available
35	Gök Madrasa,	Sivas, Turkey	Asia	Sunni	Modest
36	Karatay Madrasa,	Konya, Turkey	Asia	Sunni	Modest
37	Sirçali Medrese	Konya, Turkey	Asia	Sunni	Modest
38	Çifte Minareli Medrese	Erzurum, Turkey	Asia	Sunni	Modest
39	Kasim Pasha Madrasa	Mardin, Turkey	Asia	Sunni	Modest
40	Büyük Ağa or Kapı Ağa	Amasya, Turkey	Asia	Sunni	Modest

41	Mahmud Gawan Madrasa	Bidar, Karnataka state of India	Asia	Sunni	Available
42	Hauz Khas madrasa	Delhi, India	Asia	Sunni	Modest
43	Saray Mulk Khanum Madrasa	Samarkand, Uzbekistan	Asia	Sunni	Demolished
44	Ulugh Beg madrasa.	Samarkand, Uzbekistan	Asia	Sunni	Available
45	Shir Dar Madrasa	Samarkand, Uzbekistan	Asia	Sunni	Available
46	Tilya-Kori Madrasa,	Samarkand, Uzbekistan	Asia	Sunni	Available
47	madrasa of Abdullah Khan	Bukhara, Uzbekistan	Asia	Sunni	Available
48	Mir Arab Madrasasi	Bukhara, Uzbekistan	Asia	Sunni	Available
49	Abdulaziz Khan Madrasah	Bukhara, Uzbekistan	Asia	Sunni	Modest
50	kukeldash madrasah	Bukhara, Uzbekistan	Asia	Sunni	Modest
51	Barak Khan Madrasa,	Tashkent, Uzbekistan	Asia	Sunni	Available
52	Shah-i Mashhad Madrasa	Afghanistan	Asia	Sunni	Not Available

Table 2. Components considered in order to assess the Islamic Architecture Educational Buildings Guidelines indices in the given set of Mardaras for this study.

		Madrasa names										
			1	2	3	4	5	6	7	8	9	10	Total
No.	Components		1- Mustansiriyya	15- Amiriya	16- Ashrafiyya	23- Sultan Hassan	24- Bou Inania	27- Ben Youssef	34- Ince	41- Gawan	44- Ulugh Beg	51- Barak Khan	
		Date of Construction	1227 AD /625 AH	1504 G/ 910 AH	1467 AD / 871 AH	1350 AD/ 752 AH	1351 AD/ 751 AH	1557 AD/ 964 AH	1267 AD/ 665	1472 AD/ 876 AH	1417 AD/ 819 AH	1530 AD/ 936 AH	
		LOCATION	Baghdad, Iraq	Rada, Yemen	Jerusalem, Palestine	Cairo, Egypt	Fez, Morocco	Marrakech, Morocco	Konya, Turkey	Bidar, Karnataka State of India	Samarkand, Uzbekistan	Tashkent, Uzbekistan	
1	Courtyard (Sahn) open to sky	X		-	-	X	X	X	-	X	X	X	7
2	Closed Court	-		X	X	-	-	-	X	-	-	-	3
3	Main Gate	X		X	X	X	X	X	X	X	X	X	10

4	Hypostyle Prayer Room	X	X	X	X	X	X	X	X	X	X	10
5	Ornamentation	X	X	X	X	X	X	X	X	X	X	10
6	Water Basin	-	-	X	X	X	X	-	X	-	-	5
7	Domes	-	X	X	X	X	X	X	X	X	X	9
8	Quranic Writing	X	X	X	X	X	X	X	X	X	X	10
9	Casement Window	X	X	X	X	X	X	X	X	X	X	10
10	Arches	X	X	X	X	X	X	X	X	X	X	10
11	Iwan	X	X	-	X	-	-	X	X	X	X	7
12	Porticoes	-	X	-	-	X	X	-	-	-	-	3

The list of buildings in Table 1 are collected from various sources. Once the information is available, data are classified into three criteria. These criteria measure information with special emphasis on quality and accessibility. These criteria may have existed in more than one resource, and has a complete documented architectural file, and various pictures. The criteria are divided into three levels. When all of these levels are existed, the data level is available; if two of these criteria are offered, the data level is modest, and when one or none of these criteria is missing, the level is not available.

Also, for the discussion regarding these 6 fields: madrasa number, madrasa name, location, region, religious sector, and amount of data. The relationship between the madrasa name, location, and region is to prove the diversity of chosen buildings. The buildings are spread from the east to the west of Islamic countries. The religious sector has been added because of the request of one of the reviewers, also, it declares some differences between the two sectors Sunni and Shia in the Islamic world-building design. The main aim of the column of data availability is to give priority to 14 buildings that have architectural information and drawings which authenticated in various works of literature and organizations.

The buildings in Table 2 are excerpted from table one that their data is available. These buildings are ten madrasas. Table 2 is discussing guideline one, which is about the component existed in the madrasa buildings. Beneath this guideline, there are sub-criteria, which are the components observed in the madrasas that have the characteristics of Islamic architecture (IA). The researchers divided the components into the primary three levels. Level one, components must be available, which are scaling between 7-10. In level two, the components' existence will add value and assure the Islamic architecture for educational buildings, which are scaling between 4-6. Level three can be added to the design, but their disappearance may not affect the design and IA appearance, which are scaling between 1-3. This leads to a result that not every component can give the building the appearance of the IA. For that, the author have classified every single guideline into sub-criteria so it can assist in deciding whether the building applied the proper criteria and has all the architectural features that lead everyone to certify that this building is part of the IAS. The other two guidelines follow the same rules applied in guideline one, especially the scaling and implementation in the design.

From 52 madrasa buildings spread across the Islamic world from the Pacific Ocean to the Atlantic Ocean, ten madrasa's chose to be evaluated. These ten schools (*i.e.*, Madrasa) are mentioned in different referenced books, high impact journals, and data available on authentic websites as mentioned earlier on. Each main guideline has sub-criteria; the sub-criteria discusses the similarities between the three madrasas picked from the chosen ten buildings.

The evaluation provides the list of common components, designs, architectural solutions, and other features the specialists are looking for to implement and apply in their architectural design.

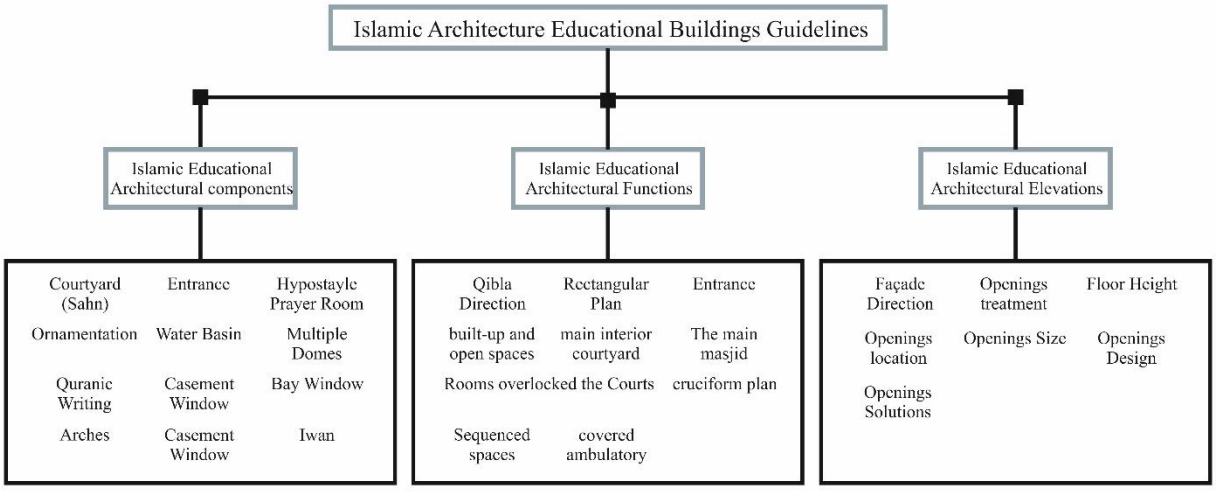

Fig. 5. Schematic diagram that the researcher has come across from the qualitative survey about common components of IA's present in the educational buildings those the researcher has considered.

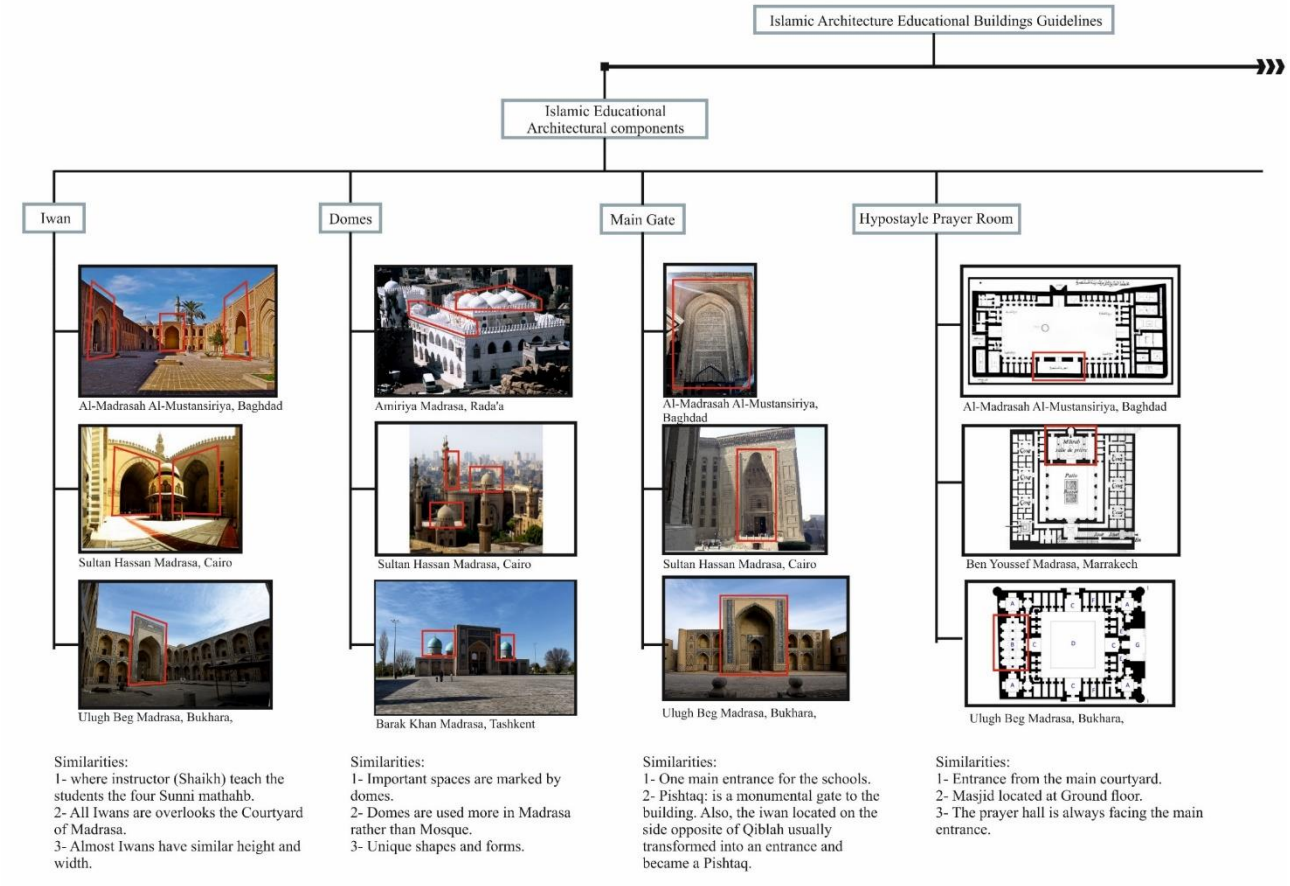

Fig. 6. Diagram of architectural components and shapes in three different locations.

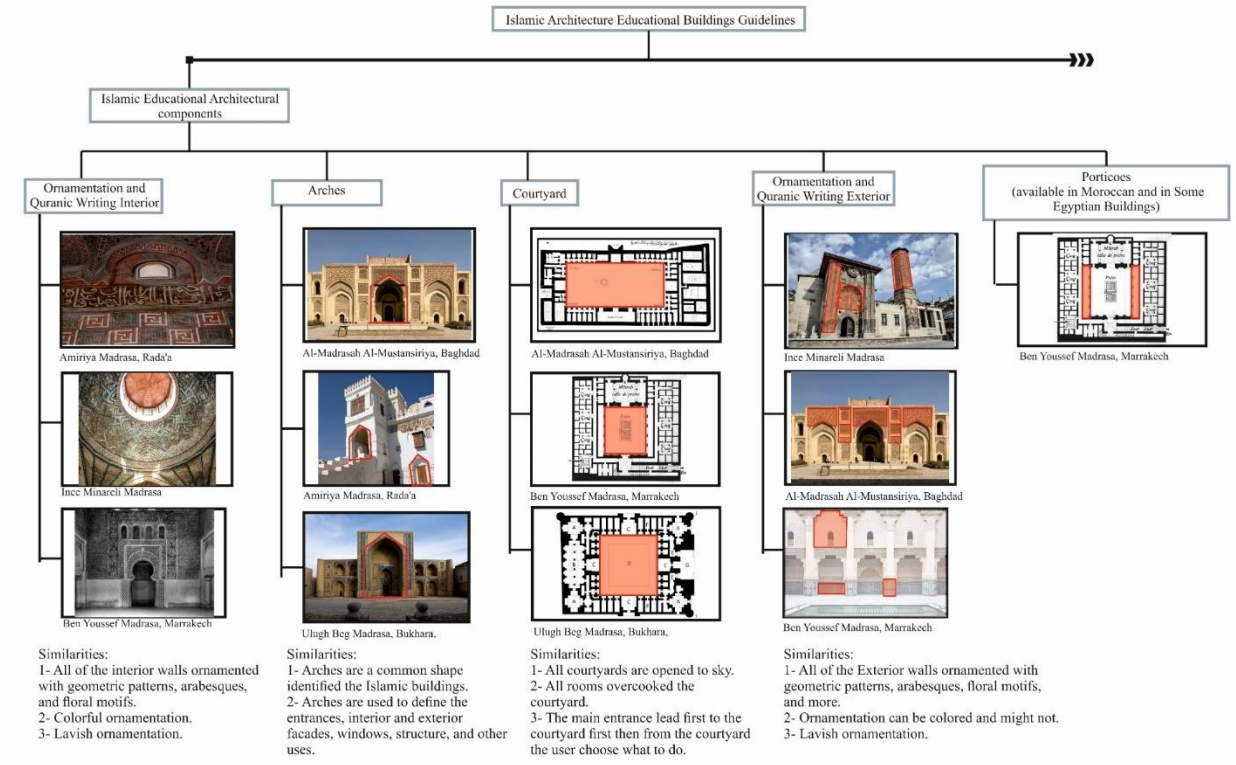

Fig. 7. Proceeding diagram of architectural components explains the components shape in three different locations, schools, and similarites.

In the above figure (Fig. 3), it can be seen that similar characteristics of shapes are present across the world in the Islamic Institutionl buildings. Consequently, Fig. 4 demonstrates the similarities of shapes of courtyards, arches, ornamentations, and porticoes observed in several institutional buildings in most of Islamic countries.

Furthermore, Fig. 5 and 6. demonstrate the functions of these institutional buildings in diverse geographical locations. The cruciform plans, wide welcoming entrance, direction of the Qibla, and location of the center mosque (*i.e.*, Masjid) have found identical. Moreover, the rectangular building plan was common in almost everywhere due to accommodate several internal services inside these buildings. Additionally, Fig. 7 illustrates that elevation and perspectives of these buildings are almost identical across the world in the Islamic countries. The exterior decorations and building colors have seemed to be closely identical although the buildings have been built in different cultural and religion era. Fig 8 and Fig 9 are exhibiting the access to natural light and air ventilation in different dynasties. Note that, the culture of access to natural light and ventilation is one of the critical characteristics of Islamic institutional buildings that the researcher has come across.

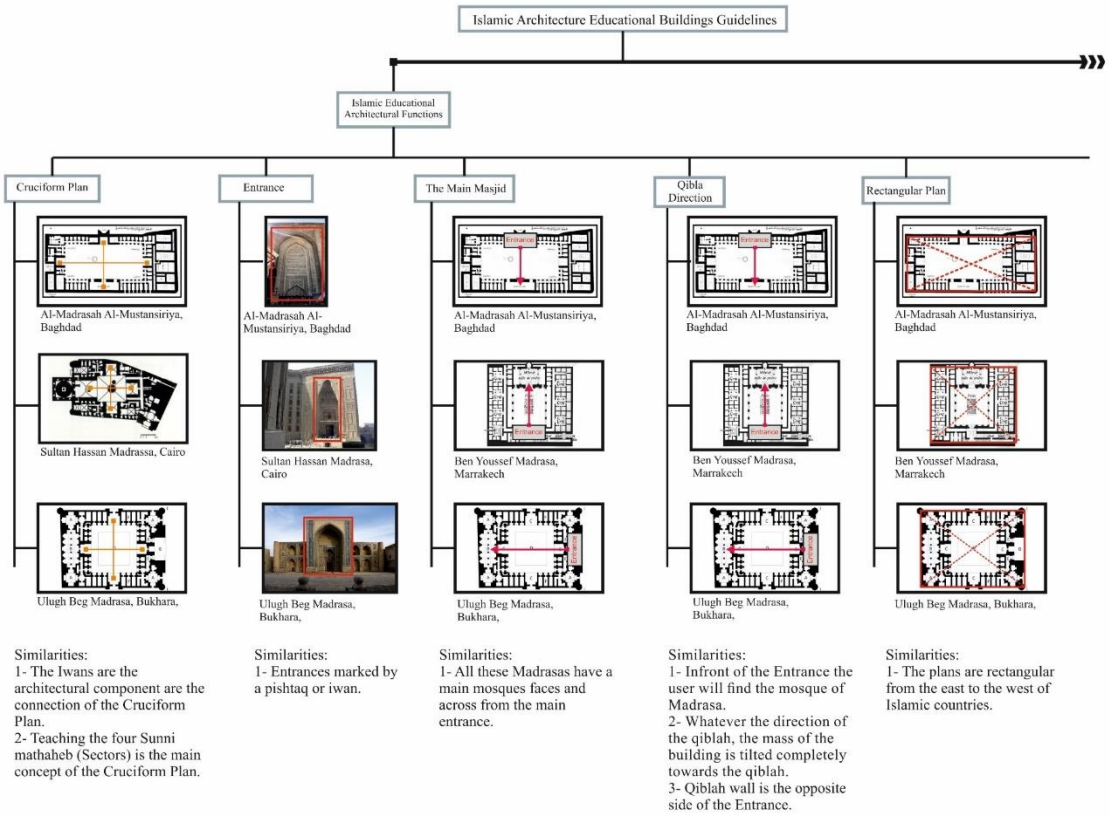

Fig. 8. Diagram of architectural function items discuss similarities between buildings at various eras and thrree different locations.

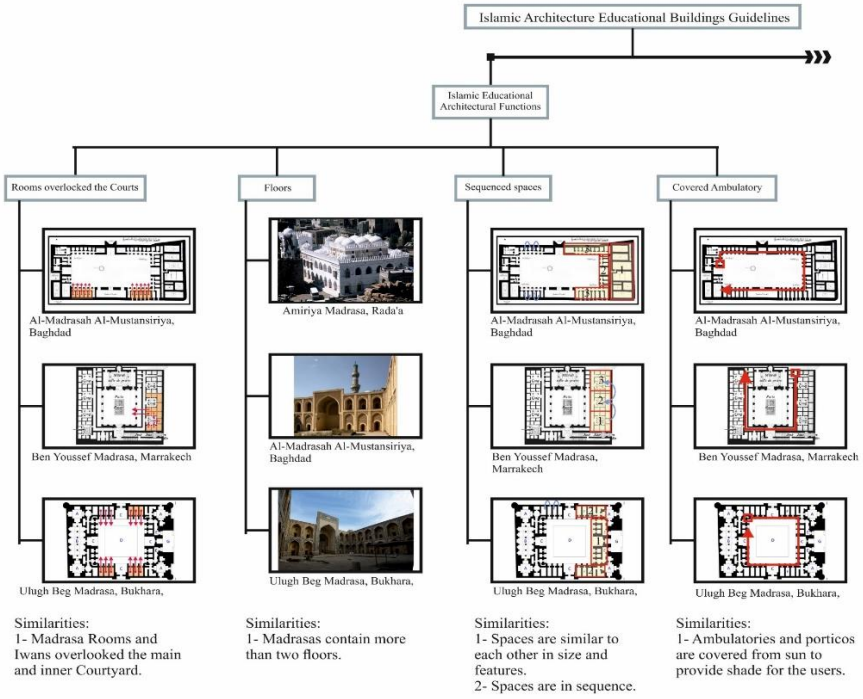

Fig. 9. Proceeding diagram of architectural function items discuss similarities between buildings at various eras and thrree different locations.

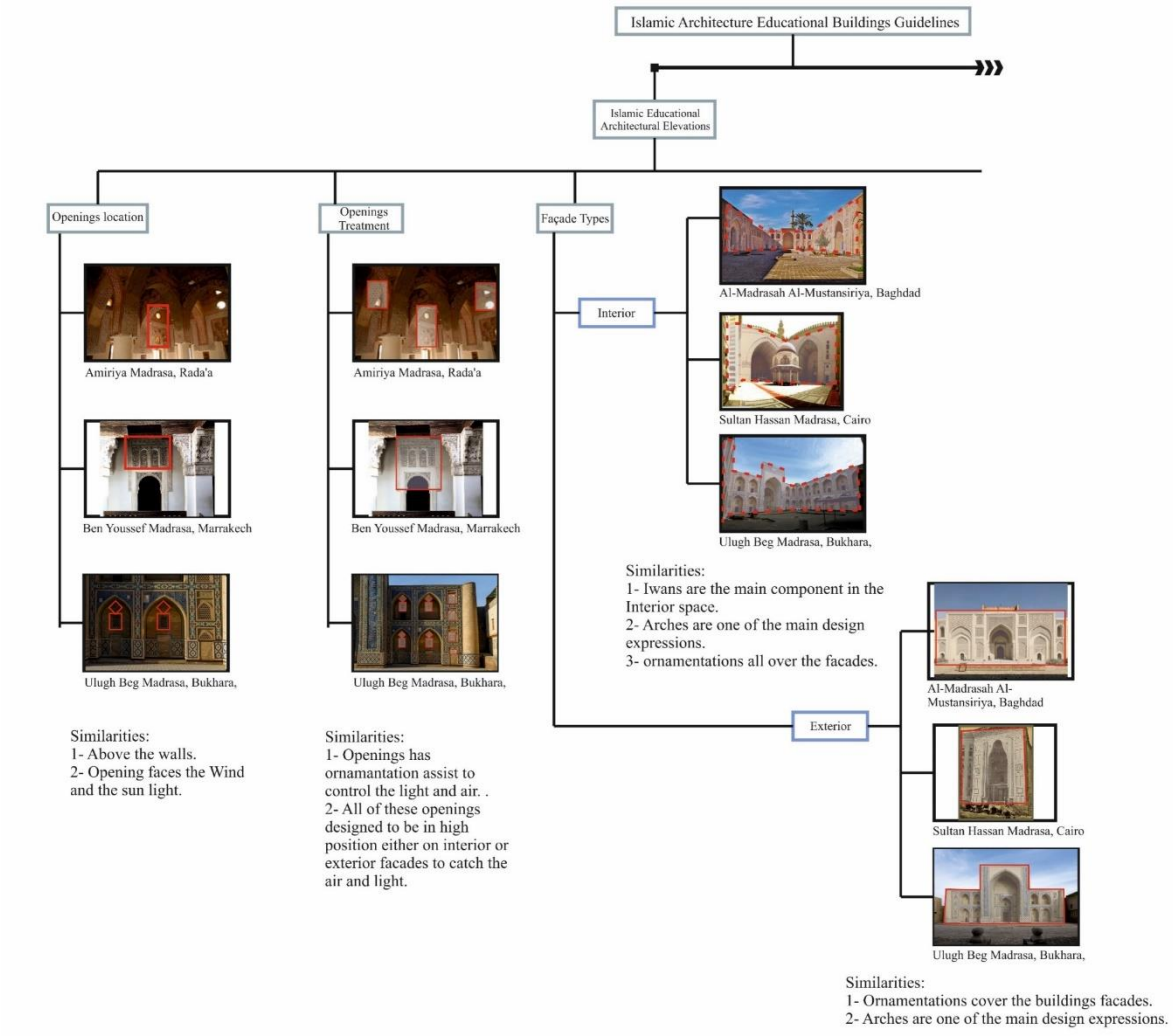

Fig. 10. Diagram studies the buildings elevations similarities in different eras and three different locations from interior and extierior perspective.

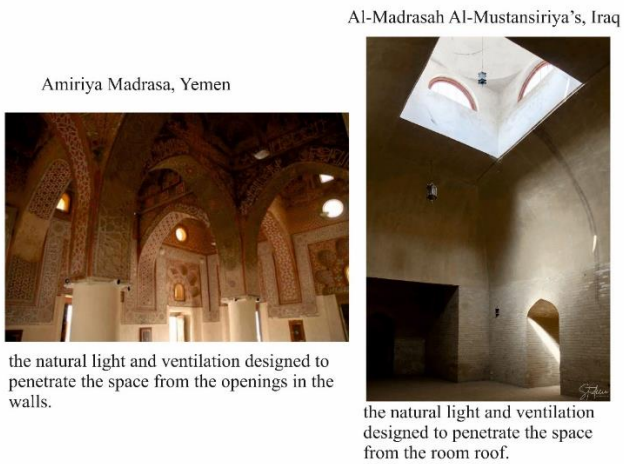

Fig. 11. Presents the similarites of the architectural solutions between two different buildings built in two separate eras.

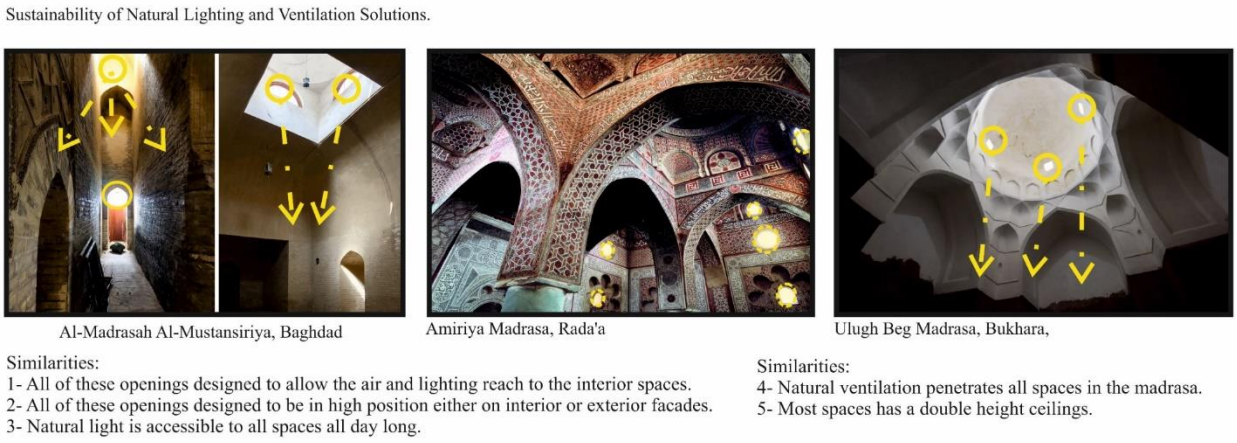

Fig. 12. Analysis of natural and ventilation solutions for three different buildings built in separate eras.

5. Discussion

After summarizing the obtained results, the researcher has come out with few critical points for further discussion to demonstrate the term ‘sustainability’ in the lense of Islamic Architecture. Note that, the Islamic insitutional buildings have been serving for educating students for decades. Interestingly, the associated maintenance initiatives was not on the regular basis for the buildings. These buildings designed and constrcted in a method to sustain for long terms. However, several interesting issues the researcher has summarized for our discussion as such:

• Durability of the institutional buildings: Most of the Islamic institutional buildings were built using bricks, mud, concrete, wood, and durable building materials. As a result, these buildings ensured a long span of time of its operation with minimal maintenance required. Also, the stakeholders involved in the maintenance of these buildings, transferred the techniques to next generations for a safe and sustainable maintenance systems. These includes but not limited to: use of similar materials, local building materials, locally adopted techniques with masonry skills, and reminding the local weather and climate.These ensured a longer time of sustainance of these buildings.

• Few research emphasized the issue of sustainability in islamic institutional buildings: Note that, very few research works considered the theme of ‘islamic architecture and institutional buildings’ in the world. Consequently, few websites, books, reports, and other scientific resources discussed, investigated, and compared the institutional buildings from an architectural perspective in the Islamic countries. As a result, we attempted to bring this critical information before the scholars to perceive specific criteria those are common in the Islamic institutional buildings around the world.

• Resources and researchers did not consider the sustainability and architectural issues of the instiutional buildings: Most of the institutional buildings in Islamic world are famous for educating scholars in decades. However, the buildings had to be maintained with minimal available resources while ensuring the quality of education to the scholars attended from diverse cultures. As a result, this study attempted to demonstrate the inherent architectural influences of educational buildings.

• Very few guidelines were available to define Islamic architecture and educational buildings: There was limited or almost no guidelines available to assist the architects and designers in comprehending what could constitute educational buildings in the Islamic architecture throughout the civilization era. As a result, we came up with this evaluation criteria and tangible architectural characteristics existed in these famous educational buildings.

• Techniques of allocation of space: According to our findings (see result section for details), we observed that one of the important aspects of the islamic institutional buildings were to use both internal and external spaces efficiently according to the need. As a result, allocation of spaces were observed competent that ensured future sustainability of the use of buildings. Consequently, this particular study considered the guidelines used and clarified the names of the architectural spaces and how they were connected to each other to serve better.

• Natural lights and air ventilation in the buildings: Furthermore, this study revealed that the elevation's height and relationship with the amount of natural light that penetrated the buildings were designed carefully. Consequently, the design of building mass, and elevatin demonstrated that the buildings were sustainable over decades after their establishments.

• Room for renovation: Many of the Islamic world's educational buildings had still been in operation after being renovated for the same educational purpose or for tourism. The reasons behind these facts revealed that these buildings held a lot of memories, were able to provide services for the users, and the functionalities remained intact.

6. Concluding Remarks

It is worth noting that most of the scientific research have opted to consider mosques as one of the critical indicators of assessing Islamic Architecture and sustainability. Interestingly, madrasas are very often co-existing with the mosques to enhance the educational practice of Islamic life styles and culture among students from diverse backgrounds. As a result, scholars have recommended several guidelines for mosques in the light of Islamic architecture and sustainability (Al Surf *et al*., 2012; Alabdullatief & Omer, 2017; Baharudin & Ismail, 2014; Kamali, 2016; Omer, 2015). However, educational buildings those are demonstrating unique design and cultural influences are always neglected while assessing the sustainability indicators in the lense of Islamic architecture. This particular research paper considers the criteria those are commonly seen in educational buildings (*i.e*., Madrasa buildings) across the Islamic world. Consequently, the researcher has attempted to follow scientific approaches in order to document the common criteria observed in these educational buildings in the majority Islamic countries and summarized the information. Interestingly, the researcher has found that there are several common architectural criteria (e.g., building facedes, air circulation systems, orientation of buildings, color and materials used, open space inside the buildings, and sense of peace, *etc*.) existing in the educational buildings even though they are located in different countries within diverse climatic and weather conditions. Moreover, the researcher has observed that the building characteristics, surrounding environment and landscapes are closely related to the life of Muslim believer and Islamic region while considering the factors of designing educational buildings. Also, the researcher recommends to continue further studies and investigations on

the remaining buildings. Our arguments in this research paper certainly open up future windows to dig deep in introducing sustainability in educational buildings in the Islamic world and pave the base for a scientific assessment tool for future.

Conflict of Interests

The Author declare no conflict of interests.

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استكشاف خصائص العمارة الإسلامية في المباني التعليمية: دراسة لبعض البلدان الإسلامية المختارة

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المستخلص. الاستدامة هي إحدى الكلمات التي يمكن الاستفادة منها بمختلف المناهج والمعاني. يتناول هذا البحث استدامة أنماط التصميم المعماري المرتبطة بالحضارة والتراث الإسلامي. تتبع المباني المؤسسية (أي المباني التعليمية) التي تشارك في تدريس التربية الإسلامية، إلى حد ما، بعض المجموعات الخاصة من معايير التصميم لاستدامة تصميمها المعماري الفريد الذي يؤدي إلى ديمومتها في المناطق الحضرية في الغالب. إن مباني المدرسة الإسلامية (أي السنية على وجه الخصوص) من منظور التصميم المعماري، والمواد، وطرق البناء، والأساليب الإنشائية، وغيرها من الأساليب المعتمدة، تعبر عن القدرات المستدامة لأنواع المباني المعمارية الإسلامية. تهدف هذه الورقة البحثية إلى تسليط الضوء على الحاجة إلى أداة لتقييم المباني المؤسسية وتجميع المعلومات المهمة لفهم أوجه التشابه في التصميم المعماري بناءً على معايير تقييم متعددة معظمها في المناطق الحضرية. وبذلك، اتبع الباحث منهج البحث النوعي لجمع المعلومات الأولية والثانوية من العديد من المباني المؤسسية حول العالم. علاوة على ذلك، قام الباحث بتقييم مخططات البناء والتصميمات والمرافق الداخلية للمباني المؤسسية من خلال جمع المعلومات من المواقع الموثوقة. علماً بأن الباحث قد استكشف وجود واجهات المباني، والأفنية، والسلالم، ومواد البناء، والألوان، وترتيبات إمدادات المياه، والتصميمات الأرضية، للمباني التعليمية المدروسة بشكل مشترك. وبعد تلخيص المعلومات، يشير الباحث إلى أن أسلوب التقييم المعتمد في هذه الدراسة قد يكون مفيداً لفهم وضمان استمرارية أنماط العمارة الإسلامية للمباني التعليمية (المدرسة) في الدول الإسلامية.

الكلمات المفتاحية: المباني المؤسسية، المباني التراثية، العمارة الإسلامية، الأدوات، الاستدامة، الثقافة.