

# Architectural, Structural and Decorative Patterns of Schools in Yazd During the Muzaffarid Period Based on the Existing Cases (14<sup>th</sup> Century AD)

Roya Rismanian<sup>1</sup> , Reza Abouei<sup>2</sup>  , Ali Aram<sup>3</sup> 

1. Ph.D. Student in Architecture, Yasuj Branch, Islamic Azad University, Yasuj, Iran. E-mail: [roya.rismanian@iau.ir](mailto:roya.rismanian@iau.ir)

2. Corresponding author, Department of Art & Architecture, Yazd University, Yazd, Iran. E-mail: [r.abouei@yazd.ac.ir](mailto:r.abouei@yazd.ac.ir)

3. Department of Engineering, Yasuj Branch, Islamic Azad University, Yasuj, Iran. E-mail: [aliaram172@yahoo.com](mailto:aliaram172@yahoo.com)

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## ABSTRACT

No studies have thoroughly examined the Yazd Style of Historic Architecture. This architectural style was during the Atabakan and Muzaffarid eras in the 12th to 14th centuries AD. Although the short reign of the Muzaffarid dynasty, significant events and innovations occurred, in central Iran. This dynasty's legacy in Yazd includes a variety of buildings like seminaries, mosques, monasteries, bazaars, and numerous qanats that influenced later architecture. Public buildings from the Muzaffarid era in Yazd comprised seminaries and scientific schools. Many of these structures have been lost over time, and there is a lack of research to understand their architectural patterns. This study aims to analyze the architectural patterns of Muzaffarid schools in Yazd from "structural-physical," "construction technology," and "decoration" perspectives. It uses a descriptive-analytical method, referencing historical sources and field observations of the remaining Muzaffarid-era sites in Yazd. Due to the limited surviving examples, this research focuses on seven schools: Ziaieh, Kamalieh, Rukniyah, Shamsieh, Hoseinian, Khanzadeh, and Shah Abolqasem. The findings reveal that despite the brief Muzaffarid era and internal conflicts, there was sustained civil, cultural, and social activity, which protected the architectural legacy from the post-Mongol invasion. The schools' architectural patterns show a significant influence from the period's cultural and social context, favoring balance and symmetry, often with domes and durable decorations. Use of various applied geometry in design, especially in Shamsieh and Rukniyah seminaries, underscores the attention from Muzaffarid rulers and architects. Thus, despite the political instability, the balanced approach ensured continuous activity in about hundred schools, setting a subsequent model construction.

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## Introduction

The historic monuments of each city are parts of the identity and cultural-historical characteristics of the people who lived there. The city of Yazd is one of the important cities in Iran, which had numerous monuments dating back to 14th and 15th centuries. The value and importance of the works of this era is doubly understood when we know that the architectural signs of this era in its capital, have almost completely demolished and we do not have many works of this important historical period in other parts of Iran. From this point of view, Yazd region is the flagship of introducing the architecture of this period. Based on this, the study and recognition of the buildings left from the Muzaffarid period, especially in the central plateau of Iran and much more importantly in Yazd.

Muzaffarid were among the rulers of Iran in the 14th century, who ruled over different parts of the country, especially the central regions, and Yazd, during its historical life and ancient history, is the only one in this era that, as the capital of Shah Yahya Muzaffarid, has significant growth and prosperity all features of its life.

One of the types of those buildings left from Muzaffarid dynasty were schools, which have not yet been subject to independent research aimed at understanding the Yazd school of architecture. Although the construction of schools in Yazd began in the era of Atabakan (11 & 12th centuries AD), it flourished during the Muzaffarid era to such an extent that historians mention dozens of schools and seminaries in the city, each of the rich and capable people built a school for themselves and later it was used as a burial ground. Most of these schools have a high dome which is the burial place of founder. This method continued until the end of Muzaffarid period, but it was almost forgotten at the beginning of the Tamerlane era. The present research aims to examine the remains of this era in Yazd to introduce the architectural model of Muzaffarid period schools in Yazd as a part of the historical and cultural heritage for the recognition of the architectural Style. Accordingly, the main question of the research can be asked as follows:

- What was the common architectural pattern in the architecture of Yazd Schools during Muzaffarid period and what morphological features does it have?

### *Yazd During the Muzaffarid Era and the Status of Scientific and Religious Schools*

The Muzaffarid family served the Atabakans from the beginning of their arrival in Yazd and reached positions in their court, and through this family they were introduced to the Mongols. The main ruler of Muzaffarid was Amir Mubarezuddin Muzaffar (1323 to 1358 AD), who ruled in the central and southern regions of Iran such as Yazd, Isfahan, Kerman, Shiraz and even the coast of the Persian Gulf (Iqbal, 2009: 442).



**Figure 1. Muzaffarid territory among other kingdoms of Iran in the 6th to 8th centuries AH (Tus Foundation)**

The era of Muzaffarid was short (less than a hundred years), but its influence in some areas was so great that it can be said that their central territory reached the peak of cultural prosperity. In addition to mosques and monasteries, the bazaars that were built in this period were considered a turning point for the economy of Yazd. These bazaars have still preserved their life to some extent. Among other actions of the rulers, is the creation of villages around Yazd and the running of aqueducts in this city, among which we can mention the Waqf Abad aqueduct located in Seyed Ruknaddin neighborhood. In additions to Yazd, these rulers worked in Fars, Kerman, and Isfahan. They built charitable and public buildings such as hospitals and repaired city wall and towers around the cities and assigned endowments of agricultural land, garden and bazaars for each to be a source of income for its costs.

The remaining buildings from the Muzaffarid era, especially the scientific and religious schools in the city, show an irreplaceable identity in the field of cultural and scientific activities of that time. Unfortunately, only a few remained from that large number and most of these magnificent cultural, scientific and religious buildings were destroyed, due to natural disasters and the neglect of the rulers after the Muzaffarid period. Various historians, including Ahmad ibn Hosein Katib, mentioned dozens of religious and scientific schools in Yazd alone, and the historical evidence and remains from that era show the great attention paid to the construction of schools and the importance of various religious and other sciences in this period. Some researchers estimated the number of these schools to be around one hundred and noted that in addition to these schools, two hundred domes and monasteries and twelve mosques were built in Yazd (Tafershi, 2010: 96). From the abundance of schools built at this time in Yazd, Meybod, Kerman, Shiraz and other cities, it is possible to understand the level of public attention and concern of the people and the rulers to the study of various sciences in the period after the

Mongol invasion. In this study, the schools of Ziaieih (Alexander Prison), Kamaliyeh (Shah Kamaluddin'tomb), Rukniyah (Seyed ruknaddin's tomb), Shamsieh (Shamseddin's tomb son of Seyd Roknaddin and son-in-lawof Rashiduddin Fazlollah Hamdani), Hoseinian (Hoseinieih Hasht), Khanzadeh (Goldasteh) and Shahab Ghasem Taraz. (Shah Abul Qasim) have been investigated and examined and its architectural patterns have been analyzed.

### Research Methodology

The method used in this research is based on historical research in a descriptive and analytical way. The primary information related to the history of Muzaffarid period and the context governing the architecture of that period was extracted from first-hand sources. The architectural features investigated in these schools are categorized in three areas including "physical-spatial features", construction technologies" and "decoration patterns" which are extracted separately for each school and finally by examining the commons between them, has led to the architectural model of Muzaffarid period schools in Yazd.

**Table 1. Ilkhanids Muzaffarid considerable schools in Yazd**

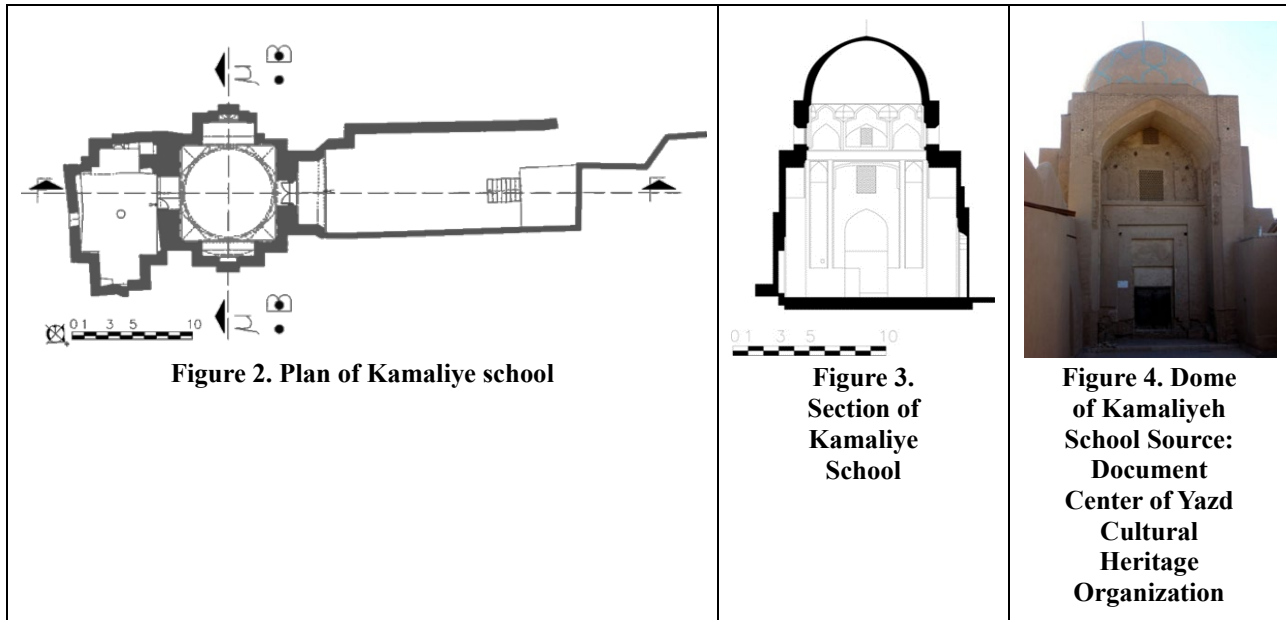
The name of the building	founder	date of construction	References
Ziaieih School (Alexander Prison)	Zia al-Din Hosein Razi ibn Molana Sharaf al-Din Ali	1233 AD	Yadegarhay-e-Yazd(Monuments), 799 - History of Yazd, 116 - Jame Mofidi, vol.3, 144
Kamaliyeh School (Baqea Shah Kamaluddin)	Shah Kamalieh	1320 AD	Yadegarhay-e-Yazd(Monuments), 610- Tarikh Jadidizd, 137- Jame Mofidi, Vol.3, 252
Shamsiyah School (Hoseinieih Shams)	Seyed Shamsuddin Mohammad	1325 AD	Yadegarhay-e-Yazd(Monuments), 588- Jame Al-Khairat, 114, 124, 154- History of Yazd, 590
Rukniyeh School (Beqaa Siderkanuddin)	Seyed Roknadin	1325 AD	Yadegarhay-e-Yazd(Monuments), 561- History of Yazd, 83- New history of Yazd, 125
Hoseinian School (Hoseinieih Hasht)	Hoseinian School (Hoseinieih Hasht)	1326 AD	Yadegarhay-e-Yazd(Monuments), 369-new history of Yazd, 142-history of Yazd, 124, 127, 132
Khanzadeh School (Goldasteh)	Khanzadeh Khatun	1384 AD	Yadegarhay-e-Yazd(Monuments), 387 - History of Yazd, 104 and 36 - New History of Yazd, 162 and 87
Shahab al-Din Qasim Taraz School (Shah Abul Qasim)	Shahabuddin Qasim Taraz	1385 AD	Yadegarhay-e-Yazd(Monuments), 605- Jame Mofidi, vol. 3, 253

## Introduction to Schools

As mentioned, seven schools left over from the Muzaffarid period in Yazd were considered as case studies, which will be briefly introduced. The architectural features also will be discussed in the following.

### *Kamaliye School (Shah Kamaluddin Dome)*

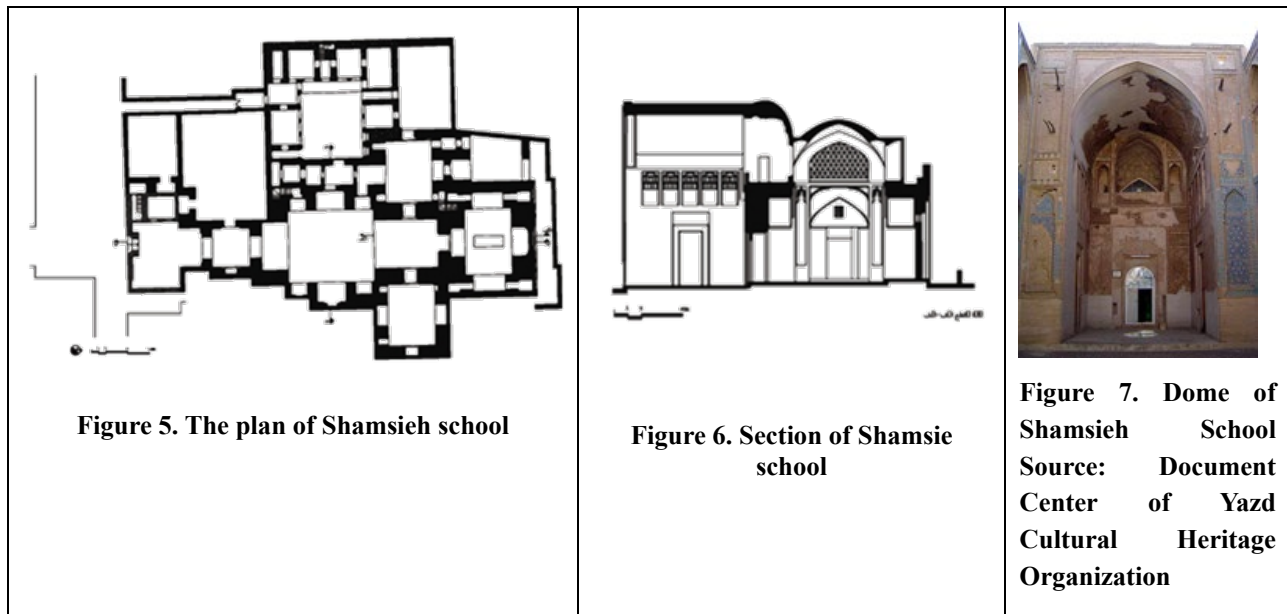
Kamaliyeh school was built in 1320 (AD) by Kamal al-Din Abul Ma'ali. The author of the history of Yazd writes in the introduction of the school: "He built this excellent school with two minarets, a dome, a square in the school, a monastery, a medicine house, a good bathhouse, and excellent houses, and he decorated the whole school with tiles and paintings, and he dedicated many endowments to it (Figure 2, 3 & 4). He made aqueducts (*qanats*) flow from Farashah village. He has many endowments for his children. (Jaafari, 2005: 115-116).



### *Shamsieh School*

Shamsieh School is located in Chaharmanar quarter. This building was built by Seyed Shamsuddin Mohammad. Now this building is known as Seyed Shamsuddin shrine. The author of the history of Yazd writes about this building: "In Tabriz, he built a plan for the Charmanar school, Dar al-Siadeh, Khanqah, bazaar, and bath house and sent it to Yazd, and they built the foundations of the building, and built two schools facing each other, and they built the Charmanar around both schools, and a double bazaars and Taft water in the middle of the bazaars. He built the monastery and the school next to it, and decorated it with tiles, and built a good bathroom, shops and a caravanserai.

From this complex, which was originally composed of the mentioned buildings, now a part of the porch and the main dome on the east side of Charmanar alley and a part of the pediment and column on the west side remain. What is still standing from the Chaharmanar complex on the west side of the alley are the two columns of the porch, which is located in front of the entrance of the Chaharmanar Bazaar. The length and width of the four dome walls of the Shamsieh school are  $58.6 \times 9.10$  from the inside, and the thickness of the walls is 1.60 meters. The entire body of the walls under the dome has been covered with beautiful geometric patterns and flowers and bushes of paint and plaster (Figure 5, 6, & 7) (Wilber, 1967).



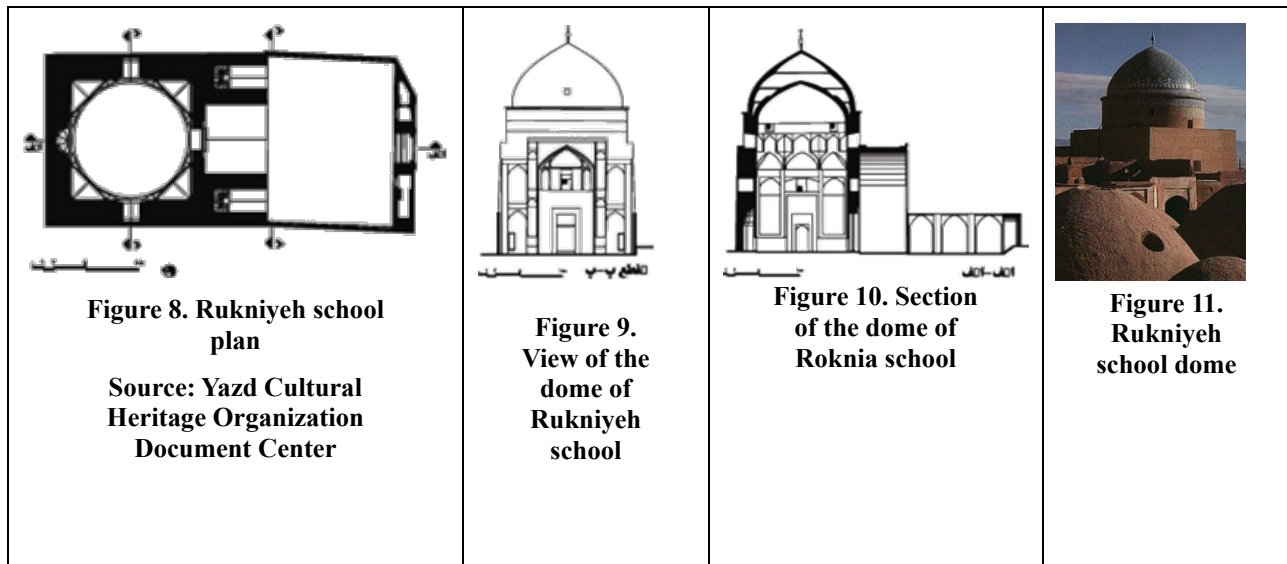
### *Rukniyeh School*

Rukniyeh school is located in Waqtosaat quarter. The founder of this school is one of the main authorities of Yazd at the time. Seyed Roknadin who lived during the reign of Ilkhanids rulers was buried in this school in 1331 (AD) (Figure 8, 9, 10, & 11). According to the reports of historians, this school was probably one of the largest and most equipped schools in Yazd. Jaafari, the author of the history of Yazd, considers this school to be "Umm al-Baqaa Madrasa of Yazd" [the greatest dome] and wrote about it:

"The door of his lofty school is as good as a vault in the world, and his green dome... is famous in the world... its raised ceiling is unparalleled in its height in front of the school, an observatory was built and two small minarets were built on both sides of it... and the author of the observatory is Khalil ibn Abi Bakr Amoli... The observatory, the dome, the mosque, and the house were built in 1324" (Jaafari, 2005: 561).



The architecture of the dome has been described by Mohammad Karim Pirnia in his note as follows: "Inside, it is decorated with fine stucco and formal patterns of lapis lazuli and yellow, and the dome has two continuous shells on four squinch and formal spirals, decorative belt." (ibid: 562). The entrance gate of the mausoleum from the north has a plaster inscription, of which very little remains. This inscription has two rows of writing in Kufic script and the lower part is made of flowers. Donald Wilber, who saw this inscription about 70 years ago, has quoted its date in his book as 1324. The length and width of the walls of the dome from the inside are 11.86 x 11.82 and the thickness of the walls is 1.40 meters. (ibid: 565).

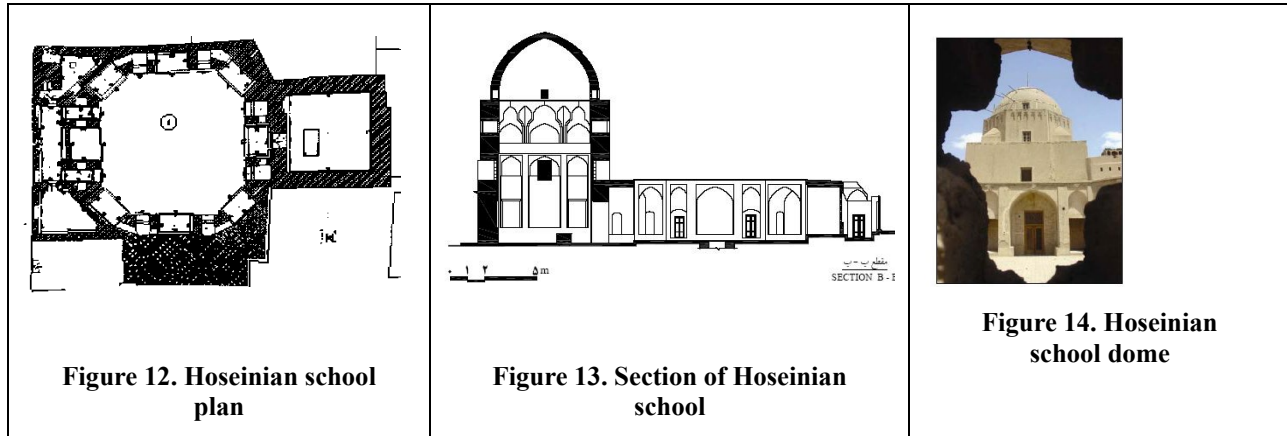


### *Hosseinian School*

This school was built in 1325 by Seyed Sharafuddin Hosein, whose name is mentioned in the history of Yazd as "Kocheh [alley] Hoseinian School" and in the new history of Yazd as "Hoseiniyeh School". The author of the history of Yazd writes about this school: "... this school was built by Amir Sharafuddin and Amir Moinuddin Ashraf made that school a mansion and placed a high dome behind it. His and his grandfather's tombs are there... and in the dome of that school Sadat Al-Qat are buried" (Jaafari, 2005: 124).

The dome of this school is very huge, which is known as the Gonbade-hasht. Later, a Hoseinieh was built next to it, which is known as Hoseinieh Hasht. The dome is built on thick walls, the internal size of which is 7.65 x 7 meters and the thickness of the walls is 1.5 meters. On the outer surface of the dome, there are no works that can be described. Its inner surface, which is completely covered with colorful inscriptions and carvings, has suffered a lot of damage due to the passage of time, climate situation and neglect. Quranic verses were engraved on all spaces under the dome and on the four sides of the wall and the period of the altar, and parts of them still

remain. In the middle of the courtyard of the school, which has now been converted into an octagonal Hoseiniyeh, is the Cellar (Figure 12, 13, & 14) (Ibid: 370).

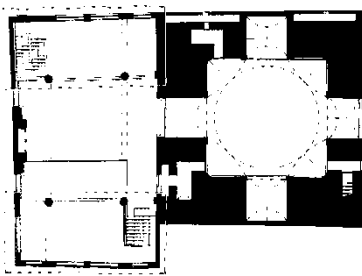


### *Khanzadeh School (Galdaste)*

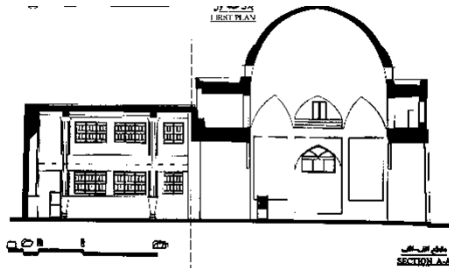
Khanzadeh School is located in Sheikhdad quarter built by Khanzadeh Khatun, one of the daughters of Sultan Mubarizuddin Mohammad Muzaffar, outside the gate and next to the tomb of Sheikh Taqiuddin Dada Mohammad, in 1586, Following the death of the founder, he was buried in the dome (Afshar, 1995: 387). The author of the new history of Yazd writes about this school: "Khatun Azami... built amazing High School and opened the houses, four rows and the high door, and straightened the four rows in front of the blessed tomb (Taghiuddin Dada's tomb)" (Kateb, 2007: 162).

The main part of the building is built as a quadrangular space with four rows on each side. At the top of each row, there are deep arches, which today have a fence in front of them. A dome covered with bricks can be seen on top of the building. Its high walls are approximately 10 meters high. On both sides of the inner wall of the small porches, verses from Surah Fatah are engraved in thulth script with colored motifs on a narrow azure-colored background. Around the ceiling of the pavilions (Figure 15, 16, & 17). Among the decorations of the additional and newly constructed space of the mosque, we can mention the mehrab (altar) which is decorated with coloured tiles. (Khademzadeh, 2008: 85).





**Figure 15. Khanzade school plan**



**Figure 16. Section of Khanzadeh School**



**Figure 17. The dome and wind tower of Khanzadeh school**

### ***Shahabuddin Qaim Taraz School (Shah Abul Qasim)***

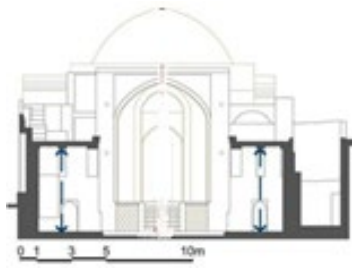
Shahabuddin Qasim Taraz School was built in 1336 in Shah Abul Qasem quarter of Yazd by Shahabuddin Qasim Taraz. Mohammad Mofid Mostofi wrote in Jame Mofidi about the personality of Shahabuddin Qasim Taraz as follows: "Shahabuddin Qasim was famous for his good character and good morals. In the days of prestige and authority, a school was built in the end with elegance and purity, and all with tiles and decorated with lapis lazuli and gold (Figure 18, 19, & 20). They completed it in the seventh and eighth year of the 14th century and built amazing mosque in front of it and a bazaar containing livestock around it, and endowed the bazaar with many gardens and orchards (Mustafi Bafghi, 1963: 253).

Jafari wrote in his book about Shahabuddin Taraz school: "Even though the school is small, it is all decorated with cut tiles, and it has an excellent door and a good dome, and the water of Taft flows in it, and the area in the mosque in front of it is arranged for a good purpose, and the field of Tameher village Waqf is there, and its completion was in the year 787" (Jafari, 2005: 127).

Kateb in his book wrote: "This school is inside the city completely tiled with two floors. It has a good dome in the main row, and high entrance, a lofty square, and shops on four sides, and a mosque with a roof in front of the school, and a stream of water in it. It flows and sometimes Taft water passes there, and it has many endowments. And this school was completed in the year seven-thirty and seven-hundredth" (Kateb-Yazdi, 2007: 138).



**Figure 18. Shah Abul Qasim school plan**



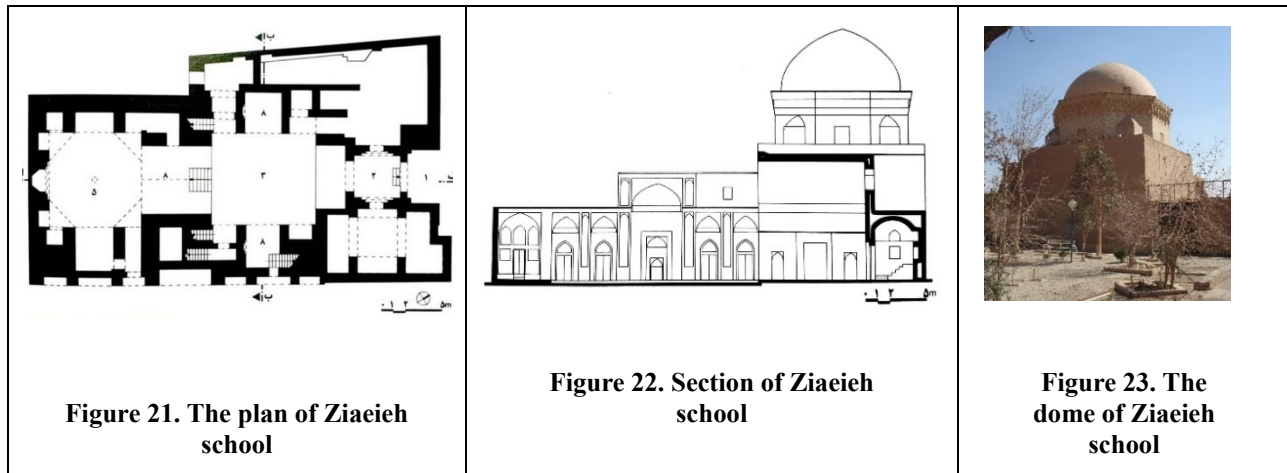
**Figure 19. Section of Shah Abul Qasim School**



**Figure 20. Middle hall of Shah Abul Qasim school**

### *Ziaieih School (Alexander Prison)*

The founder of this school is Ziauddin Hussain Razi, who founded the building in 1233. The school was completed by his sons in 1305 (Khademzadeh, 2008: 46). Although this building was built before the era of Muzaffarids, it is considered to be the era of Muzaffar due to its closeness. "This school consists of a courtyard and three porches on its three sides, a dome, a pillar, and numerous rooms. The plan of the dome is square and the size of each of its sides is 8.8 meters, on which a semi-circular dome with four-sided squinch has been implemented (Afshar, 1995, vol.2). The courtyard of the school is rectangular in shape and there are high porches on the three sides, south, north and west. Above the end room on the northeast side, there is a ventilation shaft (badgir), which can still be used today. On the eastern side of the building, there is a rectangular room covered with dome arches. In the western (main) porch, the remains of two altars and in the southern porch, a lofty altar can be seen" (Khademzadeh, 2008: 48). The space under the dome is one of the original parts of the building, which includes decorations such as kufi inscriptions, plant motifs with watercolors, and types of plastering. Inside the small arches under the dome, there are inscriptions in decorative Kufic script and in azure color (Figure 21, 22, & 23). The lofty mehrab of this building is built on two floors, and the moqarnas inside it are built with a simple pentagonal geometry (ibid: 51).



### Data Analysis

Here we analyze the architecture of these schools from three perspectives: "physical structural features", "construction technologies" and "decorations". Accordingly, each of these dimensions was examined in a separate table for case examples of the research, the results of which are given below:

### Architecture analysis of Muzaffarid schools based on structural-physical features

Table 2. Analysis of Muzaffarid period schools

Khanzadeh School	Shahabudin Taraz School	Hoseinian School	Roknia School	Shamsie School	Kamaliya School	Ziaieih school		
+	+	+	+	+	+	+	Builder's Tomb	Building performance
-	+	-	-	+	-	+	Vestibule	Components of the plan
Octagonal	Rectangular	It has turned into Hoseinieh	rectangular	rectangular	rectangular	rectangular	Yard	
-	+	-	blocked	+	seems to have existed	+	Rooms	
-	+	-	-	+	-	+	Inside the room	
Seems to have existed	Two porches	-	single porch	single porch	-	three porches	Porch	

-	-	-	-	+	-	+	Rooms inside the porch	Geometric pattern of spaces
-	Dome	South corner of the dome	dome	dome	dome	Inside the porch and dome	Altar	
Cruciform (Mosque Section)	Cruciform	cruciform	cruciform	cruciform	cruciform	cruciform	dome	
-	5 pieces:	12 pieces: On the corners and sides of the wall	12 pieces: On the corners and sides of the wall	8 pieces: On the corners and sides of the wall	12 pieces: On the corners and sides of the wall	8 pieces: On the corners and sides of the wall	Skylights of the dome	

According to the items mentioned in the above (Table 2), in relation to the common structural-physical characteristics of Muzaffarid period schools in Yazd, the following items can be extracted:

### *Building Performance*

- One of the main features of Muzaffarid period schools is the collective function of these buildings; This means that in addition to the function of the school, other uses such as Daro-Shefa (hospital), Dar al-Adowieh (Drug Store), Dar al-Kitab (Libraries), Dar al-Hadith (Hedith House), Bait al-Qanun (Court), bath and other facilities needed by the people on an urban and local scale have been built in these schools.

- In some cases, the founders of these schools were also their teachers; Therefore it is probable that there is a residence of such people in the vicinity of the school.

- There have been service spaces especially for school attendants in their vicinities such as Kamaliye and Taraz schools, which seem to have service buildings in the northwest part of it. Among these spaces were water reservoirs or factories.

- There has been access to water resources, especially cellar, under grand channels (qanat). There is an example of this access in front of Kamaliyeh school and Rukniyeh school (the entrance of the aqueduct of this school were discovered in 2019 (Shahabinejad, 2019)).

- The vast majority of schools in this period were managed by the government on the basis of large endowments, and the role of the endowment in this period of time was outstandings. These endowments included canals, agricultural lands, water resources, livestock herds, bazaars, baths, caravanserais and other sources of income, and since this method of providing current expenses was not dependent on political developments, schools were more durable (Abouei et al., 2014).

- In most of these schools, Founder's tomb is located in the school itself and usually under its dome. Of course, according to the tradition of burial at that time, the tombs were in the form of a crypt and were located at a lower level than the existing level of the dome.

### *Components of Plan*

- The plan of Muzaffarid period schools generally has a main axis, and the arrangement of spaces can be seen on this longitudinal axis. This axis starts with the main gate and after that spaces such as vestibule, entrance porch, small courtyard, main porch and dome. The overall plan of the schools is almost rectangular in shape with a ratio of more than 2 to 1 (length to width ratio). Only in two cases, Ziaieih and Khanzadeh Schools, these plans have different proportions. In this rectangular shape, two axes of symmetry are observed perpendicularly, sometimes along the south-west direction and sometimes perpendicular to it. Where it was necessary, such as Kamaliyeh, Rukniyeh, Shamsieh and Taraz schools, after the head space in the direction of the Qibla, we reach the dome (south-west) and the extension that is in the direction of the Qibla. The domes of Kamaliyeh, Shamsieh and Rukniyeh now have tombs, and it seems that the domes of Taraz and Kamaliyeh also had graves.

From the point of view of structural features, the proportions of the dome space in Khanzadeh School are different and it also resembles the quadrilateral form with a separate or single square plan, and of course, more researches are needed for better results. All these schools have service spaces and except Hoseinian School which has an octagonal plan, the dome of other schools has a square plan. It seems that there have been additions in the Shamsieh school in the eastern front, and among these schools, perhaps the Kamaliyeh school shows a more pristine environment due to its current condition.

- Most of these schools have a rectangular mezzanine plan and have a vestibule. The main porch in the direction of the Qibla and sometimes the porch in front of it (north) has been one of the features of some of these schools, and small porches can be seen around the court yard of the three schools of Ziaieih, Rukniyeh and Taraz. Also, the three divisions of the porch or the decorations and the three-piece archways are also considered to be the characteristics of these buildings. It should be noted that the place of the mehrab (altar) was placed in the dome space in most cases.

### *Geometric Pattern*

Muzaffarid period schools generally have a main axis of symmetry along the north-south stretch. Except for minor differences between the eastern and western pavilions, this symmetry is fairly complete. In addition to the existence of the main symmetry in the whole collection, individual microspaces also have relative symmetry. In addition to the symmetry and proportions

in the plan, with the exception of the dome, which mostly has a high height due to its importance, the facades are also completely symmetrical and human proportions are observed in them.

- From the point of view of the plan, the entrances are usually located in the center of the main axis and include the main hall, the vestibule, the courtyard and the dome. Therefore, it can be said that the entrance of schools mainly has a linear structure and service spaces are sometimes observed around the vestibule.

- The architects of this period had a special style in building schools and erecting its dome. The domes are generally associated with the high height of the dome and the corners of the dome are mostly in the form of squinch and trombe patkaneh. The dome is on a square plan and often in the form of a tall arch. In the Khanzadeh school, due to the wideness of the jars, this design is mostly cruciform.








- Although there are no traces of badgir found in school architecture, the existence of badgir is mentioned in many places. For example, there is a weak quote that mentioned it was a badgir above the altar of the dome of the Taraz school in the old times.

- In the studied samples, there is no case of the presence of a pond or small pools in the middle of the school court yard, although schools have seen many changes and transformations in their bodies over the course of hundreds of years.

### Architecture Analysis of Muzaffarid Schools based on Construction Technologies

In this section, the schools built in Muzaffarid period in Yazd are analyzed based on construction technologies. The data of this section will be analyzed from two perspectives including "structural patterns" and "construction materials" and the results of these investigations are presented in the table below in connection with the research samples.

**Table 3. Comparative studies of Muzaffarid period schools in terms of construction technology**

Khanzadeh School	Shahabudd in Taraz School	Hoseinian School	Roknia School	Shamsie School	Kamaliya School	Ziaieih school		
								
<i>Khagi</i> (oval)	From the 30s repairs	<i>Nari</i> three-part Continuous bilayer	Three parts slow	From the 50s repairs	<i>Nari</i> three-part Continuous bilayer	<i>Nari</i> three-part Continuou s bilayer	Dome type	Structural patterns
Convert 4 to 8 and 8 to 16	Skonj	Convert 4 to 8 and 8 to 16 hexagons	Convert 4 to 8 and 8 to 16	-	Convert 4 to 8 and 8 to 16	Convert 4 to 8 and 8 to 16	How to place a dome on a quadrilateral	



hexagons			hexagons		hexagons	hexagons	(corner making)	
<i>Colombo</i> with low rise	<i>Kaneh Posh</i>	-	-	<i>Kaneh Posh</i> with formalizati - on	-	-	top of the door	Arch performance technique
<i>Colombo</i>	<i>Colombo</i> with low rise	-	-		-	<i>Colombo</i>	vestibul e	
Elongated and pointed	Elongated and pointed	-	-	Elongated and pointed	Cradle (Semi-barrel)	-	Booths	
<i>Ahang</i> (barrel vault)	<i>Ahang</i> (barrel vault)	-	-	<i>Ahang</i> (barrel vault)	<i>Ahang</i> (barrel vault)	<i>Ahang</i> (barrel vault)	Porch	
<i>Ahang</i> (barrel vault)	-1 Elongated and -2 pointed Khanche Posh	Elongated and pointed	Elongated and pointed	-1 Elongated and -2 pointed Khanche Posh	-1 Elongated and -2 pointed Khanche Posh	-1 Elongated and -2 pointed Khanche Posh	internal space	
Terracotta bricks	Glazed brick, tile	Brick	plaster and painting	Brick, tile	Brick, tile	Brick, tile	elevation	Building Materials
Clay and mud, plaster	clay and mud	clay and mud	clay and mud	clay and mud	clay and mud	Clay and mud, plaster	Interior spaces	
Brick	Brick	Brick	Brick	Brick	Brick	Brick	The floor of the infrastructure	
Brick	Hexagonal brick	Brick	Brick	Brick	Brick	Brick	The floor of the yard	
Brick	Brick, tile	Brick	tile	Brick	Brick and blue tile	Brick	dome	

According to the results presented in (Table 3), the common architectural features of Muzaffarid period schools in Yazd can be examined from the perspective of construction technologies as follows:

### Structure Patterns

- In Muzaffarid schools, the buildings have been made lighter by reducing the thickness of the joists. The method of transferring load in these schools, like other traditional buildings, is by compression; In this way, the roofs are in the form of pointed arches that are placed on heavy joists with a square or rectangular plan. The walls generally have a load-bearing role, and the non-load-bearing joists are often installed on both sides of the load-bearing joists. The load of the roof is transferred to the load-bearing walls and through it to the foundation and the ground. In fact, the entire covering of the roof and the wall forms an integrated structure that increases the resistance of the structure against earthquakes (Khakbaz alavandian, et al., 2006).

- The domes of the pre-Muzaffarid era, that is, the Seljuq and Ilkhanids periods, especially the Seljuq era, were usually single-shelled and decorated with structures, and of course, this feature was unique to the Razi style. In the past, that is, during the Buyid period, we also had rok domes (conical and pyramidal), but the permanent domes were usually shaped like a cone or an egg (oval). Gradually, during different eras, the domes changed from single-shelled to two-shelled and sometimes three-shelled, especially during the era of Ilkhans to Tamerlane. The production of such domes has gradually increased and has affected its internal proportions. In this situation, The Avgundar domes, the ratio of height to opening width increases, related to this period are rarely seen, but generally the domes have a peak and the height of the domes has increased in the post-Seljuq era, due to their elegance.

- Examining the samples of the buildings of that era, especially the residential buildings, dome with safavid forms, shows that there is no foundation in them. For example, the houses of Muzaffarid door are either without chairs or have chairs the size of a brick at most. In the school of Tarz and Shah Kamal's Tomb school, there is a chair the size of a brick. During the Safavid era, the construction of high base-courses (corsichini) under the building was promoted to such an extent that the height of the base-courses in some buildings was up to half a yard.

### *Construction Materials*

- The main materials used in Muzaffarid schools in Yazd are bricks, clay, straw, plaster and tiles, and in some cases, wood has been used for uniform distribution of load from the upper area to the lower area. The predominant use of raw clay and mud in buildings caused homogeneity in the structural structure of the building and also the use of its thermal capacity in heating and cooling the building (Khakbaz Alvandian, et al., 2015). It should be noted that, the use of brick in these buildings is not seen anywhere else, except for a part of the walls, the dome, the path of the stairs, and the floor of the courtyard carpet.

- The studied buildings are sometimes accompanied by many decorations, which include plastering, colorful inscriptions, painting with pigments, and the like. It is worth considering that the use of tiles in some of these buildings has been in a mixed and rational manner. For example, in the Shahabuddin Taraz school, parts of the main entrance and vestibule have an extraordinary variety of decorations, and traces of Shah Abbas the Great era can be seen in these works. During this period (Muzaffarid and Ilkhanan), tiling, plastering, and painting decorations, such as those in the Soltanieh dome, reached their highest level so that the polish and glaze of the tiles have not changed after about 700 years.








- In some buildings, combined tiles (Shamse Hasht and Bazobandi "Chalipa") as well as golden form tiles were used and traces of them are still visible in the buildings. Cruciform and

Shamseh tiles were also present in the buildings according to the photographs of the late Iraj Afshar, which have remained in some mosques from that era.

### Architecture Analysis of Muzaffarid Schools based on Pattern of Decorations

In this section, the schools built during the Muzaffarid period in Yazd are analyzed based on the pattern of decorations. The results of these investigations are presented in the following table in connection with the research samples.

**Table 4. Comparative studies of Muzaffarid period schools from the point of view of decorations**

Khanzadeh School	Shahabuddin Taraz School	Hoseinian School	Roknia School	Shamsie School	Kamaliya School	Ziaieih school		
								
Altar	<i>Sardar</i> (entrance), Hashti, Dome,	Dome	Porch, dome	Porch, dome, pavilions	Dome	Dome, altar	Focus on decorations	
-	Incomplete and destroyed - moqarnas	Projected and Embossed	Projected and Embossed and molded, low thickness	Projected and Embossed and molded, low thickness	Projected and Embossed and template	Projected and Embossed and .template Low thickness	plaster	Decorations
Clay or seven colors	<i>Maraq</i>	-	Maraq Zarin Fam	Maraq Zarin Fam	Maraq Zarin Fam	-	Tile	
-	watercolor	watercolor	watercolor	watercolor	watercolor	drawing	Drawing	
-	-	Prominent and shallow	Prominent and shallow	Prominent and shallow	Prominent and shallow	Prominent and shallow	Mud	
-	Geometric, Islamic	Geometric, abstract	Geometric, Islamic	Geometric, Islamic	Geometric, abstract	Geometric, Islamic	Plaster	Motifs
-	Geometric, Islamic	-	Geometric, Islamic	Geometric, Islamic	Geometric, Islamic	-	Tile	
-	-	Geometric, Islamic, inscription	Geometric, Islamic, inscription	Geometric, Islamic, inscription	Geometric, Islamic, inscription	Demolishe d	Drawing	
-	-	Geometric, abstract	Geometric, abstract	Geometric, abstract	Geometric, abstract	Copying and framing	Mud	

<i>Thulth (sols)</i>	<i>Thulth (sols), Naskh, Kufi Banaei, Kufi Mezhar</i>	<i>Kufi Mozahar</i>	<i>Kufi Moshjar, Kufi Tahriri, Thulat, Kufi Mezhar</i>	<i>Kufi, Thulth (sols)</i>	<i>Thulth, constructional kufi, moshajar kufi, decorative kufi</i>	<i>Kufi, Kufi Mozhar</i>	Type of inscription lines
-	10-pointed star, geometric knot arrangement, plant elements	6-pointed star, solar bergamot	Shamseh, prominent star of David, bergamot	6-pointed star, solar bergamot, prominent star of David	6-pointed star, solar bergamot	Vase, 5 sides	The shape used
Azure	Blue, yellow, white, turquoise, azure	Turquoise	white, blue, turquoise, azure, navy, green, orange, black	Brown	Blue, green, red, brown	Gold, Azure, Blue, Red	Colors used

Based on the data in the (Table 4), the following are significant:

- The use of well-known Iranian geometric arches is clearly visible in the decorations used in the schools built during Muzaffarid period. In fact, the use of all kin of main geometric shapes, mesh designs using geometric principles, stars with various shapes and circles and twists in the designs used in the tiling of the main hall and vestibule, all express the objective effects of the use of geometry in the building.

- One of the most important features of the decorations in the buildings built during the Ilkhanids and Muzaffarid eras is the elaborateness of the decorations in these buildings. For example, in the schools of Shamsieh and Rukniyeh, almost no part of the building is left without decoration. The use of calligraphy in Islamic decorations in the form of verses of the Quran, praise of the founders, and inscriptions can be seen in most buildings and is an integral part of Islamic architecture.

- The use of thulth and naskh lines with plaster, tiles and paint in the decorations used in Muzaffarid era schools is common and a combination of tiles and bricks (maqli), single tiles, plastering and especially painting which can be clearly seen in the buildings of this era. It is vision (Hoseini-Yazdi, 1962).

- The wooden door of the main entrance of such buildings has been decorated with knots and mosaics. This is not far-fetched considering the fact that traces of such wooden doors existed in many mosques and schools (such as the Safdar Khan prayer school in Yazd) until the beginning of the Safavid era. Of course, gradually, the quality of the decorations of such doors decreased in

the later period, especially during the Qajar period, and less doors were made in the form of mosaic decorations in the style and style of Muzaffarid period doors.

- The porch with a lofty arch has been one of the most suitable places for all kin of painting and plastering decorations. The implementation of shallow arches on both sides of the inner wall of the porch is one of the other visible examples in the porch of Muzaffarid schools.

- In addition to the paint on the plaster, the decorations of these schools were in the form of plastering of wicks and reliefs and mosaic tiling.

- The outer surface of the dome was often covered with tiles. The glory of their tiled domes has shown the glory of the owner of the dome.

- The inner surface of the dome was often covered with inscriptions in Kufic and Thulth script, and colored drawings and plastering. The interior decorations of the dome were of the highest quality during this period.

- In the geometric rules, especially the geometry of the buildings of the Islamic period, and especially the buildings of the 14th century period, there is a mysterious role derived from the natural conditions of human life, as well as metaphysical concepts such as the unity of existence. It is from here that the buildings of this era (from after the Mongol invasion) to the end of the Safavid era are full of the most complex geometric motifs and its application in the body of architecture. Although this tradition existed centuries before that in many mosques, bazaars, baths, schools and even residential buildings, it has grown and diversified since the mentioned period (early years of the 8th century) until the Safavid period (16-17th centuries).

## Conclusion

In the era of Muzaffarid, the measures taken especially in the city of Yazd had a different appearance. Because Yazd was safe more from the Mongols' attack than other Iranian cities and provided the same ground for further development of this desert city. In such a way that Muzaffarid construction works in Yazd, especially during the era of Shah Yahya, have remained in the mind until now, such as the Jame Mosque, (city wall and fortifications), which is still called by the same name. Among the buildings that this family built on a large scale, at least in Yazd, were schools. From medicine and astronomy to philosophical, rational and narrative sciences, were taught in these schools, they had a amazing impact on the production and promotion of science for hundreds of years. Muzaffarid made a lot of efforts for the well-being of the people by creating a monthly pension for the people of culture, art, religion and knowledge, handling the poor and weak, building public spaces and digging aqueducts (qanats), and allocating a lot of endowments for the welfare of the people, and especially the recent cases on Iranian and Islamic art of that era. Most of the schools built during this period, while having the

support of the ruler of the time, were managed by a scholar and religious scientist, which showed the respect of this family for the elites of science and literature. Among the historical books, it can be seen in a documentary form, the subtleties of the dealings of some of the nobles of this family with the people of science, literature and religion. Considering the era of oppression that was left behind by the Mongols and some Ilkhans also fueled it, it is natural that the disillusionment of some of these scholars and especially the mystics occurred in the post-Mongols period. Accordingly, in the era of Muzaffarid, special attention was paid to this social courses, so that tombs and monasteries were built with the names of these scholars next to the schools of the Bab.

The building of Muzaffarid era schools in Yazd has been mentioned by many historians and most of them have used expressions such as "elegance", "accuracy" and "goodness" in describing this building. There are also many endowments on these schools in the historians' books. Therefore, these schools have enjoyed such a status that they continue to exist for hundreds of years after that thanks to the good tradition of endowment. However, unfortunately, in some periods, due to side issues such as famine, floods, and of course devastating wars, which Tamerlane was the main cause of, some of these schools were marginalized and exposed to destruction.

The architectural pattern of Muzaffarid era schools was largely influenced by the cultural and social conditions prevailing at that time. In the architectural system, there is always a mutual relationship between the social situation and the cultural values of the society, which can be seen both in the macro field of architecture and in the elements and components used in it, especially in relation to the architecture of buildings. From the point of view of architecture, most of these clay-mud schools had a rectangular courtyards and porches around and equipped with pillars for various purposes. In addition to the use of people related to the school, this equipment was also used in the nearby neighborhood and by the city residents. Next to these schools, there are service spaces depending on the size and quantitative importance of the school, which usually do not have a separate entrance. The dome was usually built on the south and with many decorations. These very voluminous and varied decorations included all kinds of plastered or painted inscriptions, as well as plant motifs and all kinds of plastering. The dominant colors with high durability used in the decoration of school buildings were generally azure and to some extent ocher, which may be related to the peaceful spirit of such educational spaces. According to the common architecture of that time, the domes are usually tall and with a relatively high ratio of height to opening. Although some of them do not have the scale of large domes such as Nizam al-Molk, Taj al-Molk or Soltanieh, their proportions clearly show their elegance and sophistication. The coexistence of the building with access to water (aqueduct) through Payab or Pakaneh, as well as the presence of geometry in many of these schools is evident. These schools



played a role as the center of the quarter next to the mosques related to those practices, such as the Shamsieh school next to the Chaharmanar mosque and Hoseinieh, and the Shahabuddin Qasim Taraz school next to the mosque of the same name and the Rukniyeh school next to the Atiq Mosque in Yazd, which is the founder of the Rukniyeh school. himself is one of the founders of that mosque. Regarding the common materials in these schools, mainly clay, brick and mud mortars have been used. Among the other aspects of the architecture of these buildings, we can mention the pavilions and cells that seem to have undergone changes during the following centuries. These rooms were mostly located around the yard and sometimes the tombs of the founders of these schools are located there. As mentioned, the court of these schools are mostly rectangular in shape and some of them do not have an entrance vestibule. Except for a few exceptions, the dominant geometric pattern of the schools follows the Yazd pattern (northeast-southwest direction) and if there are limitations in the space used in the land or arena, the architect first designed the central courtyard or the rectangular courtyard, the dome. placed in the south of it and placed the spaces according to the boundaries of the designed land. In general, it can be concluded that despite the short life of the Muzaffarid era, there was continuity in the construction activities of the post-Mongol era, and although the Mongol invasion caused distress to the people of knowledge and religion, the attention of the Muzaffarid rulers to these classes and their interest in the development of the cities created prosperity and He followed the construction of public buildings, especially schools.

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Not applicable

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