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The Impact of the Paradigm Shift on the Schools' Architecture Considering Adaptive Studies of Schools of Tabriz and Urmia in the Era of Qajar and Pahlavi I

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Research Article

Abstract

Schools are the most familiar learning spaces in the mind, which have undergone fundamental changes over time in various sectors, including architecture. The aim is to compare the architecture of Qajar and Pahlavi period schools and the effect of paradigm shift and transformation in Tabriz and Urmia schools. In this research, the evolution and continuity in the architecture of schools in the Qajar period was analyzed with regard to the spatial indicators and the body of learning the open space of Iranian schools. The research is important from two practical and descriptive-analytical aspects, it is practical for exploiting all kinds of schools of the Qajar and Pahlavi periods and fundamental for how to face them in the space of transition from architecture in the city. The method of doing the work is mixed and qualitative-quantitative. First, library information is collected and then the interview technique is used. The components extracted in the questionnaire were compiled with a Likert scale and distributed among the experts. In the qualitative part of the interview method, he collects data, and in the Atlasti software, he extracts the components and changes of schools based on open and axial coding and the results of the questionnaire with the SPSS software, analysis of variance, regression (ANOVA) for data analysis with statistics. During the Qajar period, the arrival of modernity in Iran caused a transformation and a paradigm shift in school architecture. With the establishment of Dar al-Funun by Amir Kabir, a huge change in the model of schools took place, which led to the separation of schools from mosques. As a result, the educational spaces from the school mosque with the pattern of the central courtyard later changed to the schools with the elongated plan pattern, and the educational evolution in the Qajar period

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followed the concept of physical-shape continuity of the traditional Iranian architecture and items such as the central courtyard, module and frame. The arrangement of views and symmetry, introversion and appropriate geometry, etc. can be seen.

Keywords: Paradigm Shift; School; Qajar; Pahlavi I.

1. Introduction

From the beginning of the 13th century (late of Qajar and early of Pahlavi), Iran experienced fundamental changes in political and social situation and various aspects of peoples' lives, such that dominant attitude and mindset transformed unprecedentedly (Sami Azar, 1997: 149). The architecture of Iran has been displayed in different states on frequent constructions, and it has a special place in which beliefs, rituals, and religions are exhibited in the geographical and regional states. Cultural principles and the worldview of the society create the environment and induce principles and values in humans and somehow play a role in cultural transformations (Masoudi Googani and Hooshmandpoor, 2012: 154-155). Schools are the learning space of Iran in the Islamic era. School can be described as an institution for higher education in which ancient Islamic knowledge, such as tradition, commentary, and religious education, are being taught. The school was designed to be in service of an innovative institution (Hilen Braand, 2010: 173).

As an educational organization, the school is a system of social interaction; An organized whole composed of human people who interact and interact with each other through organic and complex relationships. As a social system, the school is different from other social systems with features such as interdependence of components, defined and defined population, clear distinction to the environment, complex network of internal social relations and unique atmosphere and culture (Habibi et al., 2012: 102; Divandari et al., 2018). Knowledge of the process and way of formation of schools and the physical-functional characteristics of schools and their place in the city and their socio-cultural effects in each of the periods of Iran's history, before each subject, into a written collection including the number Schools, status of the founders, size, physical shape, their place in the city, functional characteristics and other characteristics of their requirement in each era, it is necessary to prepare the ground for a comprehensive analysis about the status of schools in history (Fali and Sultanzadeh, 2015: 18). The theoretical importance of the research on the main problem of changing the paradigm shift since the beginning of the 13th century (late Qajar and early Pahlavi) is that the country of Iran had undergone fundamental changes in the political, social and various aspects of people's lives, such that the attitude and way of thinking. The ruler changed in an unprecedented way (Sami Azar, 1997: 149; Divandari et al., 2018).

The importance and necessity of research on the change of paradigm and cultural changes in the schools of the Qajar and Pahlavi periods, which has an effect on the architecture of educational spaces, and includes the removal of cells in schools and their transformation into classrooms that are divided into four. The direction of the courtyard was the way to the cell, and later in the Qajar period, modern education replaced the traditional education, which became a classroom. In most of the schools, each cell had a porch that gives access to the cells located in the courtyard, which later in the Qajar period, these porches were used as open classroom space. It was inferred about the change of paradigm in the schools of Qajar and Pahlavi periods, which includes: design, pattern, form and basic concepts in architecture.

In this research, the study of cultural changes and physical structure of Qajar and Pahlavi era schools is considered, the reason for choosing these two periods is the transition from tradition to

modernity, which shows the effectiveness of space from such a transformation, which is based on values. For a long time, the structure of the schools was traditional in accordance with the educational values of the previous schools (in the form of schools and religious teaching), while the changes in the physical structure and cultural changes of the schools, which began at the same time as the Qajar era. The Pahlavi era is an institution where the relationship between teacher and student, the relationship between life and study in one space has completely changed in comparison with the schools of the Qajar period.

Research purposes: The objective is to conduct an adaptive investigation on the architecture of schools in the era of Qajar and Pahlavi and the impact of the paradigm shift and transformation in the schools of Tabriz and Urmia.

Research questions: How did the paradigm shift and transformation affect the schools of the Qajar and Pahlavi eras?

What was the historical process of higher education in Iran in the Qajar and Pahlavi eras?

What are the most effective factors in forming and paradigm shift impact in the architecture of schools from Qajar to the Pahlavi era?

Research assumption: Change in educational state and architectural paradigm shift can be prominent factors in the space of the schools of the Qajar and Pahlavi I era.

2. Research Background

Numerous research has been conducted about the era of Qajar and Pahlavi I on school architecture and familiarity with its patterns and transformation in the Qajar era. Among these papers, the following are notable.

Hamid Tarifi Hosseini (2012) investigated educational systems generally and the higher educational system in the book titled "Adaptive and analytic investigation of the historical process of higher education of Iran" by emphasizing effective social, economic, political, and cultural changes in Qajar, Pahlavi, and Islamic revolution. As a crucial structure and subsystem in society, these educational systems need to change and transform over time to fulfill the expected objective.

Javad Divandari, Aida Barkati and Shagaig Dashti Joshghan (2017), in the comparative article on the evolution of the spatial structure of Qajar and Pahlavi schools with an emphasis on the hidden values of education in Mashhad (case study: Suleiman Khan and Yadgar School Dr. Ali Shariati), this research by choosing two consecutive historical periods (Qajar and Pahlavi) as a starting point in the change and transformation of the structure of schools (schools and the spatial structure of schools in the Qajar and Pahlavi eras with regard to the values of the educational system in this era) explains.

Sahreh Mehrabian, Hossein Safari and Jamaluddin Sohaili (2019), in the article titled "Comparative comparison of the morphology of contemporary Iranian schools using the method of space arrangement, with the aim of analyzing the characteristics of spatial configuration and investigating the effect of the type of arrangement and spatial organization" They have worked in a pattern.

Ahmad Babaei Zarch, Soheila Torabi Farsani, and Muhammad Hassan MirHosseini (2019), in a paper titled "Effective factors on growth and establishment of the novel educational system in Yazd since Constitutional era until the end of Pahlavi I. According to the results, Zoroastrians of Yazd should be considered an effective and leading group in the way of development of schools in addition to providing highlighted social background from the Constitutional era, and as a result, the novel method of education in Yazd.

Sepideh Alaghemand and Seyed Bagher Hosseini (2014), in a paper titled "Adaptive Investigation of Architecture and Content of Traditional and contemporary schools of Iran. Case study: Two schools in Mashhad, Chahar Bagh of Isfahan, Agha Bozorg of Kashan, Dar Alfonoun, and Markar of Yazd. This research aimed to conduct an adaptive investigation of the architecture and contents of traditional and contemporary schools and to recognize the transformation and change process.

Seyyed Mohammad Hossein Zakari and Sediqeh Artman (2019), in the article entitled "Measuring students' environmental satisfaction with the environmental components of the school", in this research, some environmental components, such as radiation and light, sound, heat, color, dimensions, And the materials were evaluated and compared.

Seyedeh Boshra Mousavi (2018), in a paper titled "Representation of Qajarian Buildings of Dar Alfounoun School based on visual documents." The Dar Alfounoun School was established with the efforts of Mirza Mohammad Taqi Khan Farahani in the second year of the reign of Nasser Aldin Shah. The building of this school changed significantly over time until the end of the Qajar era.

Mehri Yasnas (2017), in a book titled "The History of novel schools of Iran (Qajar era). Education in Iran was traditional until the beginning of the second half of the 13th Hijri calendar, and there was no organized structure to take care of education in Iran, so the school was governed as an old-fashioned primary school.

Maryam Sadat Razavi Poor and Mohammad Mehdi Zakeri (2016), in a paper titled "the impact of the education system on the architecture identity of Schools in Qajar and Pahlavi eras (1876-1881)," investigated the history and transformations of architecture over time, such as changes in appearance and structural changes in forming different buildings, which had an accurate impact on the architectural identity of buildings.

Mohammad Yusuf Kayani (2013), in the book entitled "Iranian Architecture of the Islamic Period", the architectural space of schools has also entered a new stage at the same time as the changes in the architecture of mosques. Architects, following the architectural features of mosques, built schools with more or less the same features.

Hossein Soltanzadeh (1984), sometimes the process and method of forming schools and skeletal-functional features of schools and their place in the city and their cultural-civil impact on each cycle of Iranian history requires a determined set with the number of schools, path of founders, capacity, skeletal appearance, their position in the city, functional properties, and other crucial properties to provide a background for a comprehensive analysis about the school situations.

Mehdi Nasiri (1387), in the article examining the development of the educational system of schools in the Qajar and Pahlavi period, the purpose of this article is to examine these three educational periods, especially the sociological examination of the educational system in this historical period.

Naseh Mohammad Amin (2007), a comparative look at the history of six historical schools in Iran (with an approach to criticizing the teaching of the alphabet in the traditional educational system), this article seeks to identify and introduce the characteristics of the six historical schools "Dar al-Funun, Elmiyeh and Alborz Tehran, Rushdieh" Tabriz, Saadat Bushehr and Shauktieh Birjand" which are all more than one hundred years old.

Eghbal Ghasemi Pooya (1999), in the book titled "new schools of Qajar era." This paper is about the reasons for establishing and developing new schools in the Qajar era and introducing their founders and pioneers. It defines the educational system transformation and the emergence of new schools in intellectual backgrounds.

Neda Saeidi Kia (2017), in a paper titled "Evolution of the Architecture of Schools of Iran over time," noted patterns for designing schools that should be considered in the architecture of schools; patterns such as the small society of learning, the input of the missionaries, workshop of life skills, technology, and clarity, internal and external green spaces, sofa, flexibility, cozy places, using solar energy, ventilation, and natural light.

Sami Azar (1997), in the history of schools' transformation in Iran, investigated the historical transformations of the schools of Iran and believes that the architecture of current schools is the result of social and historical changes, not the consequence of thinking and finding solutions about body spaces.

Mehran Karahmadi, Mustafa Kiani, and Maryam Ghasem Sichani (2020), in a paper titled "Investigation of new schools of Isfahan in the Late Qajar and Pahlavi I Era, investigated factors of forming factors and body components to recognize historical-political, cultural, and social factors that affect creation of novel schools of Isfahan in the mentioned eras and recognizing the nature of architecture, and skeletal and architectural comparison of these schools.

Samad Sardari Nia (2003), in the book "Dar al-Funun Tabriz", is an institution of higher education during the Qajar era, which during its activity was able to leave a significant impact on the culture of this region by training some talented young people.

Professor Viladimir Minoriski (1953), in the book titled "History of Tabriz." He is considered the greatest researcher in this area and a great teacher, according to professors in the West. This book discussed Tabriz and its geographical position.

Reza Amin Sobhani (1958), in the book titled "History and Etymology of Schools of Tabriz." This book was published in the summer of 1951, but because of the beginning of the school year and increasing the volume of printed matters of the Farhang printery, the remaining could not be published, and another part, which included the history of the established school until 1946, was published and until the early of 1952.

The novelty of this research is that contrary to the previous papers that discussed the architecture of schools in the Qajar era and schools of Tabriz, this paper conducted an adaptive investigation on schools of Tabriz and Urmia in the Qajar and Pahlavi I era in terms of design indices, pattern, form, and basic concepts in the architecture. In this research, cities in the northwest of the country were selected by considering the importance of these two provinces in terms of their location in the path of the silk road, which has been the route of transforming the science and civilization of European countries to Iran, and consequently, emergence of the first ones in these cities, such as the first printery, national newspaper, deaf-mute school, and public library in Tabriz, and the first Medical school, novel school, and the first local journal in Urmia.

3. Selecting Specimens and Distribution of Questionnaires

The statistical specimen volume was 39 persons of experts and elites of architecture, according to the Morgan table, and the questionnaire included 60 questions. The information-gathering technique using the questionnaire depended on the response of researchers, and the collected data were analyzed using SPSS. The results were extracted using statistical analyses, correlation, and testing received indices.

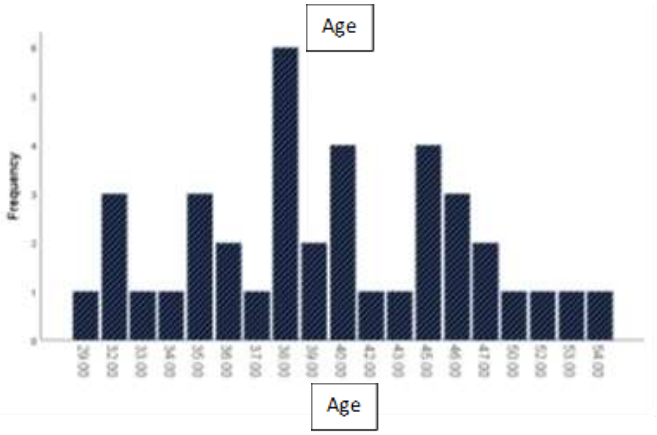


Fig 1 Analyzing the age of people (Source: authors)

4. Theoretical Fundamentals

4.1. Schools' Construction in the Era of Qajar and Pahlavi I

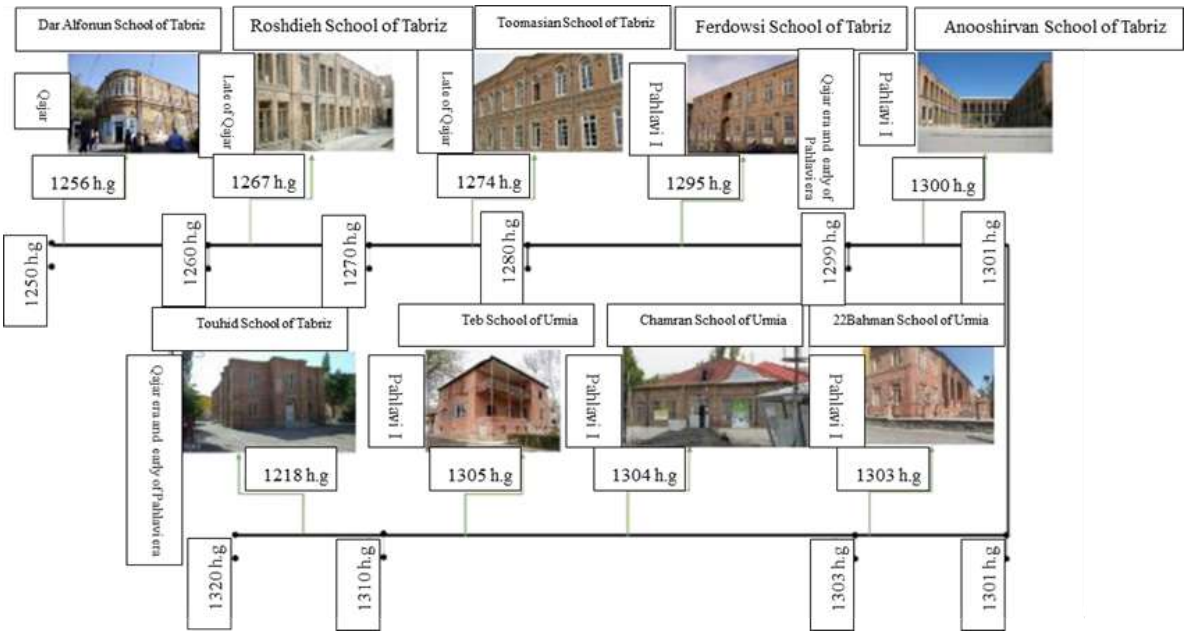


Fig 2 Timetable of Schools' construction in East- and West- Azerbaijan in the era of Qajar and Pahlavi I (Source: authors)

4.2. Adaptive Investigation of Schools' in terms of Architecture

Table 1 Adaptive investigation of schools in terms of architecture (Source: authors)

Name of School	Teb School of Urmia	Chamran School of Urmia	Anooshirvan School of Tabriz	Ferdowsi School of Tabriz	Roshdie School	Dar Alfonun School of Tabriz
Historical era	Pahlavi I	Pahlavi I	Pahlavi I	Late of the Qajar era	Late of the Qajar era	Qajar
Position	West Azerbaijan (Tabriz)	West Azerbaijan (Tabriz)	East Azerbaijan (Tabriz)	East Azerbaijan (Tabriz)	East Azerbaijan (Tabriz)	East Azerbaijan (Tabriz)
Date of Construction	1305 SH	1304 SH	1300 SH	1295 A.H	1267 A.H	1256 A.H
Use	6-classes girls elementary school	Boys high school	Junior high school	Secondary education	Girls' Knowledge and Work High school	Boys secondary high school
School components	Classes, gathering hall, Hussainiyah, janitor, sport	Classes, gathering hall, Hussainiyah, janitor, sport	-	Library, classes	Library, laboratory, industries workshop, handcraft	-
Plan	Symmetry in plan-rhythm in view	Symmetry in plan and view, rhythm in view	Symmetric and rhythm in view	Symmetry in plan and view, rhythm in view	symmetric	asymmetric
Geometry	Rectangular-shape plan	Rectangular-square shape plan	U-shape	H-shape	Z-shape	L-shape
Number of stories	Two stories-floor and the first story	Two stories-floor and basement	Three stories-floor, first, and basement	Three stories-floor, first, and basement	Two-stories	Two stories-floor and the first story
Number of yards	A yard	A large yard	2 yards-inland and outland	Two yards-Internal and external	1	1 Internal yard
Accessibility and links to the classes through the porches	Links through the porch to corridors and classes	Internal circulation and links through the corridor	Links through corridors and internal stairs	From the porch to the inside and connection corridors and stairs to the upstairs	4 separate entrance-through the court	Directly from the yard to the classes
Introvert-extrovert	Internal circulation and links through the corridor	extrovert	Introvert	extrovert	Introvert	Introvert

Spatial sense	extrovert	Sense of peace inside the school building	Sense of movement around the corridor	Sense of peace in the central yard and beautiful nature causes a reduction of stress	Reminder of traditional architecture- simple- historical symbols of survival	Sense of peace and separation of accessibility of each class- sense of attachment
Natural components	Utilizing green spaces and trees all around the school building	Utilizing the green space all around the building of Chamran school	Green space and tree	Old porch and trees in the space, green space, stress reduction	Existence of the green space	Green space and trees in the central yard
Decorations	No particular decoration	Efficient execution of brickwork on the external wall of the building, decorations of the door and windows	Brick decorations with Roman arch and quasi-convex brickwork around the windows	Brick decoration in the body of the building- bevel around the frame of the windows	Simple method to volume elements and sculpture	Bricks- Columns all around the porches

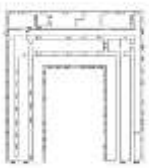
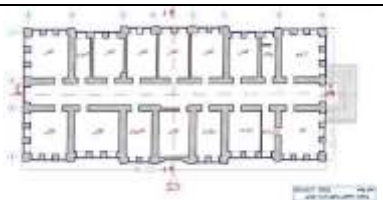
Row	**Name of school**	**Plans and images**
1	Dar Alfonun school of Tabriz	  
2	Roshdie School	  
3	Ferdowsi school of Tabriz	 
4	Anooshirvan school of Tabriz	 
5	Chamran school of Urmia	 
6	Teb school of Urmia	 

Table 2 Share funds in terms of architecture (Source: authors)

- All six schools have an architectural space suitable for the educational system.
- All the above schools have a regular geometric shape (rectangular square).
- Usually, a circuit is built near the body of the market with the main lines.
- The use of inner or outer yard and its favorable atmosphere can be seen in all schools.
- All schools have a middle corridor between classes or a corridor in the front of the yard.
- Most of the central courtyards in the traditional architecture of Iran, especially schools, are built with appropriate degree of enclosure, geometrical order in the form of a square, rectangle or complete square with a specific definition and as a complete and flawless space, usually symmetrical.
- The presence of a central courtyard and the creation of a water pond and greenery in the example of schools, the direct relationship of the school's constituent elements such as rooms, teachers, etc. And the spaces of the building on the four sides of the yard, which are placed in the optimal place according to the environmental desirability in terms of geographical directions and the importance of the role of the spaces for different seasons.
Hierarchy: First, we enter the semi-public area from the public area, and then we enter the semi-private entry way, and finally we enter the private area of the school yard.
- Transforming communication and movement paths into learning environments and places to sit and study in order to socialize corridors and stairs.
- The external order in the form of a piece of land in traditional cities with an organic texture (natural order and in accordance with environmental conditions such as the slope of the land, waterways, network of accesses and boundaries of ownership, etc.) is mostly irregular.
- The arrangement of filled and empty spaces according to the urban context and image, so that the school is considered as an important element and at the same time continuous and inseparable in the urban context and image.
- The lack of open spaces and the absence of indoor or semi-open spaces that can be used by students in special climatic conditions such as areas with intense sunlight and high temperature or rainfall in rainy areas can be used by students in many times of the year.
- The spatial quality of the school building or open space, open spaces or courtyards and covered or semi-open spaces and physical order and the relationship between them are considered to be the most important in the design of schools.

Table 3 Differences in terms of architecture (Source: authors).

- In the previous period, Qajar had cells, which were removed later.
- In order to respond to the new education system, schools change from introverted and traditional to extroverted and contemporary.
- It is a combination of introverted and extroverted spaces, in this case, in the building complex, while there are central courtyards or internal open spaces, the entire complex is surrounded by open spaces. Introversion is seen in traditional schools and extroversion is seen in contemporary schools.
- The horizontal communication space takes place through the corridors around the open space and also the semi-open spaces in traditional schools. But in contemporary schools, these horizontal connections are made through communication corridors.
- Creation of desirable visual and perceptual quality such as unity, diversity, hierarchy, sequence, comparison, continuity, continuity is seen in the collection of full and empty spaces in traditional schools.
- The role of the yard from the middle of the Qajar period onwards, from the heart of the complex and the

central space, is reduced to an open space.

- The first transformation happened in Dar al-Funun, which presents a semi-traditional model and a new definition of schools.

- The Safavid period schools evolved compared to the Timurid period, but there was no significant change from the Safavid period to the Qajar period, while from the middle of the Qajar period, a huge change occurred in the pattern and body of the schools to respond to the new way of education. In this way, new schools started to be formed with a new teaching method in the form of rows of benches in the classroom and the creation of corridors in Dar al-Funun.

5. Indices of Schools of Qajar and Pahlavi Era

Considering conducted investigations in the case study schools of the Qajar and Pahlavi eras, design, pattern, form, and basic concepts of architecture are discussed. Indices of each parameter are presented below.

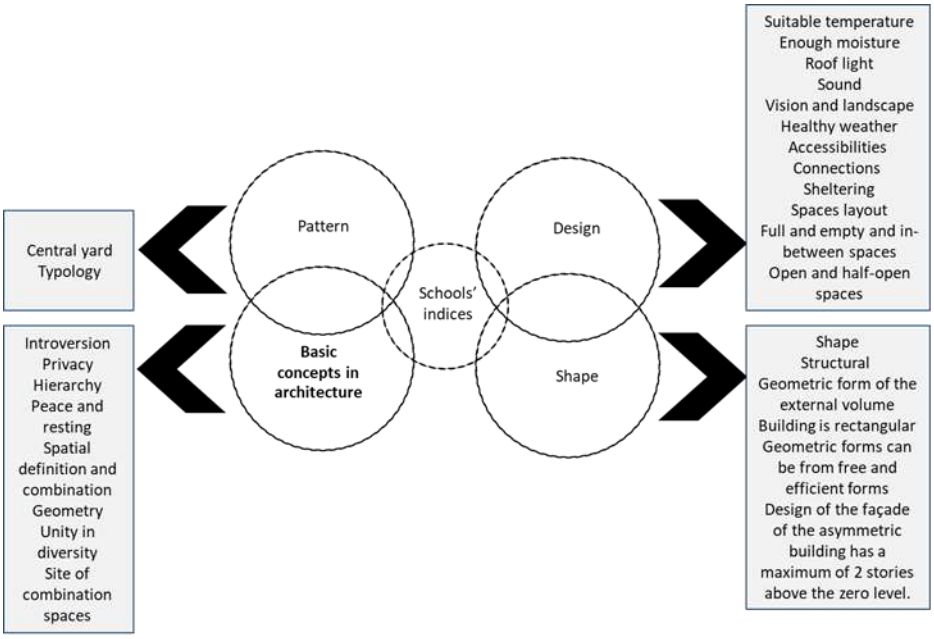


Fig 2 Indices of schools of the Qajar and Pahlavi era (Source: authors)

6. Research Method

In terms of nature, the present research is included in the set of quantitative-qualitative researches. In order to answer the research questions and achieve the main goal of the article, the research is important from two practical and descriptive-analytical aspects, and it is practical for the exploitation of all kinds of schools of the Qajar and Pahlavi periods and fundamental for how to face them in the space of transition from architecture in the city. It has been used in order to achieve the main goal set (architectural quality and paradigm shift in school education). On this basis, after extracting the appropriate theoretical framework, by researching and reviewing the surrounding texts and documents in the field of education in the first Qajar and Pahlavi eras, and developing a basic conceptual model related to the identification of the effective components on the quality of architecture and education in the schools of the period. First, Qajar and Pahlavi collected field data

using tools such as observation, interview and questionnaire. The method of doing the work is mixed and qualitative-quantitative. In the qualitative method, with the help of the contextual theory, the extraction of components is started, and in the quantitative part, the factor contribution of a variable is presented. Coding of semi-structured interviews with experts and professors of Azad University of Tabriz and Urmia has been done. The first qualitative sampling was done from 15 experts in the Azad University of Tabriz and Urmia, who had full knowledge of the subject and knowledge of the studied samples, using various components and the conditions of examining the sample of Qajar and Pahlavi period schools, scores with a spectrum 1 to 10 are given and those whose average is higher than the average of the upper and lower limits are selected and referred to the board of experts to validate the results. The research was done with an applied approach and a descriptive and analytical research method. The method of collecting information is field and library to examine the patterns of schools in these periods. First of all, this article examines the architecture of educational spaces and the impact of the paradigm shift in the Qajar and Pahlavi periods from a qualitative point of view, and then statistical indicators and tests are used to compare and evaluate the research findings. The data collection technique was based on the researchers' answers, and the collected data was analyzed with SPSS and the descriptive statistics method of deviation and regression variance (ANOVA) in Qajar and Pahlavi period schools, using statistical analysis, correlation and the received indicators have been tested and finally the results have been extracted. After evaluating the architecture of the educational spaces of Tabriz and Urmia schools, the validity and reliability of the research has been examined with Cronbach's alpha coefficient in the Qajar and Pahlavi period. According to the ground principles, labeling is done using Atlasti.9 version 9.1.3.0 software. In the analysis of semi-structured interviews, Atlas T software is used for convenience and data reduction, and the tagging approach is open and central coding, which includes the following (source: author).

7. Research Findings

7.1. Design Indices in Schools of Qajar and Pahlavi Era

Appropriate Temperature and Enough Moisture

Temperature and relative moisture are physical factors of the environment, and their increase and reduction affect the convenience of people (Bako-Biro et al., 2007: 18). Documents show that an insufficient ventilation system disturbs learning and increases the absence of students (Sterling, and Arundel, 1985).

Roof Light

Establishing the building in the direction of sun radiation in the cold season; it should be noted that immediate radiation of light in learning spaces causes mutiny of the eye and cause problems for students (Ghermezi and Nasrollahi, 2019: 8). Providing visual comfort is a fundamental principle, which is possible by providing sufficient light for classes and learning spaces. In addition to affecting the performance of the users, it also affects their health and energy efficiency (Ahadi and Khanmohammsdi, 2015).

Sound

If the sounds outside the class overpower the sound of the teacher, learners inevitably give their hearing power to the sounds outside or do not listen to any of the sounds, even the teacher's sound. These situations mostly cause disturbance in learners, and the position importance of the class is highlighted (Zoufan, LotfiPour, 2000).

Healthy Weather

The opening is an important component of the building that affect the current air of the internal space significantly (Shetabivash, 2015).

Accessibilities

In the past, accessibilities of learners existed directly from the yard, but now it is a hierarchy of the yard to the hallway and to the class. Putting functional areas related to each other and beside each other eases the accessibility to similar uses (Azemati, Aminifar, and Pourbagher, 2015).

Space Layouts

The spatial layout of schools defines link method, internal events, and space experience. The spatial discipline is an important factor in providing physical and mental convenience to the users, so trying to obtain principles of effective spatial layout seems to be essential in schools (Azemati, Aminifar, and Poorbagher, 2015). The physical design of classrooms can affect the behavior of both users, including teachers and students (Stewart and Evans, 1997).

Full and Empty Spaces

Spaces without roofs in connection with the sky and profited from natural light are called empty or open spaces, and spaces with roofs enclosed by walls and windows are called closed or filled spaces (Ghaffari et al., 1998: 29). The most significant effective aspect in defining and determining the conceptual type and quality of the architectural space is the skeletal organization of full and empty spaces in the scale of architectural units and urban complexes.

Full and Empty and In-Between Spaces

In addition to the internal design of schools, considering the design of the open space is also important. The schoolyard is the natural extension of the classroom. Connection with nature reduces neural pressures and improves the mental and spiritual health of students and teachers (Daneshmehr, 2007). Schools can benefit from open and half-open spaces as useful educational tools by improving their quality. Stoop and porches facing the yard in Islamic schools, multiple yards of the Chahar Bagh school, and porticos of the Khan School of Shiraz provided a desirable use of nature. Placing cells around the central yard and the large ratio of the yard's area to the closed space indicate the high importance of the open space in the architecture of Islamic schools (Pirnia, 2013) (Tables 4 and 5).

Table 4 Statistical and comparative analysis of design indices in the Qajar and Pahlavi era (Source: authors)

Variable	Suitable temperature		Enough moisture		Light roof		Sound		View and perspective		Healthy weather		Accessibilities		Links		Hierarchy		Layout of spaces		Full and empty spaces		Full and empty and in-between spaces	
	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi
Number	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Mean	3.10	3.41	2.97	3.10	4.05	3.95	3.10	3.33	3.64	3.72	3.49	3.44	3.77	3.72	3.54	3.59	3.54	3.33	3.56	3.62	3.13	3.74	3.10	3.74
Median	3	4	3	3	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	3	4	3	4
Deviation	0.821	0.785	0.811	0.718	0.793	0.724	0.641	0.838	1.181	1.169	1.295	1.273	0.706	0.686	0.790	0.637	0.884	0.838	0.754	0.711	0.767	0.938	0.882	1.093
Domain	4	3	3	2	3	2	3	3	4	4	4	4	3	3	4	3	3	3	3	3	3	3	4	3
Minimum	1	2	1	2	2	3	2	2	2	1	1	1	2	2	1	2	2	2	2	2	1	2	1	2
Maximum	5	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5

The value of each design index has been analyzed in the form of descriptive and comparative statistics between the Qajar and Pahlavi periods. For example, in the question of suitable temperature with the number of 39 people, its variable mean is 3.10 in the Qajar period and 3.41 in the Pahlavi period, the standard deviation is estimated at 0.821 in the Qajar period and 0.785 in the Pahlavi period. The amount of standard deviation in this variable (suitable temperature) is higher in the Qajar period than in the Pahlavi period, and the amount of standard deviation is average in both.

Table 5 Analysis of Variance (ANOVA) (Source: Authors)

		Sum of squares	Mean of squares	Degree of freedom	F	Significance
Suitable temperature	Regression	12.756	18	0.709	1.104	0.0412
	Remaining	12.833	20	0.642		
	Total	25.590	38			
Enough moisture	Regression	14.641	18	0.813	1.574	0.0163
	Remaining	10.333	20	0.517		
	Total	24.974	38			
Light roof	Regression	8.397	18	0.467	0.602	0.058
	Remaining	15.500	20	0.775		
	Total	23.897	38			
Sound	Regression	9.673	18	0.537	1.817	0.009
	Remaining	5.917	20	0.296		

	Total	15.590	38			
Vision and landscape	Regression	34.808	18	1.934	2.129	0.052
	Remaining	18.167	20	0.908		
	Total	52.974	38			
Healthy weather	Regression	40.160	18	2.231	1.892	0.008
	Remaining	23.583	20	1.179		
	Total	63.744	38			
Accessibilities	Regression	6.590	18	0.366	0.594	0.006
	Remaining	12.333	20	0.617		
	Total	18.923	38			
Links	Regression	7.609	18	0.423	0.526	0.008
	Remaining	16.083	20	0.804		
	Total	23.692	38			
Hierarchy	Regression	18.026	18	1.001	1.717	0.012
	Remaining	11.667	20	0.583		
	Total	29.692	38			
Spaces layout	Regression	10.173	18	0.565	0.990	0.050
	Remaining	11.417	20	0.571		
	Total	21.590	38			
Full and empty spaces	Regression	12.942	18	0.719	1.527	0.017
	Remaining	9.417	20	0.471		
	Total	22.359	38			
Open, half-open and in-between spaces	Regression	18.590	18	1.033	1.878	0.008
	Remaining	11.000	20	0.550		
	Total	29.590	38			
At this stage of the research, according to the regression test in Table 3, the coefficient of determination for the appropriate temperature is 0.0412 with significance (F test is equal to 1.104). According to the significance, there is a significant relationship between the variables.						

7.2. Shape Indices in Schools of Qajar and Pahlavi Era

Shape

The shape and appearance of the building must match the favorable or unfavorable thermal effects of the environment. Different shapes and forms have different thermal performance due to many reasons, including the amount of surfaces in different fronts, the ratio of surface to volume, the effect on the amount of radiant energy received at different times, etc. The difference in the light absorbing walls of these buildings, the energy consumption of their lighting is also different (Nasrullahi, 2011).

The Geometry of the External Volume of the Building is Square, Rectangle, Free and Efficient

The manner of placing spatial-functional elements in it is that they are placed in four directions around the central yard. The shape of the central yard is an extended rectangle close to a square (with chamfer corners). The school entrance is on an axial side, which passes through the middle of two edges and the center of the rectangle (Kiani, 2011: 138) (Tables 6 and 7).

Table 6 Statistical and comparative analysis of shape indices in the Qajar and Pahlavi era (Source: authors)

Variable	Shape		Organizational		The geometry of the external volume of the building is square		The geometry of the external volume of the building is rectangular		The geometry can be from the free and effective forms		Design of the building façade is symmetric		With at least two stories above the zero level	
	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi	Qajar	Pahlavi
Number	39	39	39	39	39	39	39	39	39	39	39	39	39	39
Mean	3.54	3.72	3.51	4.28	2.56	2.90	4.00	4.00	2.41	3.33	4.21	3.69	4.28	3.74
Median	4.0	4.0	4.0	4.0	2.0	3.0	4.0	4.0	2.0	3.0	5.0	4.0	4.0	4.0
Deviation	0.822	0.826	0.970	686..0	1.142	0.852	0.918	0.761	1.093	1.493	0.923	0.731	0.560	0.549
Domain	3	3	3	3	4	3	3	4	4	4	3	3	2	3
Minimum	2	2	2	2	1	1	2	1	1	1	2	2	3	2
Maximum	5	5	5	5	5	4	5	5	5	5	5	5	5	5
The variable mean, the geometric form of the external volume of the square building, in the Qajar period is 2.56 and in the Pahlavi period is 2.90 and the standard deviation in the Qajar period is 1.142 and in the Pahlavi period is 0.852, which the standard deviation in the Qajar period is excellent. is. It seems that according to the analyzes that have been done, the use of the central pattern in the school plan can be used as a strategy for designing the basic factors to create spatial coherence, integration and continuity among the school spaces.														

Table 7 Analysis of Variance (ANOVA) (Source: Authors)

Indices		Sum of squares	Mean of squares	Degree of freedom	F	Significance
Shape	Regression	9.647	18	0.536	0.610	0.052
	Remaining	17.583	20	0.879		
	Total	27.231	38			
Organizational	Regression	16.109	18	0.895	1.868	0.008
	Remaining	9.583	20	0.479		
	Total	25.692	38			
Structural	Regression	12.410	18	0.689	0.591	0.867
	Remaining	23.333	20	1.167		
	Total	35.744	38			
The geometry of external volume of the building is square	Regression	33.423	18	1.857	2.297	0.026
	Remaining	16.167	20	0.808		
	Total	49.590	38			
The geometry of external volume of the building is rectangular	Regression	17.667	18	0.981	1.370	0.024
	Remaining	14.333	20	0.717		
	Total	32.000	38			
The geometry can be from the free and effective forms	Regression	33.019	18	1.834	2.955	0.011
	Remaining	12.417	20	0.621		
	Total	45.436	38			
Design of the building façade is symmetric	Regression	23.942	18	1.330	3.161	0.007
	Remaining	8.417	20	0.421		
	Total	32.359	38			
With at least two stories above the zero level	Regression	5.314	18	0.295	0.897	0.05
	Remaining	6.583	20	0.329		
	Total	11.897	38			
At this stage of the research, according to the regression test in Table 5, the coefficient of determination for form indicators is 0.052 with significance (F test equals 0.610). According to the significance, there is a significant relationship between the variables.						

7.3. Pattern Indices of Schools in the Pahlavi and Qajar Era

Central Yard

The most important skeletal transformation in recent decades of the history of school construction in Iran is replacing the central yard with a corridor. This transformation was an end to the pattern of traditional schools and a beginning for designing schools using a novel method. This

change is the decay of introversion concepts to the central yard and traditional hierarchy in organizing spaces of the school (Sami Azar, 2000: 109-110).

Typology

Typology is usually a simple description of the properties of a building. Generally, it is applied to a type of category in which a number of different objects are organized based on one or several common properties, and the science that recognizes and analyzes types is called typology (Memarian, and Dehghani, 2016: 22) (Tables 8 and 9).

Table 8 Statistical and comparative analysis of pattern indices in the Qajar and Pahlavi era (Source: authors)

Variable	Central yard		Typology	
	Qajar	Pahlavi	Qajar	Pahlavi
Numbers	39	39	39	39
Mean	4.31	2.92	3.56	3.23
Middle	4.00	3.00	4.00	3.00
Deviation	0.766	1.08	1.095	0.90
Domain	2	4	4	3
Minimum	3	1	1	2
Maximum	5	5	5	5
The central courtyard with 39 people, its variable mean in the Qajar period is 4.31 and in the Pahlavi period is 2.92, the standard deviation in the Qajar period is 0.766 and in the Pahlavi period is estimated as 1.08.				

Table 9 Analysis of Variance (ANOVA) (Source: Authors)

		Sum of squares	Mean of squares	Degree of freedom	F	Significance
Central yard	Regression	12.724	18	0.707	1.475	0.019
	Remaining	9.583	20	0.479		
	Total	22.308	38			
Typology	Regression	28.923	18	1.607	1.928	0.007
	Remaining	16.667	20	0.833		
	Total	45.590	38			
At this stage of the research, according to the regression test in Table 9, the coefficient of determination for the model index (central yard) is 0.019 with significance (F test is equal to 1.475). Regarding the significance, there is a significant relationship between the central courtyard and typology. Until the middle of the Qajar period, Iran's traditional schools preserved the traditional model and body, which consisted of a central courtyard with a number of cells around it, but from the middle of the Qajar period onwards, with the change of the teaching method and the introduction of the new method, the old model and body of the schools did not respond to the new teaching method.						

7.4. Indices of Basic Concepts of Architecture in Schools of Pahlavi and Qajar Era

Introversion

The introversion principle is one of the fundamentals of Islam architecture, which was highly noted in organizing different elements of the building, especially in traditional houses and schools (Pirnia, 2004: 35). Separating the internal arena as an educational space and the external arena as the general arena is one of the common properties of traditional schools (Ghaffari, 1998: 9).

Privacy

By privacy in architecture and urban planning, we mean giving a skeleton to a space so that it has a boundary in terms of skeleton and meaning. Having a boundary in the area of spatial skeleton mostly focus on principles that form the security of the space and are in the meaning area of properties that give value and privacy to the architectural space, in which a person can rest (Hashemi Zarrajabad et al., 2014: 129).

Hierarchy

The existence of a series of spatial hierarchies is one of the principles that has the greatest impact on the formation of spatial privacy in the traditional architecture and urban planning of Iran (Wathiq et al., 2009: 56). The principle of hierarchy means the organization and combination of spaces and elements based on some of their physical or functional characteristics that lead to the emergence of a hierarchy in the way elements are placed, used or observed (Mahdoinejad, 2010). Hierarchy in architecture is the separation of the importance and meaning of a form or space from other organizational forms or spaces, by the size of the shape or its location (Gruter, 2003: 333).

Geometry

Geometry means kindness and justice (more manifest of kindness, wealth, and shapes, and also the justice of God) and the use of coordinated geometric patterns in components and totality of the building in internal space and self-center geometry (concentrated geometry in the circle) and unifying agent in Islamic buildings (Burkhart, 2013: 87).

Unity of Diversity

In a world of abundance and diversity, there is one real unity. On the contrary, there is an understandable and ideal abundance in a world of absolute unity (Namazi, 2003).

Arena of Different Spaces

The placement of different performances and combinations of open and closed spaces in Islamic schools created a proper arena in these spaces. Considering the performance of Islamic schools and residential chambers, the presence of a mosque beside the school is required.

Table 10 Statistical and comparative analysis of basic concepts in the Qajar and Pahlavi era (Source: authors)

Variable		Number	Mean	Median	Deviation	Domain	Minimum	Maximum
Introversion	Qajar	39	4.28	4.00	0.759	3	2	5
	Pahlavi	39	3.00	3.00	1.00	4	1	5
Privacy	Qajar	39	4.49	5.00	0.683	2	3	5
	Pahlavi	39	2.87	3.00	0.789	3	2	5
Hierarchy	Qajar	39	4.13	4.00	0.801	3	2	5
	Pahlavi	39	3.46	3.00	0.789	3	2	5
Peace and resting	Qajar	39	4.00	4.00	0.795	3	2	5
	Pahlavi	39	3.38	4.00	1.01	3	2	5
Spatial definition and combination	Qajar	39	3.59	4.00	0.751	3	2	5
	Pahlavi	39	3.76	4.00	0.985	3	2	5
Geometry	Qajar	39	3.92	4.00	1.036	4	1	5
	Pahlavi	39	3.74	4.00	1.04	3	2	5
Unity in diversity	Qajar	39	3.49	4.00	0.721	3	2	5
	Pahlavi	39	3.28	3.00	0.998	3	2	5
Arena of different spaces	Qajar	39	3.40	4.00	0.998	3	2	5
	Pahlavi	39	3.58	4.00	1.069	3	2	5

The average value of introversion in the Qajar period is 4.28 and in the Pahlavi period is 3.00, and the deviation in the Qajar period is 0.759 and in the Pahlavi period is 1.00, and the deviation in the Pahlavi period is excellent. From the end of the Qajar era onwards, the role of the yard and introversion was reduced from the communicative heart of the complex to an open space. From the middle of the Qajar era onwards, there was a huge change in the pattern of schools. In the new era, imitation of the architecture of the West and the conquest of the modern educational system can be seen comprehensively in modern schools.

Table 11 Analysis of Variance (ANOVA) (Source: Authors)

Indices		Sum of squares	Mean of squares	Degree of freedom	F	Significance
Introversion	Regression	14.147	18	0.786	2.028	0.006
	Remaining	7.750	20	0.388		
	Total	21.897	38			
Privacy	Regression	9.577	18	0.532	1.303	0.028
	Remaining	8.167	20	0.408		

	Total	17.744	38			
Hierarchy	Regression	13.942	18	0.775	1.487	0.012
	Remaining	10.417	20	0.521		
	Total	24.359	38			
Peace and resting	Regression	12.250	18	0.681	1.158	0.037
	Remaining	11.750	20	0.588		
	Total	24.000	38			
Spatial definition and combination	Regression	13.519	18	0.751	1.897	0.008
	Remaining	7.917	20	0.396		
	Total	21.436	38			
Geometry	Regression	20.519	18	1.140	1.126	0.039
	Remaining	20.250	20	1.013		
	Total	40.769	38			
Unity in diversity	Regression	11.410	18	0.634	1.521	0.018
	Remaining	8.333	20	0.417		
	Total	19.744	38			
Arena of different spaces	Regression	17.827	18	0.990	1.997	0.05
	Remaining	9.917	20	0.496		
	Total	27.744	38			
At this stage of the research, according to the regression test in Table 9, the coefficient of determination for the indicators of basic concepts in architecture is (introversion) with a significance of 0.006 (F test is equal to 2.028).						

8. Adaptive and Comparative Analysis of Case Study Schools

The case study schools and standard deviation was analyzed by considering the conducted analyses and regression analysis in schools of Qajar and Pahlavi I eras.

Table 12 Analysis of schools of the Qajar and Pahlavi era and the deviation value (Source: authors)

Indices	Variables	Deviation		Dar Alfonun school of Tabriz	Roshdie School	Ferdowsi school of Tabriz	Anooshirvan school of Tabriz	Chamran school of Urmia	Teb school of Urmia
		Qajar	Pahlavi						
Design indicators	Suitable temperature	0.821	0.785	Opening and Ventilation inside spaces	Large openings and green space	Wide presence of trees and green space to reduce air pollution	Providing suitable temperature with a desirable orientation of the building	Opening all around the building	Using green space and tree all around the building of the school
	Light roof	0.793	0.724	Organizing chairs of the class by the maximum utilizing of the light	Large yard with very large openings	Entrance of the proper light through windows	Using the daylight by considering the visual comfort	Direct lighting of main spaces from the yard	Lighting from all around the building from the yard

	Sound	0.641	0.838	Separating official-service spaces from educational spaces		Using hallways and internal walls without the opening in the middle of the classes	The presence of closed porches all around the classes that face the yard, prevents sound in the space	-	Far from sport spaces and preventing from the sound
	Vision and landscape	1.181	1.169	Providing a landscape that faces the green space for classrooms, by installing windows with an appropriate height	Green space in the yard	View from the windows to the yard and from porches to the external yard	Providing a desirable view by using large windows and a closed porch	View from the windows of the classrooms to the main yard	The building is in the middle of the yard and has a good view from the classes to the yard
	Healthy weather	1.295	1.273	Healthy weather in the yard and transforming it into the internal space	Large windows on both sides create a healthy weather	Healthy weather in corridors through the draft through porches	Providing a suitable vision and healthy weather in half-opened porches facing the yard	Creating healthy weather in the middle corridor between classes	Healthy weather in classes with many windows
	Accessibilities	0.706	0.686	Accessibility from the yard to the classes	4 separate entrances through the court	Accessibility to the classes from the corridor	Accessibility from the internal yard and all around the yard, corridor, and classes all around the corridor	Accessibility from the main yard to corridors and classes	Accessibility from the main yard to the half-opened porch and by entering the corridor and classes
	Links	0.790	0.637	Directly from the yard to the classes	4 separate entrance-through the court	From the porch to the inside and connection corridors and stairs to the upstairs	Links through corridors and internal stairs	Internal circulation and links through the corridor	Links through the porch to corridors and classes
	Hierarchy	0.884	0.838	Entrance with entrance components of the yard and porch	Entrance from the yard and main porches	Entrance from the yard and from the porch to the corridor	Entrance from the internal yard to porches and the corridor	Corridor exist between classes	Link through the porch to the corridor and classes
	Spaces layout	0.754	0.711	Proper layout of all classes facing the yard	All around the central yard	Classes are organized between the corridor	Organization of the classes is all around the corridor which is in the form of a closed porch	Organization of the classes in between the corridor in the middle of the classes	Regular organization of the classes between the two corridors and connection as the hierarchy
	Full and empty spaces	0.754	0.938	Yard-Porch	Porches are open	Yard and porch-Closed stoop	The closed-porch yard	Main yard	Half-opened yard and porch
	Full and empty spaces	0.882	1.093	Half-opened space	A porch exists between the open and half-opened space	Open and half-open space with a porch and corridor between classes	External and internal yard-Open and half-opened space of porches	A large main yard and, like the new schools, without the porch	The main yard all around the building and half-opened porch
Shape indices	Shape	0.847	0.986	L-shape	Z-shape	H-shape	U-shape	Rectangular-square shape plan	Rectangular-shape plan

	Structural	0.822	0.826	Structure fitting the use (educational)	Structure fitting the school with the yard	Structure of school fitting with the external yard close to the new schools	The structure fits the new school	The structure fits the new school	-
	Square volume	1.142	0.852	-	-	-	-	-	Square-shape
	Rectangular volume	0.918	0.761	Rectangular-square	-	Square and rectangle	3 attached rectangular-square	Rectangular	-
	Free and effective forms	1.093	1.493	-	Clear shape	-	-	-	-
	Façade symmetric	0.923	0.731	asymmetric	symmetric	Symmetry in plan and view, rhythm in view	Symmetric and rhythm in view	Symmetry in plan and view, rhythm in view	Symmetry in plan-rhythm in view
	At least two stories above the zero level	0.560	0.549	Two stories	Two-stories	Three stories-	Three stories-	Two stories-	Two stories
Pattern indices	Central yard	0.766	1.085	inner courtyard	Coherence factor of surrounding spaces	It has two inner and outer courtyards	Outer courtyard and inner courtyard	Outer courtyard	Outer courtyard
Indices of the basic concepts in the architecture	Introversion	0.759	0.902	Introvert	Introvert	Introvert	Introvert	Extrovert	Extrovert
	Hierarchy	0.801	0.789	Entrance with entrance components of the yard and porch	Entrance from the yard and main porches	Entrance from the yard and from the porch to the corridor	Entrance from the internal yard to porches and the corridor	Corridor exist between classes	Link through the porch to the corridor and classes
	Peace and resting	0.795	1.016	Sense of peace inside the school building	Sense of peace and separation of accessibility of each class-sense of attachment	Reminder of traditional architecture-simple- historical symbols of survival	Sense of peace in the central yard and beautiful nature causes reduction of stress	Sense of movement around the corridor	Sense of peace inside the school building
	Spatial combination and definition	0.751	0.985	Combination of square and rectangle	Combination of square and rectangle	Combination of square and rectangle	Combination of square and rectangle	Combination of square and rectangle	Square
									

9. Open Coding for the Transformation of the Historical schools Concept

Interviews conducted

In introverted architecture, three problems of creating a favorable relationship between man and nature, setting environmental conditions for human life and logical connection with the features of the site are considered (Kedbaz: environmental and climatic factors, the presence of nature,...)

The internal order of traditional schools is geometric, symmetrical and with introverted architecture and with a special connection in the form of successive spaces between outside and inside (Kedbaz: geometric order,...)

In the architecture of traditional schools, the module and rhythm of the components play an important role in the quality of the expression of the space (Kedbaz: rhythm,...)

In these schools, it is possible to understand their good quality as the empty spaces dominate the spaces and evoke a feeling of lightness and transparency in people (Kedbaz: transparency,...)

The sequence of diverse spaces, dark and light, changes in the density of space, diversity in the degree of enclosure, size, direction, color, decorations, etc. can be considered as desirable measures for schools (Kodebaz: spatial diversity, decorations, color, ...).

In school architecture, human scale means the relationship between human dimensions, sizes and abilities with space or elements (Kedbaz: human scale,...)

Having the right identity and connection with sustainable values in native and traditional architecture. The school has a desirable personality and identity, which is the adaptation of form and function and concept in the body of the building (Kedbaz: form and function,...)

The school building is an effective element in the quality of image and urban architecture, which has the desired form and visual quality (Kedbaz: Urban image, ...)

Visibility and the importance of its role in the image and view from the distance of the city (Kedbaz: physical form, ...)

In the architecture of historical schools, paying attention to the skyline and the view from the far side of the city and creating the necessary legibility in the school's dimensions (Kedbaz: legibility, ...) (Source: authors).

9.1. Open Coding

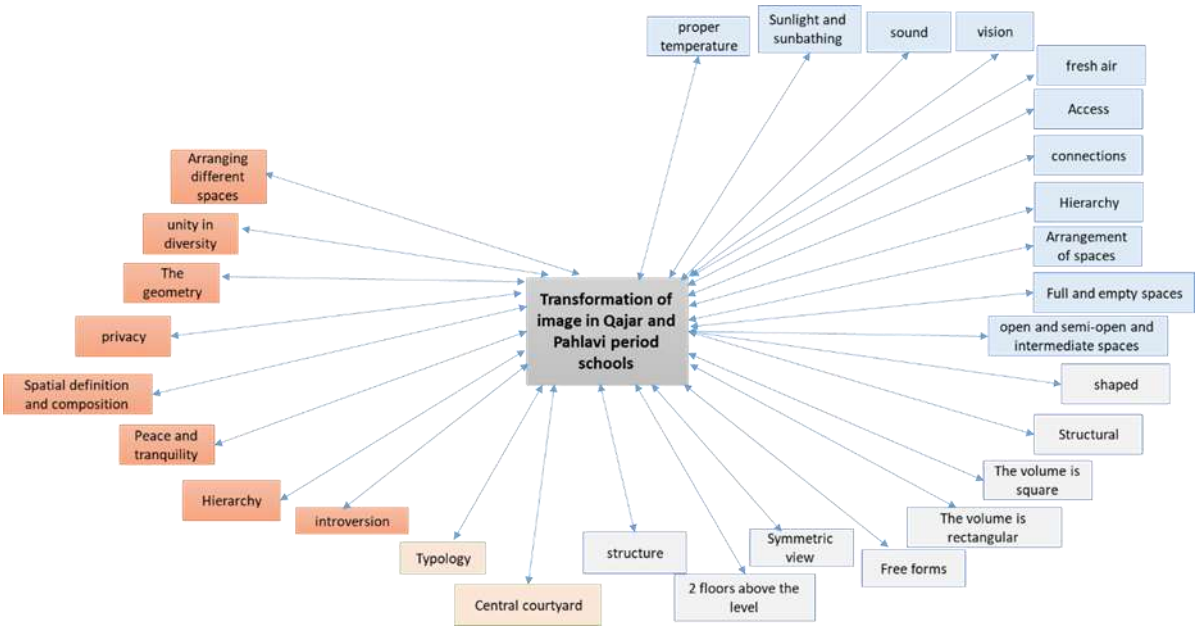


Fig 3 Open coding of semi-structured interviews with experts (Source: author)

9.2. Axial Coding

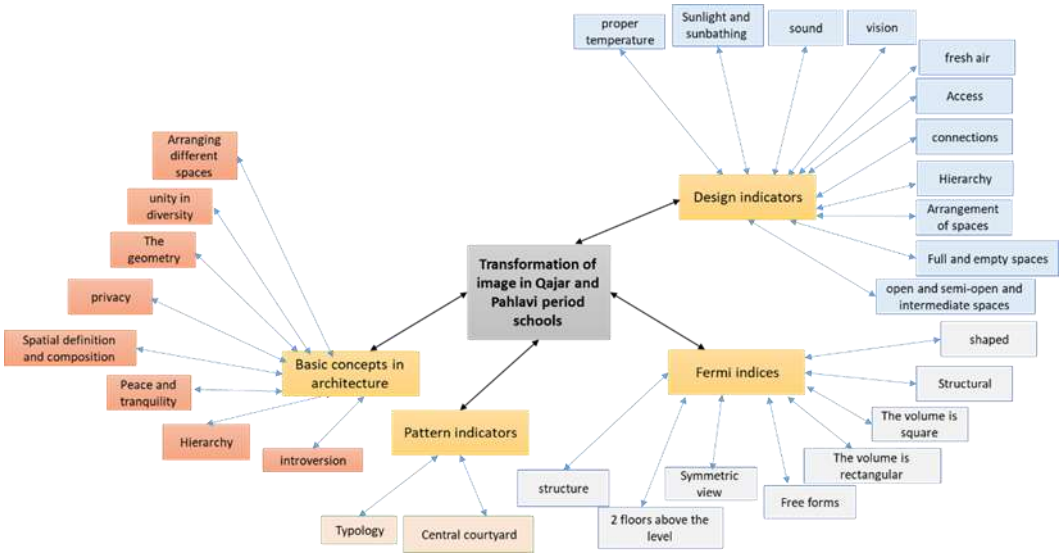


Fig 4 Qualitative model extracted from the process of open coding and interviews with experts (Source: author)

10. Smirnov's Kolmogorov Test

In this stage, after choosing the selected variables from the qualitative stage, a questionnaire is compiled and randomly distributed among space users. The results are entered into SPSS software, predictive relationships (regression) and correlation relationships are used for analysis. Two-Sample Kolmogorov-Smirnov Test is used to check the parametric and non-parametric type of data (Source: authors).

Table 13 Kolmogorov-Smirnov test to check the normality of the components of the paradigm shift indicators (Source: authors)

Variable	**Average**	**Standard deviation**	**Z Kolmogorov Smirnov**	**Asymp. Sig. (2-tailed)**	**p**
Components of the indicators of conceptual transformation	40/46	6/19	1/10	0/0170	0/177

As can be seen in Table 13, the Kolmogorov-Smirnov test for the score of the components of cultural changes and the indicators of paradigm shift is significant (p=0.177) and therefore the internal and external indicators do not have a normal distribution and non-parametric analyzes should be used for them. used. If the value of Sig is less than 500, it means that the test is significant and non-parametric tests should be used. Here, since it is less than 5 percent, it means that the non-parametric test should be used (Source: authors).

11. Cronbach's Alpha Coefficient of Statistics for Research in the Qajat Period

It can be stated that the best method of calculating internal consistency is to use Cronbach's alpha coefficient to measure the reliability of a questionnaire. This method is based on the coordination and compatibility of questionnaire questions. It is obtained by finding the variance of each question and the variance of the total of questions. Its calculation formula is as follows (Source: authors).

Table 14 Cronbach's alpha coefficient of the Qajar period.

Reliability statistics	
Cronbach's alpha	A number of cases
0/707	30

Table 13 Summary of the statistics of Qajar period research.

	Number	Percent
Items	30	100.0
Excluded	0	0.0
Total	30	100.0

The results obtained in Table 16 are as follows: The numerical value of Cronbach's alpha coefficient, which considers the 30 questions of the questionnaire, is equal to 0.707, which shows that the reliability of the questionnaire is average (Source: authors)

- Cronbach's alpha coefficient of research handling statistics in the Pahlavi period.

Table 16 Cronbach's alpha coefficient of the Pahlavi period.

Reliability statistics	
Cronbach's alpha	A number of cases
0/877	30

Table 15 Summary of the statistics of Pahlavi period.

	Number	Percent
Items	30	100.0
Excluded	0	0.0

		Total	30	100.0

The results obtained in Table 16 are as follows: The numerical value of Cronbach's alpha coefficient, which considers the 30 questions of the questionnaire, is equal to 0.877, which shows that the reliability of the questionnaire is average (Source: authors).

12. Architectural Solutions of Effective Indices in the Architectural design of Schools

Change in the overall structure of the school building, which stepped toward extroversion and increased the students' desire to be present in the school.

Change in the structure of micro spaces, creating new educational spaces in new schools.

Accessibility hierarchy, since new schools are extrovert and have new educational spaces.

Natural elements in the Qajar era used the central yard to provide light and ventilation, and afterward, since the middle of the Qajar era, the central yard was emitted and transformed to the extrovert type, and the green space should be used in yards of the school.

The introversion form should be maintained in the architecture of schools, and connection should be established through corridors.

Central organization in the plan of schools to create a visual connection and high clarity in the school space

Using linear organization in combination with the central organization to create numerous spaces, the more nonlinearity in the corridor and spatial opening, the value of its indices increased.

Using the visual type in an open space is an interaction to create a link between inside and outside using a method that links customers to each other.

Using more reliable and up-to-date heating equipment in renovated schools, the comfort temperature of students according to standards was not considered

Despite considering safety and aesthetic factors, the psychological matters in designing the pattern of windows and openings in renovated schools were not considered

Existence of hierarchy and green space as links between places, green space is the common link between places

Using rhythm, discipline, and connection between components coordinates them and creates the feeling of balance, belonging, being purposeful, clarity, spatial transparency, and comfort

Using Iranian architectural evidence, materials such as brick and using tilework and arches

Changes in the educational environment facilitate the flexible design of classrooms

Improving the quality of environmental factors by providing a proper ventilation system, providing sufficient light, and vicinity to the window to use the natural light and more view

Design of furniture and layout of the educational space to improve the psychological situation by creating a desirable educational atmosphere and improving the relationship between authorities and students (Source: authors).

13. Discussion and Conclusion

Changes in architectural methods occurred over history, and above all, the industrial revolution transformed the learning system of trainer-student into a desirable academic system. The arrival of civilization to Iran in the Qajar era caused a change and paradigm shift in school architecture. A significant transformation appeared in the architecture of schools through the establishment of Dar al-Funun. Before the Qajar era, mosques were the place of teaching and training. By separating schools from mosques and considering changes over time, the construction of schools using the novel method began in the late Qajar era, and most importantly, quick transformations in the Pahlavi I era affected the educational system of Iran significantly. Considering the analyses of

design indices in schools of the Qajar and Pahlavi eras, open spaces with different spatial elements like green space and pools are more observable in the Qajar era, while closed, half-opened, and in-between spaces with appropriate and human relationships are more considered in the Pahlavi era. Providing sufficient natural light is critical in all eras. According to analyses, using the central pattern in the school plan can be used as the design solution of fundamental factors for creating spatial unity, uniformity, and continuity between spaces of the school. Until the middle of the Qajar era, traditional schools of Iran maintained traditional patterns and skeletons; it consisted of a central yard with some chambers around it. But since the middle of the Qajar era and after changing education methods and the entrance of new methods, the old style of schools was not enough. In the late Qajar era, the role of the yard and introversion was reduced from the connection heart of a set to an open space. Since the middle of the Qajar era, a significant change appeared in the patterns of schools. The architecture of traditional buildings of the Qajar era is symmetric around one axis or two perpendicular axes. The main elements of the school building are placed on two sides of the axis and boost the centrality of the yard and general skeleton, which is seen in the case study schools. It seems that the educational evolution in the Qajar period can follow the concept of formal and physical continuity of the traditional Iranian architectural format and items such as the central courtyard and module and the framing of facades and symmetry, introversion and appropriate geometry And... it can be seen. The model of these schools includes a central courtyard with a number of classrooms around the courtyard. In the architecture of these schools, the form of introversion is maintained and communication is possible through the corridors. During the Qajar period, the cell part was removed and turned into a corridor and classroom, and later schools changed from an introverted type to an extroverted type. In a comparative comparison between traditional schools and modern schools, it is possible to point out the difference between centralism in the mosque of traditional schools and centralism and polarity in modern and modern schools in the analysis of plans and sections according to the basic concepts of architecture (order, proportions) , symmetry and axis, hierarchy) we can refer to the macro policy of the country during the time of Reza Shah, which was manifested in the form of the Shah, a symbol of power, centrality and axis, and also to the authority of Reza Shah, along with the import of science from the West, and his unconscious influence on the educational system. The architecture of traditional schools is often symmetrically formed around one axis or two perpendicular axes, the main elements of the school building are located on both sides of the axis and together with the design of the courtyard, they strengthen the centrality of the courtyard and the overall structure. The formation of educational spaces based on geometric form, central courtyard, introvert and extrovert type, privacy, spatial arrangement, communication and open and semi-open spaces have evolved in both periods. In the Pahlavi period, the central courtyard is lost and the linear form is replaced. During the Qajar period, Iran's schools maintained the traditional model, but from this period onwards, with the establishment of the Dar al-Funun, changes were made in school architecture. In the new era, imitating Western architecture and the dominance of the novel educational system are observable. Plan and architecture are not similar to old schools and are in the form of an extended rectangle. In this age, introversion is removed, extroversion is formed, and the linear state is replaced with the corridor in the middle and side flanges replacing the central yard. It creates shape diversity and changes in the architectural skeleton of schools. This point has been created in the building plan, internal performance, transformation, and paradigm shift in the entrance and yard of the school.

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