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Research Paper

The Relationship between Spatial Configuration and Accessibility in Improving Performance Quality of Elementary Schools for Boys in Shiraz, Iran; Case Study: Sehat, Maaref 6, Maaref 7, and Science and Life Schools

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ABSTRACT

As one of the environmental features in schools, accessibility seemingly plays a vital role in improving interaction between students and promoting environmental attraction in schools. This study aims to examine the role of accessibility components on the performance quality of students and analyze and evaluate the relationship between them. For this purpose, the effective components of accessibility in schools are extracted using library studies and reaching theoretical consensus in interviews with architecture experts. These effective components include connection and control, interrelationship of spaces, geometric proportions of communication routes, legibility of routes, natural landscape, and depth of space. A questionnaire is then designed and distributed among architecture students, and data analysis is done based on the correlation method and route analysis to explain the model and extract four functional, communicational, geometrical, and perceptual cycles. The nexus between components and their effects on each other are then analyzed in the final model. Depth of space affects the functional cycle of the model due to components of connection and control and geometric proportions of routes. Moreover, depth of space has a nonlinear relationship with the interrelationship component, expressing improved school performance quality. Also, spatial configuration has been used in the four schools selected through cluster sampling in Shiraz to analyze their spatial syntax through the space syntax software. According to collected studies in the final model of study, there is a definability between privacy and syntax index of space depth, routes' connection with syntax index of connection and connectivity, and finally between the route's invitation and syntax index of interrelationship. The results of the study indicate that the results of objective observations in configuration analyses are matched with the route analysis results in the final research model, and accessibility plays a substantial role in improving the performance quality of schools.

Keywords: Accessibility, Depth of Space, Connection, Interrelationship, Boys' Schools.

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1. INTRODUCTION

The number of educational spaces has considerably increased over recent years in Iran due to the establishment of educational institutions, non-profit and non-governmental schools, cultural and art centers, and educational centers in various fields. This factor has provided the field with a severe competitive space in educational environments. On the other hand, the development of various educational spaces has led to some problems for society, such as the establishment of centers without facilities. Often, these kinds of centers are created in environments where buildings have no association with educational performance and their previous use has been generally residential. Therefore, such contexts would not have a useful function and performance for audiences and users. In this case, the successful institutions are those providing a functional environment with high quality for students and researchers.

Education and educational and learning spaces have often the highest influence on the society and formation of civilizations (Torkaman, Jalilian, and Dezhdar 2019). The development of educational centers in improper places has led to adverse effects on the pedagogy system (Heidari, Yazdanfar, and Behdadfar 2014). In one of the definitions, Carmona and De Magalhaes (2009) presented 12 measurable factors for environmental quality that include regularity, accessibility, attraction, comfort, inclusiveness, durability, functionality, distinctive, secure, solid, complete, green, and pollution-free (Carmona 2018). Therefore, these factors can be examined in schools to measure and evaluate the environmental quality rate of indoor and outdoor spaces. Modern pedagogy and learning emphasize the constant interactions between individuals and environmental resources (Greeno 1998). It means that the school environment must perform as a vital and dynamic factor, and affect the education quality of students. To create such interaction, the design of spaces for students' activities, proportions and hierarchy of entrance to spaces, accessibilities, connection and continuity between spaces, privacy, legibility of routes, natural landscapes, and general configuration of spaces are important points that must be considered in architectural design of schools. Accordingly, learning environments and schools are the most effective spaces in the pedagogy process affecting the selection of schools by students and their parents; hence, the spatial arrangement of schools is an important factor for improving the academic performance of students. In this regard, this study aims to identify the accessibility components in the performance quality rate of schools by analyzing the space configuration and syntax. Finally, the research question is designed as follows:

- What are accessibility components affecting the improvement of performance quality of schools?

Therefore, this study assumes there is a significant relationship between spatial configuration and accessibility, and accessibility has an effective role in improving the performance quality of schools. To test the hypothesis, the components of accessibility in schools were first extracted by using authenticate research methods, and then the relationship between them was addressed by using route analysis. In the next step, the space syntax method was used to analyze the same components and relationships in random samples of schools located in Shiraz. Accordingly, the conceptual model of the study has been illustrated in Figure 1. The conceptual model has been proposed by expressing components and the relationship between them. accessibility and legibility of routes natural landscape

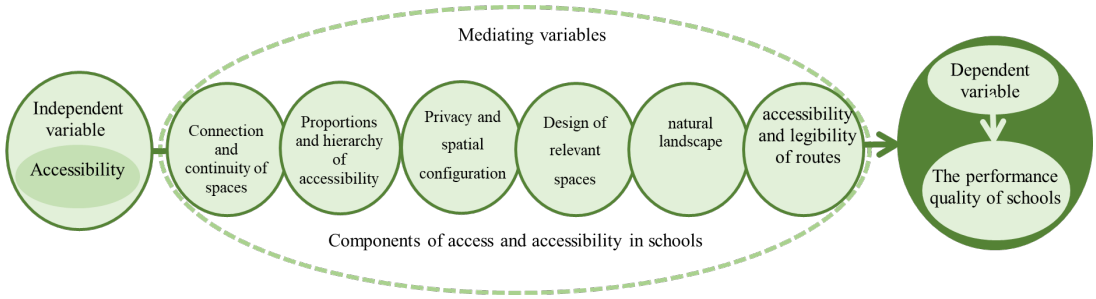


Fig. 1. Conceptual Model of Variables Studied in the Research

2. BACKGROUND

According to collected studies, the factors affecting students' learning in schools are classified into four categories: teacher's skills, educational course conditions, education environment, and conditions and amenities of the classroom (Butt and Rehman 2010). Moreover, access has been known as an important element in architectural design (Zallio and Clarkson 2021). Architects have paid attention to the tole of light, color, and play in the learning space over several decades (Mozafar, Mahdizade Seraj, and Mirmoradi 2009). The criteria of the spatial arrangement of the school environment, such as moving in the space, flexibility, connection between

indoor and outdoor space, and classroom' furniture may affect the users' learning (Azemati, Aminifar, and Pourbagher 2016). Some factors, including spatial dimensions, legibility and accessibility, space beauty, realm, and participation of individuals can improve users' satisfaction (Pourbagher 2013). In addition, geometry, scale and physical dimensions of schools' space, and geometric organization of classrooms will enhance the sense of curiosity and aesthetics. Creation of some suitable landscapes between indoor and courtyard spaces, wide corridors with broad lighting, decorations, green indoor space, etc. can effectively decrease fatigue and increase students' performance (Abbaszadeh, Rashid Koliver, and Rezaei Sharif 2019).

Proper and sufficient access to spaces that can be operated publicly would improve the presence in that space (Carr 1998). In environmental perception, the space is usually examined based on the distance, depth, size, and movement of individuals (Benedikt 1979). Accessibility depends on a person's mobility, the location of activities compared to the start point of the person, and times when activities are available (Lau and Chiu 2004). Routing is a purposeful, directed, and exciting activity serving as a process for determining and looking for the route between the origin and destination (Golledge 1999). A simple definition of accessibility indicates how fast a person must walk or pass how far to reach a certain destination. This concept implies the spatial connection between the origin and destination, and or the degree of continuity between that location and other locations in a certain area. However, accessibility has been defined as the relative closeness or adjacency between two places (Yin and Xu 2009). Access is a dynamic act rooted in comfort or the cost and time required for reaching considered activities and destinations. Therefore, a suitable location for activities is highly important (Taghvaei, Sheykh Baygloo, and Bandali 2010). Access is mainly divided into two relative and hybrid types. Relative access describes the connection or rate of interaction between two certain locations, while hybrid access defines interaction between one location and other locations in a geographical space (Rahnama and Lyth 2007). In some gathered studies, accessibility has been defined as spatial justice meaning the proper and balanced access to physical and social infrastructures of society while considering the living standards, opportunities, and potentials of this notion (Fasihi 2022). Moreover, the satisfaction of space users depends on physical, visual, mental, and cognitive factors. In other words, the mental routing of users based on the physical factors and access patterns would improve the users' satisfaction (Hanaee et al. 2022). Moreover, the mental image has a relationship with the physical arrangement of space and mental comfort rate (Daneshpour and Charkhchyan 2007). Therefore, access is sufficient if population density is matched with the spatial distribution of performances (Unal, Uslu, and Cilek 2016).

Many studies have been done among around 100 references to Latin and Persian books and relevant academic papers. Due to numerous available references, the frequency table has been presented as the summarized background of the study. These studies have been done on factors affecting accessibility, including spatial connections, spatial circulation, spatial dimensions and depth, spatial legibility, movement circulation, movement pattern of users, and green space extension in the movement routes, which are coded based on the topic frequency in Figure 2.

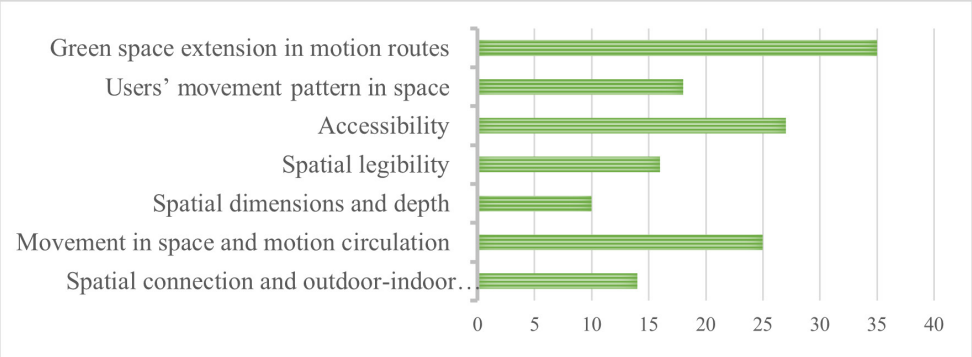


Fig. 2. Classification of Categories based on the Topic Frequency in References related to the 2000-2018 Period

3. THEORETICAL FOUNDATIONS

Regarding the spatial arrangement of schools improving the academic performance of students and considering the importance of learning environments and schools in the pedagogy and education process, theoretical foundations were assigned to the expression of schools' quality, accessibility, components, configuration, and space syntax.

3.1. Accessibility and Quality of Schools

It is a wrong approach to consider the educational

environment as a space limited to the building' inside. The educational environment indeed comprised open, closed, and semi-open spaces and all elements belonged to that space. The spatial quality of the school or filled space, open spaces or courtyard, covered spaces, physical arrangement, and relationship are the most important aspects in the design of schools. In most modern schools, the architectural design of the school, buildings has been shaped without considering and analyzing the site's features, and the courtyards of schools are the part of land that remained without design (Kamelnia 2009). In the opinion of Descartes, when we remove an object from its surrounding space then its extension still exists as a spatial feature. Therefore, space is the generalized extension prefix or object-less extension, and its extension is not removed after deleting an object from space (Hillier 1996).

The first presumption for the design of a good space is accessibility to that space. In the opinion of Tibbalds, it is important whether we can allow all individuals to choose providing them with diversity in access to various activities and places (Tibbalds 2015). There is indeed a relationship between spatial circulations, circulations, accessibility, and visibility of the space and access to the space, which is called physical access by Tibbalds, and itself leads to security and positive performance of space. Also, physical access is one of the most important spatial dimensions and features for creating opportunities required for social interactions. When users interact with each other would feel a stronger relationship with their places (Daneshpour and Charkhchyan 2007). Different schools, such as social schools and open schools with classrooms have been experienced in some countries (Saghafi 2017). It is about one century in Iran, however, that the imported linear pattern of classes arranged in a corridor is repeated in various native and cultural conditions and climates. The history of this pattern goes back to the military schools in the UK, which were used in Darolfonoon of Tehran (Soltanzadeh 1985).

According to gathered studies, the features related to access criterion in the educational environment include enclosure limit and realm of spaces proportions of corridors and communication routes, invitation rate of entrance, various functions in the spaces, and indoor-outdoor connection (Lotfata 2008). The size of corridors and interior design, used materials and the lighting in the schools' corridors can positively affect the users' behaviors. The space of entrance must be more attractive and inviting compared to other spaces to encourage students to be present in the space creating proper mental preparedness in them for learning before entering the school (Sarchami and Heravi 2015). Ultimately, this study illustrates Figure 3 to introduce the effective components of accessibility in improving the quality of schools based on the available studies and categories derived from the frequency table of studies related to the research background.

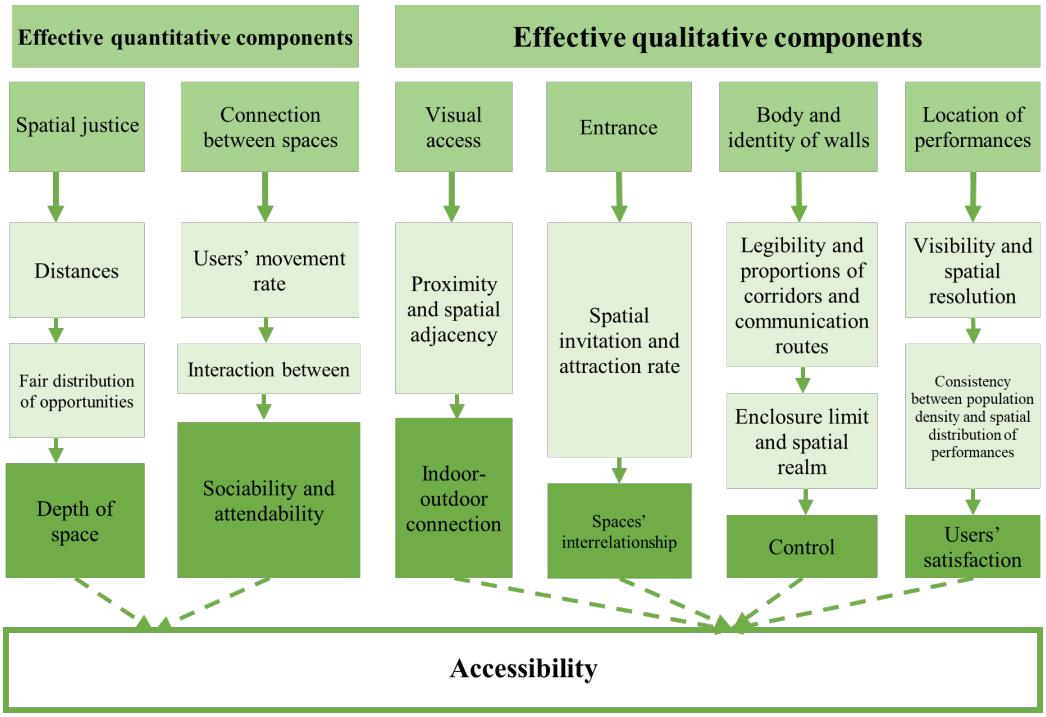


Fig. 3. Effective Qualitative and Quantitative Components of Accessibility

3.2. Spatial Configuration-Framework of Initial Foundations of Study

Various theories are now used to examine the quality of spaces. In this lieu, space arrangement theory including some theories and techniques for analysis of space configuration appeared in the late 1970s by Bill Hillier, Julian Hanson, et al. in the Bartlett School of Architecture and Design of London College after several years of studying and findings effective factors and patterns existing in the forms of indigenous settlement space (Bazaei et al. 2020). These theories have been used by famous individuals, such as Normal Foster and Richard Rogers. Some individuals who have conducted many studies on space layout theory are Hillier, Dalton, Congreve, Hana, Turner, and Vaughan (Mahvari, Ghalehnoee, and Mokhtarzadeh 2021). Space syntax is a method for a better understanding of complexities in space, morphology, and behavioral patterns (Hillier et al. 1993). The definition and explanation of spatial configuration by Hillier point to the generality of architecture more than its details. Configuration is indeed a set of complex and internal relationships between objects in the general structure of space. configuration exists anywhere that a connection and relationship exist between two spaces, so that configuration will change when this relationship is changed. Therefore, the configuration is a collection of relationships in that each relationship is obtained through relationships with other elements (Hamedani Golshan, Motallebi, and Behzadfar 2020). Spatial configuration can considerably affect complicated social processes, including stabilization through its effect on the movement pattern (Hillier, Greene, and Desyllas 2000). Creation and distribution of such different configurations would convert the space into a powerful initial matter for transferring culture through settlement buildings and shapes, also to strong tool to discover and create architecture. Analysis of spaces and performances based on their configuration relationships and searching common patterns among samples help to understand how buildings can convey common cultural tendencies through spatial form. Spatial configurations, in turn, provide a range of limitations and potentials. Architectural space may follow some restrictive rules to determine morphological limits in which, relationships between form and performance in buildings are determined (Hillier 1996). Therefore, configuration is effective in creating order, making events understandable, and helping to find spatial goals, so analysis of configuration can play an effective role in improving spatial performance.

Regarding the space syntax attitude to reach final analyses, this study has addressed the available factors in the building space, including connection, interrelationship, control, and depth of space. Connection is defined as the number of points that are directly connected to other points, and interrelationship expresses the continuity with separation from the whole system. There is a linear relationship between these two indicators meaning that the higher interrelationship equals the higher connection (Bazaei et al. 2020). One can predict the number of passing people using interrelationship radius in the space arrangement technique. There is a relationship between space interrelationship ratio and space use, and or the number of passing people, which is called Movement Potential (Penn 2003). Also, this technique helps to measure the legibility rate of a space, so that the higher the interrelationship ratio of a space improves the movement potential of individuals making space suitable and desired for users (Bahrainy and Taghabon 2012). The concept of depth of space indicates the private or public level of space that identifies the farther spaces (Penn 2003). The concept of depth is defined as the number of steps that must be passed to transit from one point to another location. The concept of control is a parameter specifying the authority rate of one point from other points to which it is connected. Recognition of conceptual connection between components relying on the space syntax technique is an introduction to creating modern architecture patterns (Bazaei et al. 2020). On the other hand, this theory indicates that the relationship between activity and space is more definable in the relationships between spaces or spatial configuration and communications between audiences and social interactions rather than space' features. This kind of attitude towards space allows the quantitative recognition of social behaviors that are usually qualitative (Ghalambor Dezfooli and Farzadi Moghadam 2018).

4. METHOD

Regarding the research title and objective considering the role of two configuration and accessibility factors in improving the performance quality of schools, the relationship between these two factors must be evaluated and analyzed precisely in this study. To do this, components of accessibility space configuration and syntax are extracted and analyzed separately, and finally, the relationship between these two factors is examined. Therefore, the research method has been designed within two field and adaptation-evaluation phases as reported in Table 1. The first phase includes a field method that is formulated in four steps library studies, interviews, questionnaires, and observation. In This lieu, the authentic books and papers are reviewed to collect the components affecting the schools' accessibility, and then the theoretical framework of the model is illustrated based on the components extracted from research bases. The components extracted from the first step of the studies include quantitative components of space depth, sociability, and qualitative components

of an indoor-outdoor connection, interrelationship of spaces, control, and satisfaction of users, which are evaluated in the next analyses.

Table 1. Research Process and Phases

Phase	Step	Research Process	The Outcome of the Research Process
First (Field)	1	Library Studies	Components extracted from studies and designing the theoretical framework of the model
	2	Interview with Architecture Professors and Experts	Assessing the quality of the theoretical model
	3	Closed-Ended Questionnaire of Users and Correlation Test	Designing the final model of study and determining the relationships between factors affecting the schools' space
	4	Objective Observations	Examining the scalability of outdoor space with indoor space
Second (Adaptation and Evaluation)	1	Spatial Syntax Data and Analyses of Schools	Space syntax and examining interrelationship, connection, spatial depth, and control in studied schools
	2	Adaptation	Adaptation and evaluation of relationships between final subcomponents of research

In the interview with several architecture experts and professors in the second step, the quality of the theoretical model is examined, and then the questionnaire is prepared and designed based on the final effective components in the third step and is distributed among 179 architecture students that were sampled as the sample size based on the simple random method and Klein's perspective. The validity and reliability of the questionnaire are assessed through two techniques of face validity based on the experts' consensus and utility rate of components for examining the considered goals and the content validity by gathering the table of objectives. The final content of the relationship between objective and content has been assessed based on the experts' opinions. Also, the reliability of the questionnaire is calculated based on Cronbach's alpha, which equaled 0.959 expressing the data homogeneity and reliability of the questionnaire's results. In the data analysis of the questionnaire, a correlation test is done to determine the relationships between factors affecting the schools' space regarding accessibility, which results are reported in Table 2.

Table 2. Results of Correlation Test and Pearson Coefficient

Components	Quality of Schools	Interrela-tionship	Proportions of Routes	Spatial Leg-ibility	Connec-tion	Control	Depth of Space	Natural Landscape
Quality of Schools	1.000	0.817	0.621	0.684	0.869	0.742	0.794	0.657
Interrelationship	0.817	1.000	0.568	0.570	0.764	0.659	0.632	0.499
Proportions of Routes	0.621	0.568	1.000	0.266	0.576	0.472	0.396	0.378
Spatial Legibility	0.684	0.570	0.266	1.000	0.691	0.568	0.591	0.606
Connection	0.869	0.764	0.576	0.691	1.000	0.640	0.692	0.620
Control	0.742	0.659	0.472	0.568	0.640	1.000	0.725	0.395
Depth of Space	0.794	0.632	0.396	0.591	0.692	0.725	1.000	0.529
Natural Land-scape	0.657	0.499	0.378	0.606	0.620	0.395	0.529	1.000

The final model of research is then designed based on the causal relationships and route analysis technique through AMOS Software, and several indicators are used to evaluate its fit. Table 3 reports the acceptable rate and range of each indicator of the model that indicates the final fit of the model. The mentioned model examines and analyses the relationship between components.

Table 3. Model's Fit and Acceptability Indicators

Fit Index		Model	Acceptable Range
CMIN	Chi-Squared	0.024	>0: Less Fit
CMIN/DF	Ch-Squared/df	0.024	<2: Perfect Fit Between 2-5: Good Fit >5: Poor Fit
P	Significance and Probability Level	0.876	>0.05: Acceptable Model
GFI	Goodness of Fit	1.00	>0.95: Better Fit
CFI	Comparative Fit Index	1.00	>0.95: Better Fit
NFI	Normalized Fit Index	1.00	>0.95: Better Fit
RMSEA	The Root-Mean-Square Error of Approximation	0.00	>0.10: Poor Fit Between 0.08-0.10: Moderate Fit Between 0.05-0.08: Good Fir <0.05: Perfect Fit

After extracting the components analyzing the statistical model and finally confirming the relationship between accessibility and improved quality of schools' performance, the final step of the first phase is shaped due to creating a complementary process in the research process based on the space configuration and syntax of objective observations. For this purpose, four schools have been selected based on cluster sampling. In the process of cluster sampling, schools for boys are first selected among the schools for girls and boys. Among the four districts of Shiraz, those schools with open courtyards and in-between spaces as the connecting bridge with closed spaces where their courtyards had behavior and performance with the surrounding environment were chosen. Four schools of Sehat, Maaref 6, Maaref 7, and Science and Life are randomly selected. In these schools, interrelationship, connection, spatial depth, and control are examined through Space Syntax software. This software has been used due to the examination of the scalability of outdoor space with indoor space, and results of space syntax analyses have been proposed in the discussion and analysis of findings.

Ultimately, the second phase includes adapting data and analyses obtained from spatial syntax in schools with the relationships between extracted subcomponents of the final model. Also, the optimum rate of accessibility in each school has been separately examined in the final results of the study. Therefore, a statistical assessment of the relationships between these components has been presented based on the subcomponents of configuration and accessibility factors.

5. DISCUSSION AND ANALYSIS OF SPACE SYNTAX SOFTWARE'S RESULTS

In the third step of the field step of research, the components obtained from the analysis of the questionnaire have been modeled based on the correlation relations and route analysis method. In the final model presented in Figure 4, the mechanism of components on each other and the covert relationships between them have been identified. Moreover, the significance of the relationships between variables and the effect rate of each component has been measured as the route coefficient.

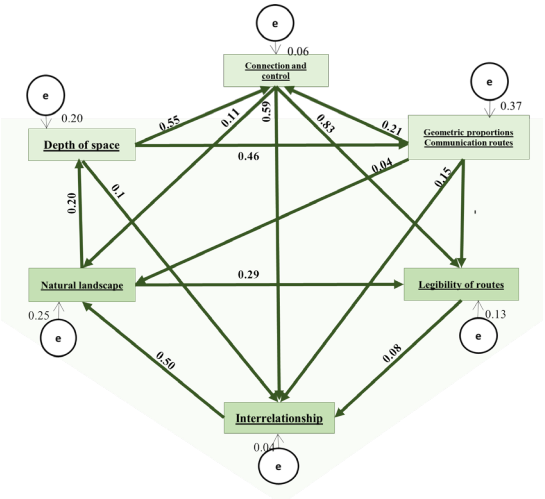


Fig. 4. The Final Model of the Relationship between Accessibility and Performance Quality of Schools

Table 4 reports direct effect, indirect effect, sum of effects, and standard error of the relationships between variables affecting the performance quality of schools. In addition, the effect of all available relationships and intermediate variables has been estimated.

Table 4. Rate and Effects of the Relationships between Components in the Model

Relationship between two Components			Direct Relationship	Indirect Relationship	Sum	Standard Error	Impact Rate	Intermediate Variable
Depth of Space		Connection and Control	** 0.632	** 0.176	** 0.552	0.040	30%	Geometric Proportions
Geometric Proportions	→	Connection and Control	** 0.319	Does not have	** 0.212	0.030	5%	--
Connection and Control	→	Natural Landscape	-- 0.075	Does not have	-- 0.106	0.204	--	--
Connection and Control	→	Legibility of Routes	** 0.646	-- 0.140	** 0.828	0.085	70%	--
Natural Landscape	→	Legibility of Routes	** 0.317	* 0.138	** 0.288	0.054	10%	Depth of Space
Depth of Space	→	Interrelationship	** 0.156	** 0.592	* 0.145	0.050	5%	Connection and Control
Connection and Control	→	Interrelationship	** 0.556	Does not have	** 0.592	0.075	35%	--
Geometric Proportions	→	Interrelationship	** 0.210	Does not have	** 0.148	0.029	2%	--
Geometric Proportions	→	Natural Landscape	-- 0.039	* 0.190	-- 0.037	0.077	--	Interrelationship
Legibility of Routes	→	Interrelationship	* 0.091	Does not have	-- 0.076	0.042	--	--
Geometric Proportions	→	Legibility Of Routes	** 0.228-	** 0.301	** 0.194-	0.050	5%	Connection and Control
Interrelationship	→	Natural Landscape	-- 0.377	Does not have	* 0.499	0.193	25%	--
Natural Landscape	→	Depth of Space	** 0.243	Does not have	* 0.197	0.087	5%	--
Depth of Space	→	Geometric Proportions	** 0.349	Does not have	** 0.459	0.097	20%	--
			p > 0.05 --		p < 0.05 *			p < 0.01 **

According to the table that indicates the mechanism of variables' effect in the model and significant direct and indirect effects of relationships between some components, the effect of "depth of space" on "connection and control," "geometric proportions" on "connection and control," "connection and control" on "legibility of routes," "natural landscape" on "legibility of routes," "depth of space" on "interrelationship," "connection and control" on "interrelationship," "geometric proportions" on "interrelationship," "geometric proportions" on "legibility of routes," "interrelationship" on "natural landscape," "natural landscape" on "depth of space," and finally the effect of "depth of space" on "geometric proportions" is significant at confidence level of p smaller than 0.01 and 0.05.

In general, the final model of study comprises four functional, communicational, geometrical, and perceptual cycles that are depicted in Figure 5. The relationship between "interrelationship," "natural landscape" and "legibility of routes" has created a cycle called the functional cycle in which, the determination coefficient of the model's effect on the improved quality of performance is around 81%. Also, two cycles exist between "depth of space" and the functional cycle. The first cycle called the communicational cycle, is "depth of space" through "connection and control" with a determination coefficient of 69.7%, and the second cycle called the geometrical cycle through "geometric proportions of communication routes" with a determination coefficient of 15.4% will lead to the functional cycles of "interrelationship > natural landscape > legibility of routes > interrelationship" and finally, both cycles again affect "depth of space." On the other hand, the component of "depth of space" directly affects the "improvement of performance quality of schools" in a cycle called perceptual, which indicates the nonlinear

relationship between these two variables. In other words, "depth of space" would improve performance to a certain extent. Moreover, Improved quality would promote the natural landscape which again affects the depth of space. The determination coefficient of the model effect on "depth of space" is around 19.8% in this cycle.

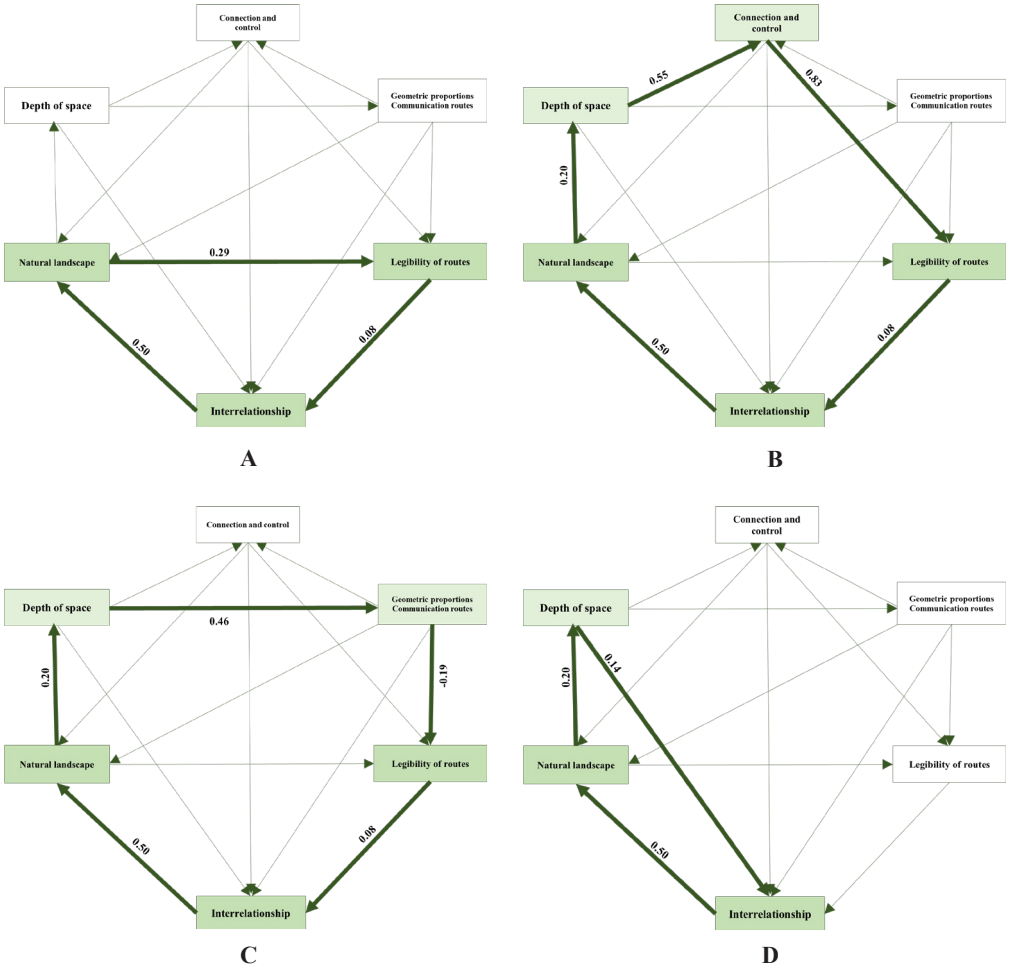
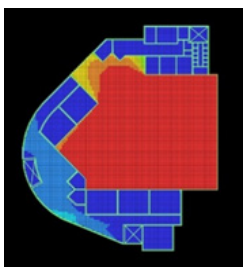
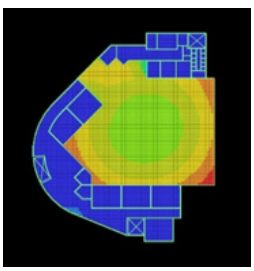
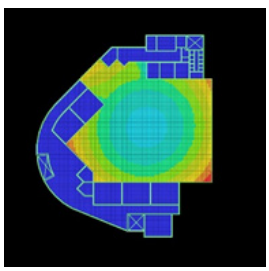
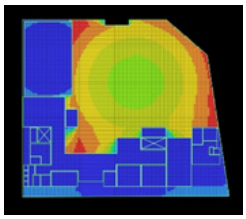
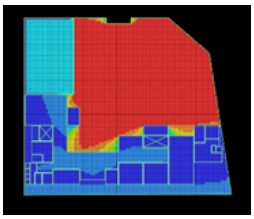
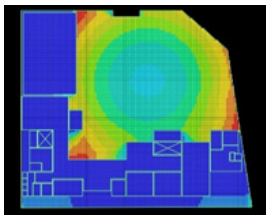
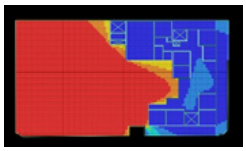
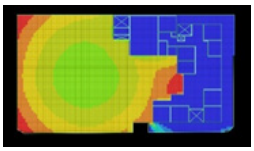
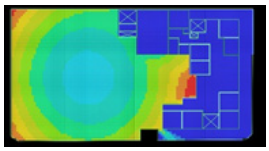
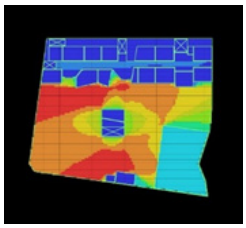
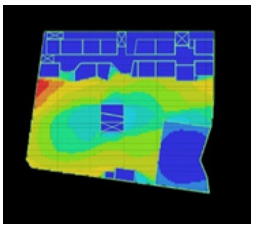
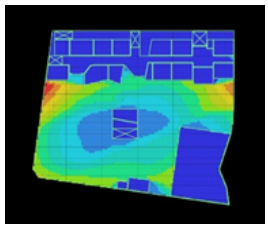


Fig. 5. Final Cycles of Model (A) Functional Cycle, (B) Communicational Cycle, (C) Geometrical Cycle, (D) Perceptual Cycle

In the research process and step of objective observations, the indicators of connection, depth of space, and interrelationship have been drawn in analyzing the configuration of Sehat, Maaref 6, Maaref 7, and Science and Life schools through Space Syntax Software, which its output data have been extracted from the main entrance gate of the school, the entrance gate of building to the courtyard, courtyard, playground, conference hall, and gathering space. The obtained are reported in Figure 6.

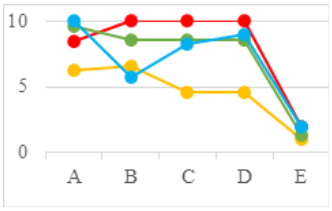
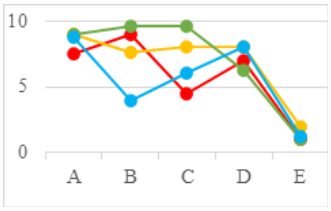
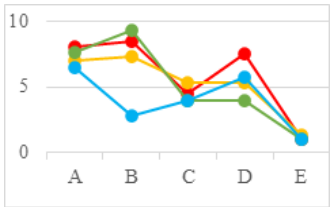
Fig. 6. Results of Graphic Data Obtained from Space Syntax Analysis in Studied Schools

Schools	Syntax Index of Connection	Syntax Index of Depth of Space	Syntax Index of Interrelationship
Sehat School			

Schools	Syntax Index of Connection	Syntax Index of Depth of Space	Syntax Index of Interrelationship
Maaref 6 School			
Maaref 7 School			
Science and Life School			

In this figure, the syntax index of connection means the direct relationship between the courtyard and side space existing in the courtyards of schools, including the main entrance gate of the school from the street side, the entrance gate of the school's building to the courtyard, playgrounds, conference halls, corridors, and access staircases and gathering spaces that are shown as a colorful spectrum. The rating degree of the colorful spectrum becomes greater from blue to red colors. The syntax index of interrelationship expresses the continuity of space with the wholeness of the schools' space. As shown in the diagram, the higher the interrelationship leads to higher the connection. Moreover, private or public levels of spaces can be determined based on the interrelationship index. The distance between spaces has been addressed in the diagram of the syntax index of depth of space. In the next step, diagrams of the studied schools' configuration analysis are drawn separately the diagrams of syntax index of connection, depth of space, and interrelationship have been compared and analyzed in Table 5.

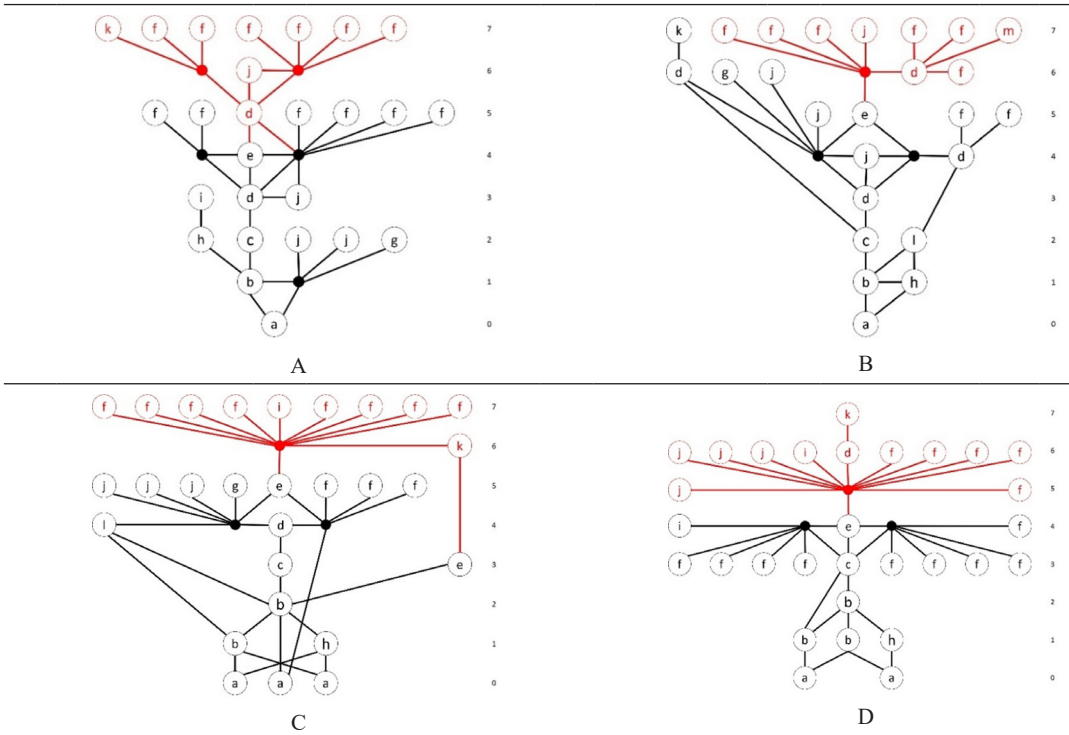
Table 5. Comparative Diagrams of Syntax Indicators of Connection, Depth of Space, and Interrelationship in Studied Schools

Connection	Depth of Space	Interrelationship
		

—	Sehat School	—	Maaref 6 School	—	Maaref 7 School	—	Science and Life School
A	The Main Entrance Gate of the School	C	Courtyard	E	Conference Hall and Gathering Spaces		
B	Entrance Access to the Courtyard	D	Playground				

Moreover, the access graph of spaces in studied schools has been separately illustrated in Table 6 to evaluate the depth of space and control indicators. As expressed before, the control is less over those spaces that have a lower degree of choice than other spaces.

Table 6. The Access Graph of Spaces in Studied Schools



Ground Spaces and Accesses ■ Floors' Spaces and Accesses ■

a	Entrance from the Street to the School	d	Lobby and Gathering Space	g	Management Department	j	Administrative Department	m	Library
b	School's Courtyard	e	Connection Staircase of Floors	h	Playground	k	Conference Hall		
c	Building's Entrance	f	Educational Classrooms	i	WC	l	Pray Room		

Analyses presented in Table 4 and Figures 4 and 5 are related to the path analysis of the final model and the role of accessibility components in improving the performance quality of schools. The results show that the factor of time has led to a significant relationship between components of accessibility and improvement of performance quality of schools. Also, estimates related to objective observations, space configuration, and syntax of studied schools in Figure 6 and Table 5 indicate that regarding the effective role of accessibility components and syntax indicators of connection, depth of space, and interrelationship in schools as well as the connection between spaces in the access graph of Tale 6, two factors of configuration and accessibility play a vital role in improving performance quality of schools.

6. CONCLUSION

Invalidation of the research hypothesis that points to the significant relationship between spatial configuration and accessibility, the conceptual model expresses the relationship between components, and a final statistical model is proposed to measure the components. Moreover, the following results can be provided based on the final findings and analyses:

1. According to available statistical analyses in the functional cycle in the schools by determining spaces' inviting rate, the component of "interrelationship" can be pointed that shows a space's continuity with or separation from other spaces. For instance, some solutions and strategies, including the design of a defined entrance for spaces, installing signboards in communication routes, diversity of materials and distinction in color design of connecting points of spaces, lack of movement barriers in the connection routes between spaces, etc. can effectively improve the inviting rate of spaces and interrelationship between them. Improved connection and continuity between spaces in schools can increase the visual view of spaces, and this continuity certainly passes through open and green spaces. Therefore, some windows and openings are designed in the connection routes towards green space regarding the need for the natural landscape. Finally, improved spatial transparency in wall-less routes and lack of visual barriers would increase the legibility of spaces which in turn affects the connection and continuity of spaces in schools.

2. Regarding the communications available in the communicational cycle, the depth of spaces can be defined based on the privacy indicators. It means that the hierarchy of privacy and realms defined for separating private and public spaces in schools can create desired results in the design of schools and express the depth of each space compared to other spaces. One positive outcome of creating clear privacy between spaces is forming in-between spaces with certain uses in connection routes, providing direct access between functions, creating the landscape in connection routes, and so forth that strengthen the connection between spaces. Such spatial connection and continuity would improve controllability and remote monitoring of access routes forming an environmental security in schools' space and onset of functional cycle. Ultimately, this cycle affects the formation of privacy and depth of space.
3. According to final analyses of the geometrical cycle, the depth of space affects not only the privacy but also the dimensions and size of access corridors, shape, and form of routes. Moreover, the constituency between spaces' function and shape or form of routes would lead to consistency between passing users' density and dimensions of connection routes. On the other hand, a lack of complexity in the routes would initiate the functional cycle by improving the legibility of routes and finally affect the depth of space.
4. According to statistical analyses in the perceptual cycle, the effect of privacy and realm is seen in improved continuity and interrelationship between spaces in deep levels of schools' spaces. The outcome of this connection and cohesion would improve the visual connection with outdoor space shaping the natural landscape in indoor space of schools. Therefore, the concept of nature experience in this study emphasizes mental perception and evaluation of environmental features. This experience occurs inside the person and its effects are more exchanged between person and environment over the long term.
Moreover, statistical analyses in the final model of the study indicate that the parameter of rime affects all mentioned components and cycles, and improves the performance quality of schools. Therefore, a significant relationship exists between spatial configuration and accessibility, so the research hypothesis is confirmed. This hypothesis indeed has become a theory expressing that accessibility components and syntax indicators of connection, depth of space, and interrelationship play an effective role in improving the performance quality of schools. Moreover, the relationships between available components and errors indicate that the highest CR belongs to the depth of space indicating that more exogenous variables can be found that affect the depth of space to complete the model and achieve a higher fit rate. Therefore, it has been proposed as a recommendation for research development in the future.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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The authors state that they have directly participated in the stages of conducting research and writing the article.

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