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Investigating the Impact of School Physical Environment Quality on Attention Deficit Hyperactivity Disorder; A Case Study of Six Schools in Different Districts (2, 5, and 9) of Tehran (Students Aged 7 to 10)*

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ABSTRACT

Attention-Deficit Hyperactivity Disorder (ADHD) is one of the most common behavioral disorders in children and can have negative effects on students' academic and social performance. The physical environment of schools is recognized as an important factor in shaping students' behavior and attention. The issue addressed in the present study is the evaluation of children's educational centers that, in terms of architectural physicality and types of activities, do not align with the real needs of students with ADHD. Accordingly, the relationship between the quality of the physical environment in schools and ADHD among students in six schools in Tehran was investigated. This study is applied in nature and utilizes correlation and stepwise regression methods. Survey instruments included the standardized Conners questionnaire, a school physical environment quality questionnaire comprising eight environmental indicators (air quality, acoustics, lighting, thermal comfort, façade, layout, green space, and color), and a questionnaire for evaluating moderating factors (teacher, individual intelligence, academic status, and family income). The selected schools were: Alborz Boys' School and Shahid Fahmideh Girls' School (District 2), Ibn Sina Boys' School and Moftah 1 Girls' School (District 5), and Shohada-ye Moallem Boys' School and Afsharian Girls' School (District 9), chosen through cluster sampling. The study subjects consisted of 100 students diagnosed with ADHD (aged 7 to 10 years; 44 boys and 46 girls) and 124 of their teachers. The schools were assessed using the Physical Environment Evaluation Questionnaire, and the contribution of each environmental dimension was determined. The physical environment components—green space (standard coefficient +0.15), layout (–0.08), façade (–0.19), lighting (–0.20), color (–0.32), environmental comfort (–0.31), and acoustics (–0.12)—played a determining role in reducing ADHD symptoms. The results indicated that the eight indicators of school physical environment quality and three moderating factors were correlated with both the diagnosis and severity of symptoms in students with ADHD. Improving the quality of the school environment can lead to a reduction in the symptoms and severity of the disorder among students.

Keywords: Environmental Quality, Physical Environment, School, Students, Attention Deficit Hyperactivity Disorder (ADHD).

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1. INTRODUCTION

The relationship between Attention Deficit Hyperactivity Disorder (ADHD) in children and the physical characteristics of their learning environment is an important research area because it can significantly affect their academic performance and overall well-being. This study aims to investigate the relationship between the quality of the physical environment in schools and ADHD in students from six schools in Tehran. Therefore, the present research evaluates children's educational centers that, in terms of both architectural physicality and the types of activities, are neither compatible with the needs of students with ADHD. Children require spaces that are controllable yet do not restrict them, are engaging, and have a nature that emphasizes movement more than pause and stillness (Azmoodeh 2009). Identifying physical factors that significantly contribute to reducing ADHD symptoms in students is essential. The innovation of this study lies in investigating the correlation and valuation of eight physical elements and three moderating variables in six girls' and boys' schools in Tehran to assess the relationship between the physical environment and the reduction of ADHD in students. The objective of this research is to investigate the relationship between the quality of the physical environment in schools and the prevalence of ADHD in elementary school students. Accordingly, the research hypothesis is based on demonstrating a significant relationship between the school physical environment (independent variable) and ADHD (dependent variable) in students. It also addresses the question of how the physical school environment relates to ADHD in students; thus, Fisher's statistic was used to test this hypothesis and answer this question.

2. LITERATURE REVIEW

The educational physical environment plays an essential role in supporting children with Attention Deficit Hyperactivity Disorder (ADHD). A well-designed classroom can significantly enhance focus and learning for students. Classrooms should have adaptable layouts that allow for movement and collaboration, meeting the dynamic needs of students with ADHD (Dewitz 2014). The use of sound-absorbing materials and visual stimuli can help reduce distractions and improve concentration. The combination of natural light and calming colors can positively affect mood and focus, making the learning environment more desirable (Alkahtany 2014). Excessive daylight or direct (glare) light, as well as poor sound quality or noise, negatively affect children's mental health, increase distraction, and impact the child's performance, particularly in school (Alizadeh et al. 2023). Schools designed with natural elements (trees, flowers, sand, water, grass, hills, and shrubs) increase children's activity levels and improve physical health. Green spaces and yards play a more effective role than asphalt schoolyards in enhancing play levels for children and students with ADHD (Bikomeye, Balza, and Beyer 2021). Educational spaces must be capable of influencing children's cognitive and mental abilities to both participate in their education and create an environment full of energy and joy (Azmoodeh 2009). The educational environment has a significant impact on children's mental well-being. The environment is more than just physical spaces where the child moves. The brain of a child with ADHD is resistant to structure; this presents a significant challenge but also the possibility of change (Hallowell and Ratey 2021). ADHD is the most common behavioral and neurodevelopmental disorder in childhood, with a prevalence twice as high in boys compared to girls (Hassanzadeh, Amraei, and Samadzadeh 2019). ADHD is sometimes accompanied by symptoms of both inattention and impulsivity (Remschmidt 2005). Environmental factors affecting physical activity include environmental attractiveness, sociality, and playfulness. Attention to each of these factors in the design process of open spaces in schools can improve the physical and mental health, as well as the activity levels, of children and adolescents (Aminifar and Azemati 2023). Rich life experiences during the intellectual development phase, from adolescence to adulthood, are highly influential (Azizisaeid, Kordnoghabi, and Erfani 2019). The quality of the physical school environment has become a significant public health concern because children spend longer periods at school and with peers after leaving home (Wargocki and Wyon 2013). Students have returned to school environments more frequently since the COVID-19 pandemic and, consequently, have been more exposed to the effects of school environmental quality (Cheshmehzangi 2021). Environmental quality indicators, including building conditions, color, lighting, green space, façade, acoustics, and layout, significantly affect psychological and physical health, as well as user productivity, especially in children. The sensitivity of children to environmental indicators is considerable (Bluyssen et al. 2018). The behavior of elementary school children reflects their adaptation during this stage of development. However, not all children successfully develop this adaptation, and some may exhibit externalized or internalized emotional-behavioral problems at home, school, or in relation to peers, teachers, and family, often manifesting as aggression (Movahedian, Ghamrani, and Sajadian 2022). Flexibility and an authoritative parenting style significantly improve behavioral disorder symptoms in trainable intellectually disabled children (Taheri and Soleymani 2020). Behavior management, based on communicative and behavioral approaches, is feasible for age groups ranging from 3 to 12 years

(Bahari Gharagoz 2015). Among these, therapeutic strategies based on parent and teacher awareness and training are preferred over other treatment methods (Rahim, Akrami, and Ghamarani 2021). Changes in the educational system can alter behaviors that impact social interactions across various systems (Torkashvand and Ghamaran 2023). Family-child interactions play a significant role in reducing behavioral vulnerability in children and adolescents with ADHD (Nejati 2021). Additionally, internalized behavioral problems of students in preschool and elementary stages decrease and essentially improve with the enhancement of the relationship between the teacher and ADHD students (Moghadam and Ghamaran 2021).

Table 1. Some Studies Conducted on the Physical Factors Affecting ADHD in Children

Research Title	Findings	Method
Designing Learning Environment for School Children Having Attention-Deficit/Hyperactivity Disorder (Arif Kamal, Chomal Naveen, and Sukhbir 2024)	Classroom space for children with ADHD often hinders their concentration and contributes to academic problems. Effective design strategies for learning environments can enhance mental stability and educational success for these students.	Proposed design strategies for classroom environments aimed at improving mental stability and academic success.
Perancangan ruang kelas bagi anak usia sekolah dasar penyandang attention deficit hyperactivity disorder (Claurent Surya and Mekar Sari 2024)	ADHD in children affects their ability to adapt in educational settings and requires modifications to the classroom design. Ideal educational spaces should meet their needs by increasing focus and mental well-being through layouts that are compatible with their behavioral characteristics and spatial requirements.	Qualitative methods: observation and in-depth interviews; Analysis of children's behavior and spatial needs.
Concentration Techniques in the Classroom for Children with ADHD, in an Educational Unit in the Province of (Villao and Alcivar Ponce 2024)	This study shows that environmental adaptation in the physical learning space is crucial for children with ADHD. Effective strategies include minimizing distractions, using visual and auditory cues, and creating supportive spaces to enhance focus and academic performance.	Mixed-method approach with surveys and interviews, classroom behavior observation.
Universal Design for Learning for Children with ADHD (Frolli et al. 2023)	This paper does not explicitly address physical learning space features for children with ADHD. The program adopts a universal design approach to learning, focusing on improving academic skills by teaching based on students' strengths and weaknesses.	Universal Design for Learning approach for individualized teaching; educational interventions to improve reading, writing, and math skills.
A New and Improved Physical Education Setting for Children with ADHD (Higgins 2018)	ADHD in children often leads to challenges in physical education due to distractions and a lack of structure. A structured and organized environment with clear boundaries and designated points significantly increases focus and reduces impulsive behaviors in students with ADHD.	Mark points with bright tape for organization; create a retreat area for overstimulated students.
Classroom Designs to Accommodate ADHD and Learning Disabled Students (Dewitz 2014)	Classroom layout design for students with ADHD should incorporate flexible seating, minimize distractions, and provide designated quiet areas. These features facilitate movement and focus, enhancing the learning experience by addressing the unique needs of students like Franklin, who struggle with attention and hyperactivity.	Classroom design for inattentive and learning-disabled students; attention to learning style details.
Contribution to the Development of Interior Spaces in Hyperactivity and Distracted Attention: An Analytical Case Study (Alkahtany 2014)	ADHD in children requires educational spaces designed to minimize distractions with clear organization, appropriate colors, sound-absorbing materials, and specially designed furniture. These features enhance focus, increase comfort, facilitate peer integration, and support effective learning environments for children with ADHD.	ADHD-friendly interior space design methods; integration of specialized educational programs and resources.

Research Title	Findings	Method
Concentration Difficulties in the School Environment - with focus on children with ADHD (Autism and Down syndrome) (Tufvesson 2007)	Children with ADHD are positively affected by features such as built environment façade, multiple windows, wall decoration, and teamwork. Classroom design significantly impacts their ability to focus.	Experts were surveyed rather than children directly due to the symptoms of disability; group questionnaires and observations were used for data collection.
Classroom Interventions: Methods to Improve Academic Performance and Classroom Behavior for Students with Attention-Deficit/Hyperactivity Disorder (Reiber and McLaughlin 2004)	Classroom structure significantly impacts students with ADHD and requires an orderly environment. Changes such as cubicles, minimal distractions, and neutral decor help reduce negative stimuli, increase focus, and improve academic performance, supported by extensive research on physical settings in educational environments.	Classroom structure and teaching modifications; peer interventions and token economies.

The literature review reveals three different approaches. The first approach establishes a direct relationship between the physical environment components and ADHD. The second approach examines environmental factors concerning ADHD, while the third focuses on the relationship between the teacher and parents with the hyperactive child. These differences stem from the varying methodologies employed by these three approaches. While these design strategies are helpful, it is essential to understand that not all children with ADHD respond similarly to environmental changes. As shown in Figure 1, attention to individual characteristics is also necessary to address the diverse needs within the classroom environment.

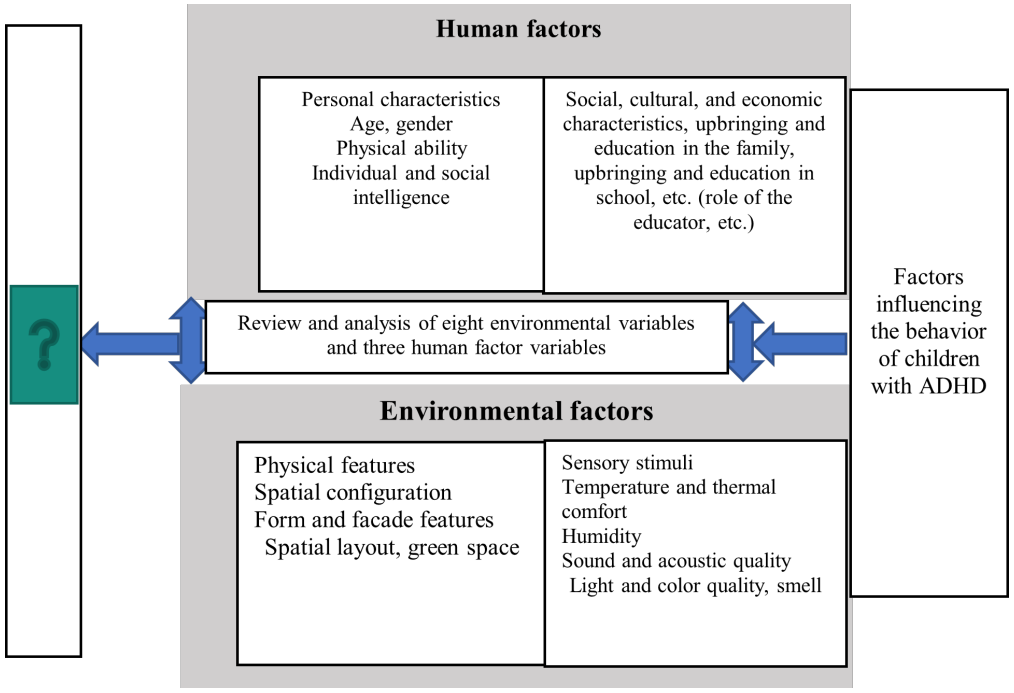

Fig. 1. Factors Influencing the Behavior of Children with ADHD

3. RESEARCH METHODOLOGY

This study employed correlation and stepwise regression methods. Data analysis was conducted using the statistical software IBM SPSS. The Chi-square test (χ^2) or Fisher's exact test, univariate analysis of variance (ANOVA), and Pearson's correlation coefficient were used to examine the relationship between school environmental quality factors and the severity of ADHD symptoms. Stepwise linear regression analysis was performed to evaluate the predictive power of school environmental quality factors in the diagnosis and severity of ADHD, as well as to identify the most significant variables in regression models. The case study included Alborz Boys' School and Shahid Fahmideh Girls' School (District 2), Ibn Sina Boys' School and Moftah 1 Girls' School (District 5), and Shohada-ye Moallem

Boys' School and Afsharian Girls' School (District 9) in Tehran. The participants consisted of 100 students diagnosed with ADHD (aged 7 to 10; 44 boys and 46 girls) and 124 of their teachers. Initially, children with ADHD were identified through counseling and the Conners questionnaire[1]. Subsequently, the opinions and experiences of participants were gathered via the physical environment quality questionnaire, including eight environmental indicators (air quality, acoustic quality, lighting quality, thermal comfort, façade, layout, green space, and color)—each indicator comprising three specific questions—and moderators (teacher, individual and social intelligence) were evaluated in the schools. Finally, the contribution of each indicator was prioritized to determine which factor has the most tremendous impact on reducing ADHD in the studied schools.

3.1. Implementation Procedure

To estimate the statistical sample size, a cluster sampling method was employed. First, from the 22 education districts, three districts were selected. Then, the number of elementary schools in each selected district was identified from the education offices. Next, a sample group representative of the statistical population and its characteristics was selected; thus, 10% of the elementary schools in the three districts (2, 5, and 9) were chosen. In the third stage, school administrators and counselors were asked via the Conners questionnaire to report the number of hyperactive students aged 7 to 11 in each school. The number of hyperactive students became the statistical sample of this study.

3.2. Data Collection Instruments

Primary data collection was conducted through field studies and interviews. In the field study, the behavioral patterns of hyperactive students were recorded using survey tools, including the standardized Conners questionnaire, completed by teachers regarding students diagnosed with ADHD; a standardized physical environment quality questionnaire; and a questionnaire evaluating moderating factors, such as teacher, individual, and social intelligence, family income, and educational levels. The Conner's Teacher Rating Scale (C.T.) is a valid and reliable tool for screening and assessing the severity of symptoms (Conners 1999). The reliability of the Conners questionnaire was reported as 0.90. The school physical environment questionnaire included eight physical factors, each consisting of three specific questions (24 questions in total), presented in simple language to teachers and hyperactive students. A 14-item physical factors questionnaire was also used, whose items were extracted and validated through exploratory and confirmatory factor analyses (Torkashvand and Ghamarani 2023). Furthermore, the measurement levels of the independent variable—the school physical environment—were assessed using a four-point Likert scale (Najafi et al. 2005). The validity of the Physical Environment Questionnaire was reported as 0.85 by cognitive and environmental sciences. The reliability of the questionnaires was assessed through a pilot study involving 30 participants, using Cronbach's alpha, which yielded an estimate of 0.73, indicating acceptable reliability.

4. FINDINGS

In this section, to examine the relationship between components of the school physical environment and ADHD in hyperactive students aged 7 to 11 in Tehran, a regression model was utilized. A notable feature of this method is that, in addition to indicating the degree of correlation and strength of association, the regression model also shows the influence level of each variable. The school physical environment indicators were each measured by three questions related to eight aspects of physical environment indicators and three moderating aspects (teacher, individual intelligence, and social intelligence). The environmental indicators included façade, layout, green plants, color, air quality, acoustic quality, lighting quality, and thermal comfort across six schools in three districts (2, 5, and 9), namely Alborz Boys' School and Shahid Fahmideh Girls' School (District 2), Ibn Sina Boys' School and Moftah 1 Girls' School (District 5), and Shohada-ye Moallem Boys' School and Afsharian Girls' School (District 9) in Tehran. To investigate their relationship with ADHD diagnosis and symptom severity (dependent variables), 24 items (three questions per indicator) were included in the analyses. The sample consisted of 100 hyperactive students (44 boys and 56 girls) and 124 teachers from these schools. Regarding the visual façade dimension, the mean scores were as follows: Alborz School, 6.79; Shahid Fahmideh Girls' School, 9.12; Ibn Sina Boys' School, 9.77; Moftah 1 Girls' School, 9.77; Shohada-ye Moallem Boys' School, 8.17; and Afsharian Girls' School, 8.87. Results show that Alborz, Shohada-ye Moallem, and Afsharian schools had lower averages compared to Shahid Fahmideh, Ibn Sina, and Moftah 1 schools. For the green space dimension, mean scores were: Alborz 7.47, Shahid Fahmideh 9.95, Ibn Sina 9.07, Moftah 1 9.72, Shohada-ye Moallem 8.57, and Afsharian 8.90. In the classroom layout dimension, the average survey scores were: Alborz 6.91, Shahid Fahmideh 9.15, Ibn Sina 8.48, Moftah 1 8.55, Shohada-ye Moallem 8.75, and Afsharian 8.09. For lighting, mean scores were: Alborz Boys' School 7.43, Shahid Fahmideh 9.70, Moftah 1 9.16, Shohada-ye Moallem 8.50, and Afsharian 8.30. For color, mean scores were: Alborz 7.16, Shahid Fahmideh 7.90, Ibn Sina 8.30, Shohada-ye Moallem 7.60, and Afsharian 8.15. In thermal comfort, mean scores were: Alborz 8.12, Shahid Fahmideh 8.72, Ibn Sina 8.64, Moftah 1 8.61, Shohada-ye Moallem 8.28, and Afsharian 8.36. For acoustics (sound), mean scores

were: Alborz Boys' School 7.35, Shahid Fahmideh 8.52, Ibn Sina 8.41, Moftah 1 8.50, Shohada-ye Moallem 8.64, and Afsharian 8.51. In the air quality dimension, satisfaction means were: Alborz 7.35, Shahid Fahmideh 8.45, Ibn Sina 8.05, Moftah 1 8.66, Shohada-ye Moallem 7.78, and Afsharian 8.09. The current study's findings, based on a regression model assessing the overall impact of each indicator on ADHD levels, indicate that the school's visual façade indicator has a direct effect of 19.0% in reducing ADHD symptoms. The study examined items of each physical environment aspect from various perspectives, including their suitability and degree of controllability. Comparisons were made between the perceptions of teachers and hyperactive students regarding the physical environment indicators. Descriptive findings included comparisons of physical environment indicators by school, analysis of their differences, and related correlations. Multiple-choice questions required participants to identify features or conditions present or absent in the schools. The findings are presented in two sections: the impact of school physical environment factors and the influence of moderating factors on ADHD in students. First-hand experiences of participants were gathered via deep, semi-structured interviews. Main and subcategories were identified through a coding process. The purpose of coding was to organize information, summarize participant descriptions, and classify the data. Information in tables and charts obtained from participants was developed and displayed using practical guidelines for preparing statistical tables in behavioral research (Delheid and Pexman 2010).

4.1. Findings on the Impact of Moderating Factors on ADHD

Table 2 examines the relationship between moderating characteristic components and ADHD in hyperactive students. According to linear regression analysis results, the standardized beta coefficients indicate the impact level of each variable on the dependent variable (ADHD) and the degree of influence of each moderating component. Among these, the moderating factors, such as individual intelligence (-0.25), teacher (-0.19), and social moderator (family income, -0.27), showed a significant influence in reducing attention deficit disorder.

Table 2. Predictive Equation Coefficients for the Impact and Role of Moderating Characteristics on ADHD in Students

Variable	B Coefficients	Standard Error	Standardized Beta Coefficients	t-Value	Significance (p)
Teacher Moderator	-4.892	2.567	-0.198	-1.906	0.058
Individual Intelligence Moderator	-6.184	2.032	-0.254	-3.043	0.003
Social Moderator (Family Education)	0.063	0.654	0.003	0.096	0.923
Social Moderator (Family Income)	-9.404	2.510	-0.376	-3.746	0.000

Table 3 presents the results of an independent t-test comparing the opinions of two groups—teachers and students diagnosed with ADHD. Based on the findings, there is no significant difference between the two groups regarding ADHD. Accordingly, teachers' predictions related to ADHD in students show close means, indicating that teachers have been able to report the severity of ADHD in children with considerable accuracy.

Table 3. Independent t-Test Results for Comparing two Groups of Educators and Students with ADHD

Indicator	Group	N	Mean	Std. Dev.	F	Sig. (p)	t	df	Sig. (2-Tailed)
Child Behavior	Student	100	34.35	15.018	0.119	0.731	1.905	222	0.058
	Teacher	124	30.45	15.394					
Group Participation	Student	100	13.06	6.078	1.0006	0.317	1.955	222	0.052
	Teacher	124	11.41	15.394					
Child Attitude	Student	100	10.41	4.481	0.210	0.317	1.955	222	0.030
	Teacher	124	9.08	5.572					
Total Disorder	Student	100	57.82	24.688	0.560	0.455	2.034	222	0.043
	Teacher	124	50.94	25.519					

4.2. Findings on the Impact of School Physical Environment Factors on ADHD

Table 4 shows the influence of physical environment factors on ADHD, along with the coefficient of determination. The results indicate that R2=0.86R^2 = 0.86R2=0.86 with F=112.460F = 112.460F=112.460 and a significance level of p<0.001p < 0.001p<0.001 confirm that the predictive components presented in Table 1 explain 86% of the variance related to ADHD.

Table 4. Analysis of Variance related to the Regression of the Effect of School Physical Environment Components on Students' ADHD

Source of Variance	Sum of Squares	df	Mean Square	F	Sig.	R	R2	SE	Durbin-Watson
Regression	115,411.748	11	10,491.977	112.460	0.000	0.92	0.86	9.65	1.810
Residual	18,472.519	198	93.296						
Total	133,884.267	209							

Table 5 reports the results of one-way ANOVA comparing the opinions of two participant groups by school. Based on F=4.335F = 4.335F=4.335 and significance p<0.001p < 0.001p<0.001 for the variable Façade, there is a significant difference between one or more schools regarding this dimension. However, no significant differences were found between schools for variables such as Green Space, Layout, Lighting, Color, Acoustic, and Air Quality.

Table 5. Results of Intergroup Analysis of Variance to Compare the Opinions of two Groups of Subjects by Group

Variable	Indicator	Sum of Squares	df	Mean Square	F	Sig.
Façade	Between Groups	247.872	5	49.574	4.335	0.001
	Within Groups	2,493.111	218	11.436		
	Total	2,740.982	223			
Green Space	Between Groups	169.576	5	33.915	6.311	0.000
	Within Groups	1,171.455	218	5.374		
	Total	1,341.031	223			
Layout	Between Groups	131.119	5	26.224	5.116	0.000
	Within Groups	1,117.376	218	5.126		
	Total	1,248.496	223			
Lighting	Between Groups	128.349	5	25.670	3.340	0.006
	Within Groups	1,675.490	218	7.686		
	Total	1,803.839	223			
Color	Between Groups	65.504	5	13.101	2.257	0.050
	Within Groups	1,265.134	218	5.803		
	Total	1,330.638	223			
Comfort	Between Groups	11.448	5	2.290	0.485	0.787
	Within Groups	1,028.106	218	4.716		
	Total	1,039.554	223			
Acoustic	Between Groups	51.399	5	10.280	2.880	0.015
	Within Groups	778.061	218	3.569		
	Total	829.460	223			
Air Quality	Between Groups	45.335	5	9.067	2.282	0.048
	Within Groups	866.218	218	3.973		
	Total	911.554	223			

Table 6 summarizes the linear regression results, presenting standardized beta coefficients for the effect of each school physical environment variable on ADHD in students. For Façade, the standardized beta

of -0.192 and t-value of -3.515 indicate a significant negative relationship with ADHD. Other environment components also significantly reduce ADHD: green space (0.153), layout (-0.085), façade (-0.192), lighting (-0.203), color (-0.322), environmental comfort (-0.314), and acoustics (-0.121).

Table 6. Coefficients of the Prediction Equation for the Effect of School Physical Environment Components on Students' ADHD

Variable	B Coefficient	Std. Error	Std. Beta Coefficient	t-Value	Sig. (p)
Air Quality	197.046	13.701	-	14.382	0.000
Façade	-1.363	0.388	-0.192	-3.515	0.001
Green Space	1.561	0.443	0.153	3.522	0.001
Layout	-0.882	0.361	-0.085	-2.443	0.015
Lighting	-1.785	0.402	-0.203	-4.438	0.000
Color	-3.388	0.477	-0.322	-7.100	0.000
Environmental Comfort	-3.627	0.472	-0.314	-6.679	0.000
Acoustic	-1.570	0.474	-0.121	-3.143	0.003

Table 7 indicates that the mean comparisons between the two groups reveal no significant differences, and their score variances are equal, suggesting that both groups hold similar opinions.

Table 7. Independent t-Test Results for Comparing two Groups of Teachers and Students in the School Physical Index

Indicator	Group	N	Mean	Std. Deviation	F	Sig. (p)	t	df	Sig. (2-Tailed)
Façade	Student	100	8.06	3.567	1.009	0.316	-2.149	222	0.033
	Teacher	124	9.06	3.404					
Space	Student	100	8.78	2.435	0.000	0.997	-0.691	222	0.490
	Teacher	124	9.00	2.471					
Layout	Student	100	7.98	2.566	2.298	0.131	-1.564	222	0.119
	Teacher	124	8.47	2.177					
Lighting	Student	100	8.31	2.795	0.060	0.807	-1.365	222	0.174
	Teacher	124	8.83	2.873					
Color	Student	100	7.59	2.396	0.015	0.903	-2.049	222	0.042
	Teacher	124	8.25	2.449					
Comfort	Student	100	8.34	2.189	0.001	0.972	-0.717	222	0.474
	Teacher	124	8.54	2.139					
Acoustic	Student	100	8.05	1.882	1.265	0.262	-1.491	222	0.137
	Teacher	124	8.43	1.956					
Air Quality	Student	100	7.83	2.035	0.049	0.824	-1.430	222	0.154
	Teacher	124	8.21	2.002					

5. DISCUSSION AND CONCLUSION

The findings of the present study indicate that the examined physical environmental indicators of schools—including color, thermal comfort, lighting, façade, green space, acoustics, classroom layout, and proper ventilation—as well as moderating factors such as individual traits, teacher influence, and social moderators (family income and education), have a direct relationship with the reduction of ADHD symptoms in students. Like most studies conducted in this field, the current research had some limitations. Notably, the sample group was selected solely from schools in Tehran city; therefore, generalizing the results to other regions, cities, or different populations should be approached with caution. Accordingly, it is recommended that educational institutions, especially schools, pay particular attention to physical and spatial indicators, as the results of this study indicate that these factors significantly influence the prevalence of ADHD symptoms among schoolchildren. Furthermore, researchers are encouraged to examine familial,

individual, and social factors more thoroughly to identify the most significant variables associated with ADHD. Officials, educators, and parents can utilize the findings of such studies to promote the mental health, motivation, and academic performance of students with ADHD. This descriptive-correlational study examined the relationship between eight physical environmental components (visual façade, green space, classroom layout, lighting level, color, thermal comfort, acoustics, and air quality) and three moderating factors (teacher, individual intelligence, and social factors) with ADHD symptoms among students in six girls' and boys' schools across districts 2, 5, and 9 in Tehran. By comparing the mean scores related to these eight physical environment indicators across the schools, it can be stated that both students and teachers claim that the lower the quality of these environmental indicators, the greater the impact on increasing ADHD symptoms in students, exerting a negative influence on their disorder. Among the schools, Alborz boys' school showed a significant difference in physical environment indicators compared to Shahid Fahmideh, Ibn Sina, and Mofatteh 1 schools. However, no considerable difference was observed between this school and Shohada Moallem and Afsharian schools. No significant differences were found among the other schools. The survey comparing teachers' and ADHD students' perspectives on the eight environmental indicators revealed no significant difference between the two groups' opinions regarding the physical environment of the schools; their views were consistent and similar. In reporting this research, efforts were made to investigate realistically, avoiding the pitfalls of generalized judgments. The conclusions and practical recommendations derived from this study highlight that access to green space and classroom layout have the most significant influence on children's concentration, suggesting that nature and green spaces are pleasant elements with the most substantial impact on managing ADHD symptoms. Ultimately, whether the research fully resolves the issue is not a straightforward answer. The environmental performance and creativity of teachers in maintaining connections with children throughout learning are critical, energy-intensive, and time-consuming. Therefore, further studies should explore physical, behavioral, and social indicators on a broader scale.

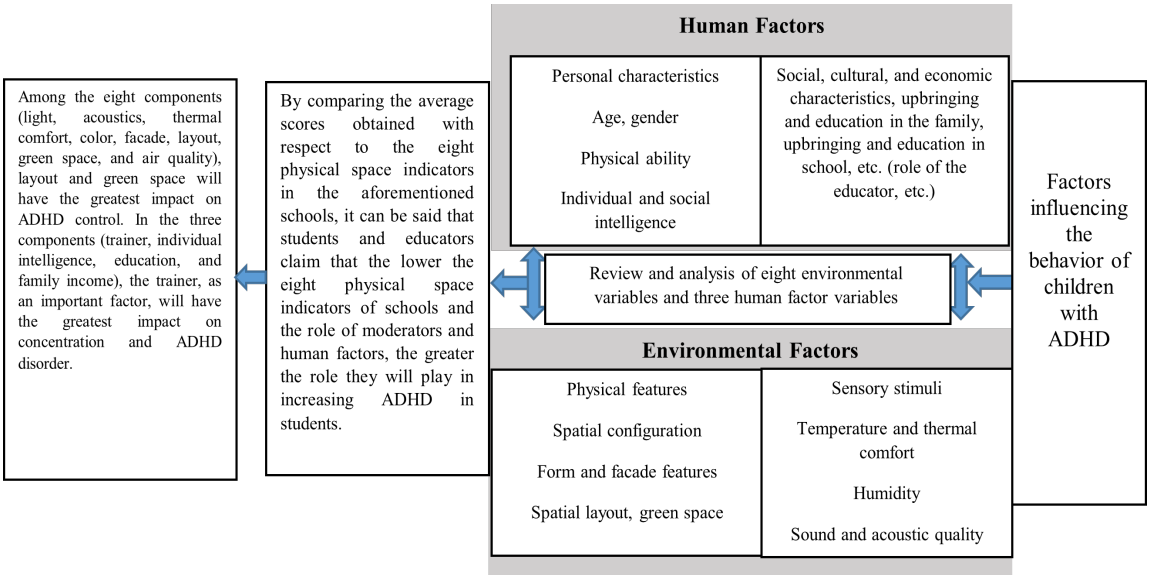

Fig. 2. Final Research Model

APPENDIX

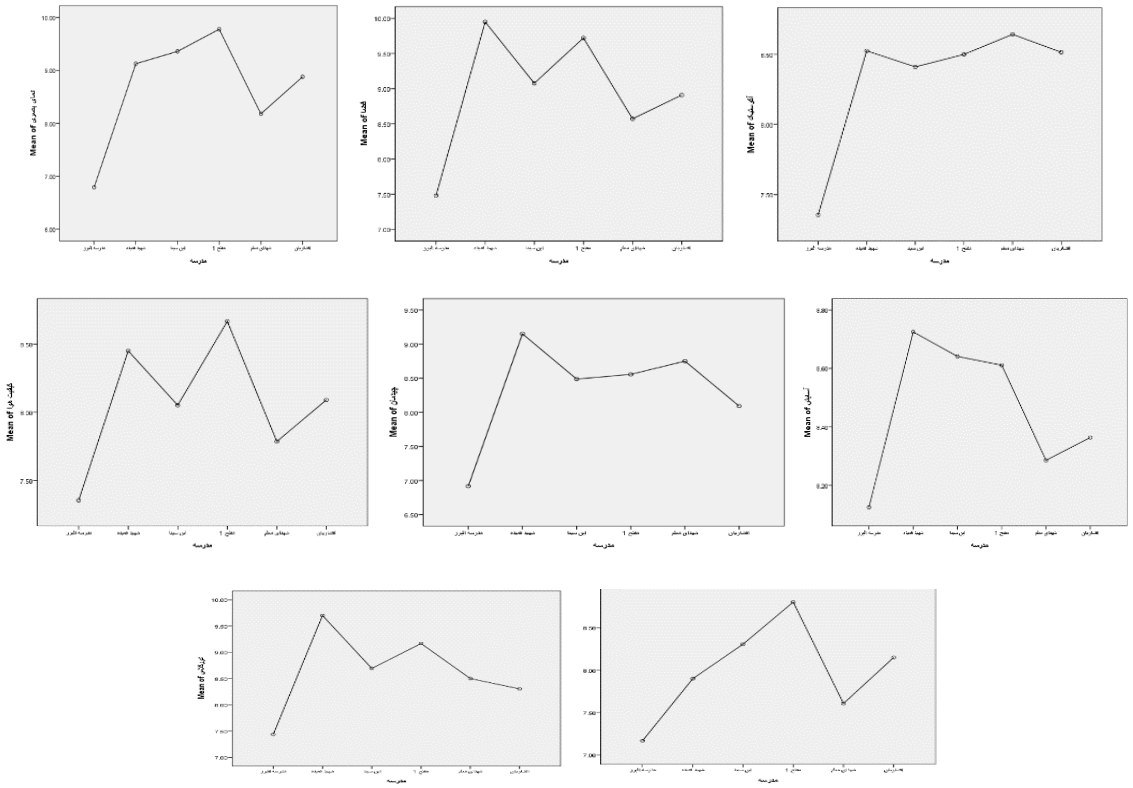

Fig. 3. Relationship between Eight Physical Components and ADHD in the Schools Studied

Figure 3 illustrates the relationship between eight physical environmental components (visual facade, green space, classroom layout, lighting level, color, thermal comfort, acoustics, and air quality) and the reduction of ADHD symptoms among students in six boys' and girls' schools located in districts 2, 5, and 9 of Tehran.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

MORAL APPROVAL

The authors commit to observe all the ethical principles of the publication of the scientific work based on the ethical principles of COPE. In case of any violation of the ethical principles, even after the publication of the article, they give the journal the right to delete the article and follow up on the matter.

PARTICIPATION PERCENTAGE

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

ENDNOTE

1. One of the common tools for measuring children's behavior, based on the dimensional classification system, is the Conners Rating Scales, which consists of numerous behavioral questionnaires specifically for children. This scale has been widely used in Western cultures and has been considered and used in numerous studies and in research and clinical contexts for more than 30 years (Shahayian 2007).

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