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Achieving Healthy Upbringing through School Design: A Case Study of Iraqi School Buildings

تحقيق التنشئة الصحية من خلال تصميم المدارس: دراسة حالة لمباني المدارس العراقية

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KEYWORDS

Health-Promoting Schools, Healthy Upbringing, Sustainable Design, Architectural Health Considerations, Child Health, Iraqi Schools Design.

ABSTRACT

Children worldwide face critical health challenges, including obesity, physical inactivity, poor awareness of healthy lifestyles, and the spread of infectious diseases during the school year, affecting their future well-being. Given the vital role of school buildings in children's development: by providing supportive environments that enhance physical, mental, and social well-being—the concept of "health-promoting schools" has gained research attention. This study reviews global literature to identify key design considerations and indicators for such schools, analyzing successful international models. It also examines the current state of local schools, both existing and newly constructed, along with proposed designs from the Engineering Affairs Unit of the Ministry of Education. The research problem is defined as the "lack of a clear framework for locally adapted health-promoting school design." By using an analytical approach, the study establishes these considerations in a local context, revealing that effective school architecture relies on four core aspects: environmental, psychological, physical, and social health. The study emphasizes the need to adopt detailed indicators for these aspects in future school designs while proposing solutions to improve existing buildings, ultimately enhancing children's overall well-being.

الكلمات المفتاحية

المدارس المعززة للصحة، التنشئة الصحية، التصميم المستدام، الاعتبارات الصحية المعمارية، صحة الطفل، تصميم المدارس العراقية.

الملخص

يواجه الأطفال في جميع أنحاء العالم تحديات صحية خطيرة، مثل السمنة، قلة النشاط البدني، ضعف الوعي بالأنماط الصحية، وانتشار الأمراض المعدية خلال العام الدراسي، مما يؤثر على صحتهم المستقبلية. ونظرًا للدور الأساسي الذي تؤديه الأبنية المدرسية في تنشئة الأطفال، من خلال توفير بيئات داعمة تعزز رفاههم البدني والعقلي والاجتماعي، حظي مفهوم "المدارس المعززة للصحة" ليشكل محور الاهتمام البحثي في هذا المجال. تستعرض هذه الدراسة الأدبيات العالمية لتحديد الاعتبارات والمؤشرات التصميمية الأساسية لهذه المدارس، مع تحليل نماذج دولية ناجحة في تطبيقها. كما تتناول الدراسة الواقع الحالي للمدارس المحلية، سواء القائمة أو الحديثة، بالإضافة إلى تحليل النماذج التصميمية المقترحة من قبل وحدة الشؤون الهندسية في وزارة التربية. وتتمثل مشكلة البحث في "غياب إطار واضح لتصميم المدارس المعززة للصحة في السياق المحلي." ومن خلال منهجية تحليلية، تحدد الدراسة هذه الاعتبارات في ضوء الخصوصية المحلية، وتكشف أن التصاميم المدرسية الفعالة تستند إلى أربعة جوانب رئيسة: الصحة البيئية، النفسية، الجسدية، والاجتماعية. وتؤكد الدراسة أهمية تبني مؤشرات تفصيلية لهذه الجوانب في تصميم المدارس المستقبلية، مع اقتراح حلول لمعالجة التحديات القائمة، بما يسهم في تعزيز الرفاه الشامل للأطفال.

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1. Introduction

Children around the world face various health challenges that directly impact their lives and well-being. Infectious and non-communicable diseases are among the most significant of these challenges, with approximately 10 million children under the age of five dying each year, a large proportion of whom succumb to infectious diseases such as sepsis, pneumonia, diarrhoea, and tetanus (Bhutta and Saeed, 2008). Furthermore, nearly 2.1 billion children and adolescents suffer from non-communicable diseases, including cardiovascular diseases, cancer, and chronic respiratory disorders, which continue to escalate annually (UNICEF, 2023b). Malnutrition also poses a significant threat to children's health, with approximately 41 million children affected by obesity and 149 million suffering from stunted growth due to undernutrition (WHO, 2024). In addition to these health challenges, emerging issues such as the COVID-19 pandemic in 2019 and escalating environmental and economic challenges further exacerbate the situation (Kahachi, 2017; Kahachi, Abdulqader and Al-Hinkawi, 2022).

On the other hand, rapid urban and developmental transformations provide substantial opportunities for large-scale strategic responses to these health challenges. Among these opportunities are rapid technological advancements, dynamic urban planning that responds to community and environmental needs, and the comprehensive spatial management of cities and urban areas (Kahachi, 2020a, 2020b). The need for new development strategies that put forth human well-being and allow for a better tomorrow is another important factor given the rapid urban growth (Kahachi, Abreu and Ehsan, 2024b, 2024a).

In this context, the concept of health-promoting upbringing has emerged as a comprehensive approach aimed at instilling healthy habits in children from early childhood in response to escalating health issues resulting from inadequate health guidance during critical developmental stages, which ultimately affects long-term quality of life (Koshalieva, 2023). A review of specialized studies on family health and statistical reports on child health in Iraq revealed significant health challenges, including (malnutrition, whether due to severe vitamin and mineral deficiencies or obesity caused by unbalanced diets, the prevalence of infectious diseases such as respiratory infections and influenza due to environmental pollution and inadequate health services, and psychological disorders stemming from social and economic pressures, contributing to rising anxiety and depression rates among children) (UNICEF, 2023b, 2023a). These findings underscore the need to strengthen health-promoting strategies to ensure a supportive environment for children's healthy development. Consequently, this research focused on the role of school buildings in guidance, education, and upbringing, emphasizing the necessity of an integrated environment that harmonizes environmental, social, psychological, and physical aspects to establish lifelong healthy lifestyle patterns. The study highlights the importance of incorporating indicators from these dimensions into the architectural design process for school buildings, which directs the research focus. Following an exploratory study of local school buildings and interviews with specialists from the Engineering Affairs Unit at the Ministry of Education, it became evident that both existing and under-construction school designs follow a standardized and traditional approach that fails to implement the concept of health-promoting upbringing. This led to identifying the research problem as the (lack of a clear framework for the design considerations of locally adapted health-promoting school buildings), with the research objective defined as the (urgent need to propose school building design plans that effectively integrate the concept of health-promoting upbringing within the Iraqi context). These proposed design strategies will also serve as remedial solutions for existing school buildings, ensuring a more holistic and supportive environment for children's overall well-being.

2. Research Methodology

The research adopted an analytical methodology and focused on exploring the concept of "health-promoting school buildings," which has recently emerged to address individual health issues from childhood. Given that primary schools represent the first environment beyond the home where individuals learn healthy habits, the study examined specialized global architectural literature due to the novelty of the concept and the absence of local studies. Through this discussion, the study identified the design considerations for health-promoting schools, categorized into four main dimensions: environmental health, psychological health, physical health, and social health, each encompassing a set of indicators and values established within a comprehensive theoretical framework. Moving to the second phase, the research aimed

to validate these considerations and their values in the local context by conducting a focus group with two categories of experts: academic architectural specialists in educational building design and consulting engineers from the Ministry of Education responsible for school project implementation, selected based on criteria such as professional reputation and extensive practical experience in large-scale projects. Their information is detailed in Table (1). Official invitations were sent to clarify their role in providing practical recommendations, and a series of meetings were held over three weeks, beginning with an initial workshop to present the study objectives and enhance their understanding of the research topic, followed by another session that formulated practical applications of these design considerations in Iraq, ultimately leading to the development of a revised theoretical framework informed by local architectural expertise. In the third phase, this modified framework was applied to the most common school design models in Iraq, selecting two representative models reflecting the prevailing architectural trends in Karkh and Rusafa districts of Baghdad: the Open Central Courtyard Model, a widely adopted traditional design characterized by an open layout surrounding an internal courtyard, and the Enclosed Model, representing a modern school design approach featuring an integrated, enclosed spatial distribution within the building. This selection aimed to generalize the findings on a broader scale, forming the fourth phase of the research, which laid the groundwork for deriving the conclusions and recommendations.

Table 1. Focus group composition details (Source: Authors).

Field of Expertise	Rank of Participant	Profile of Expert	Geographical Area of Provenance
Engineering	Licensed	Engineer from the Ministry of Education.	Baghdad (Al-Karkh)
Engineering	Practitioner	Engineer from the Ministry of Education.	Babil
Engineering	Consultant	Engineer from the Ministry of Education.	Nineveh
Educational Infrastructure Design	Consultant	Expert in educational building design working in the private sector.	Erbil
Architecture & Planning	Assistant Professor	University professor specializing in educational building design.	Baghdad (Al-Rusafa)
Architecture & Planning	Lecturer	University professor specializing in educational building design.	Karbala
Architecture & Planning	Assistant Lecturer	University professor specializing in educational building design.	Najaf

3. The Concept of Health-Promoting Schools

Health-promoting schools are educational institutions that go beyond their traditional role of providing academic education to become comprehensive environments that support the healthy upbringing of children and youth. This concept focuses on designing school buildings in a way that enhances health across four dimensions: environmental, physical, psychological, and social, ensuring full integration between the physical environment and both educational and health functions. The model is based on integrating architectural principles with health and sustainable development standards to create learning environments that foster both academic and healthy growth. This is achieved through designing school spaces that support natural lighting and proper ventilation while minimizing sources of noise and visual pollution. Additionally, the model emphasizes flexible spaces that promote physical activity and healthy nutrition. Special attention is given to areas that support psychological well-being, such as green spaces and facilities that encourage social interaction and positive communication among students. The primary goal of this model is to establish an educational environment that contributes to the balanced and sustainable development of students' health, ensuring their long-term well-being. This concept reflects modern trends in school building design (Electra Bada et al., 2019; Monika Raniti et al., 2020).

4. Design Considerations for Health-Promoting Schools in Academic Literature

This section reviews academic literature to develop a comprehensive framework identifying design considerations mentioned in the literature and their relation to key dimensions.

4.1. Design Considerations for Environmental Health

Environmental health indicators are closely tied to indoor environmental quality, influencing students' health, academic performance, and teachers' well-being through factors such as air quality, daylight access, natural landscapes, acoustic comfort, and control over lighting and thermal conditions (Kubba, 2016). Strategies to reduce thermal stress include enhancing shading with trees or artificial structures, promoting natural ventilation, adding water features like fountains, and using light-coloured materials to lower surface temperatures (Kennedy et al., 2021). In classrooms, optimizing airflow and humidity is essential to minimize the spread of seasonal illnesses like influenza and reduce headaches and asthma. This can be achieved through well-placed openings covering more than 5% of floor space, vertical fins to manage airflow and limit direct solar radiation, and effective control of indoor humidity and temperature to alleviate dizziness and respiratory symptoms (US Environmental Protection Agency, no date). Furthermore, proper natural lighting improves students' health by reducing eye strain, fatigue, and anxiety, as they are more sensitive to daylight than adults (Gregg D. Ander, 2016). For example, the Montessori School in Rionegro, Colombia, employed a green open design to foster interaction with nature, enhancing physical and mental health through outdoor activities. Its effective ventilation systems regulate temperatures and air quality, reducing dependence on artificial cooling while supporting overall well-being (Arch Daily, 2020).

4.2. Design Considerations for Social Health

Social health upbringing focuses on building self-esteem encouraging effective communication, collaboration, and community engagement. Schools support these principles by providing public spaces designed to foster interaction and cooperation among students (The Pennsylvania State University, 2017). Breakout areas, located at hallway ends, intersections, or near classrooms, offer flexible, comfortable spaces for short breaks or independent work, featuring distinct design elements like varied ceiling heights, special lighting, and vibrant colours to inspire creativity (Ann Marie Procopio, 2017). Learning pods, smaller educational spaces within larger environments, promote collaborative learning and independent study with flexible layouts that can be adjusted to suit activity needs, offering both openness and privacy (Perkins and Will, 2023).

Family participation in school events, such as sports, musical performances, and craft fairs, positively impacts students' social skills, behaviour, and adaptability despite challenges that prevent some families from attending. Notable initiatives, such as Hartford's Learning Corridor in Connecticut, integrate community resources to create socially enriching environments within schools (Homes.com, no date).

4.3. Design Considerations for Mental Health

Efforts to mitigate depression, anxiety, and stress among students focus on strategies like biophilic design, which integrates natural elements such as wood, stone, greenery, and natural lighting into indoor environments to enhance memory, creativity, and relaxation while reducing absenteeism (Gillis and Gatersleben, 2015). For instance, the Korea National Arboretum's Children's Forest School employed nature-inspired colours (green, brown, blue), patterns resembling natural shapes, and features like water fountains and indoor plants to create a calming atmosphere that improves mood, reduces stress, and enhances air quality (Hana Abdel, 2022). Psychological well-being also relies on secure school environments, achieved through controlled entry systems, touchless technologies, and hygiene stations to minimize contamination risks and ensure health (Perkins and Will, 2023). The Novemern School in Kyiv demonstrates this approach by separating entryways from learning areas, enhancing safety while fostering open and collaborative educational spaces (Royal Design, 2023). Additionally, fostering a sense of belonging reduces isolation and boosts confidence through shared narratives, visual symbols, and spaces showcasing collective achievements and goals. Engaging students in design processes, such as selecting colours or creating interactive areas, cultivates ownership and strengthens their connection to the school environment (Perkins and Will, 2023).

4.4. Design Considerations for Physical Health

The school environment plays a crucial role in promoting physical activity among students through design and facilities. This begins with ensuring safe access to schools via walking paths, cycling tracks, and public transportation while linking schools to nearby recreational spaces such as parks and sports

facilities to encourage physical activities outside school hours. Secure bicycle storage further motivates cycling (Boarnet et al., 2005). Outdoor facilities, such as multi-surface sports fields and tracks for running or walking, along with playgrounds and school gardens, significantly enhance physical engagement. Indoor facilities, like gymnasiums and multipurpose halls, support a wide range of physical activities (Brittin J et al., 2015). Flexible classroom designs incorporate dynamic furniture like swivel chairs, encourage natural movement, improve circulation, and foster activity compared to traditional setups (Oliver Ludwig, 2008). Health-focused designs also promote healthy eating by creating attractive cafeteria spaces and integrating architectural elements that encourage nutritional education. Service areas are structured to offer easy access to healthy choices, including mobile food stations, salad bars, and strategically placed healthy food displays at children's eye level. Open commercial kitchens, educational kitchens, and school gardens foster engagement with fresh, organic foods, facilitating practical learning in nutrition and cooking. Examples include outdoor traditional cooking setups like fire pits and solar ovens, as seen in the Carter G. Woodson Education Complex (Huang TT et al., 2013).

4.5. Derivation of the Theoretical Framework for Design Considerations of Health-Promoting Schools

The results identified four key dimensions of design considerations (environmental, social, psychological, and physical) based on academic literature, as outlined in Table (2), which presents the design considerations for health-promoting schools along with their indicators and values.

Table 2. The Theoretical Framework for Health Promoting Schools Details, (Source: Authors).

Design Considerations	Indicators	Values
Design Considerations for Environmental Health	Thermal Comfort- Outdoor Spaces	Shading using trees and artificial structures (e.g., canopies)
		Using reflective materials such as light-coloured surfaces to reduce heat absorption
		Utilizing permeable pavements such as porous surfaces and artificial grass
		Adding water features (fountains, ponds)
	Thermal Comfort- Indoor spaces	Changing wall paint colours to beige
		Using vertical or horizontal solar shading devices on building facades to direct airflow and reduce solar heat gain
		Providing cross-ventilation to enhance natural airflow
	Acoustic Comfort-Classroom	Using sound-absorbing materials (gypsum panels on ceilings and walls)
		Locating classrooms away from external noise sources.
		Using sound-insulated windows and doors.
	Acoustic Comfort-Gymnasiums	Sound-absorbing materials on ceilings and walls (wooden panels or perforated bricks) are used.
		Avoiding parallel walls and domed ceilings.
		Using sloped surfaces to reduce sound reverberation interference.
	Indoor Air Quality (IAQ)	Mechanical HVAC systems (Heating, ventilation, and air conditioning) are used.
	Natural Lighting	Providing a natural lighting ratio ranging between 2% and 5% of the total lighting.
		Ensuring appropriate exposure to sunlight for 2 to 4 hours daily, with reflective surfaces or shading to control glare
		Ensuring windows account for 20% to 25% of the room's floor area
		Using adjustable artificial lighting to complement natural lighting
Design Considerations for Social Health	Collaboration	Breakout areas
		Learning pods
	Community Participation	Providing spaces for parent meetings
		Participating in non-curricular activities
		Providing spaces for sports events
		Participating in musical performances
		Providing spaces to display craft professions
		Using technology to enable families to engage in non-curricular activities remotely

Design Considerations	Indicators		Values
Design Considerations for Mental Health	Connection to Nature		Use of natural materials
			Nature-inspired colours and patterns
			The addition of water and green features
			Providing green spaces
	Enhancing Safety and Security		Providing a secure lobby with a check-in window and proactive visitor management
			Directing entrances away from main roads
			Clear and secure single-entry point
			Providing ample space at the entrance
	Sense of Belonging		Displaying murals narrating student and community success stories
			Motivational boards displaying school mission goals
			Walls showcasing student achievements or group projects.
			Engaging students in design processes, such as choosing colours or designing custom spaces
Design Considerations for Physical Health	Encouraging Physical Activity		Providing safe walking and cycling paths as well as access through public transportation
			Connecting the school to parks, playgrounds, and outdoor community facilities
			Providing secure spaces for bicycle storage
		School Playgrounds	Football fields
			Basketball courts
			Tennis courts
			Providing running or walking tracks
			Outdoor play areas equipped with both fixed and movable play equipment
			Closed gymnasium
			Gymatorium featuring a stage and flexible space
			Incorporating adjustable furniture: standing desks, rotating chairs with three-dimensional moving surfaces
	Promoting Healthy Nutrition	Service Areas	Service area
			Providing a commercial kitchen
			Providing an educational kitchen
		Dining Areas	Providing diverse seating options and social arrangements indoors
			Providing covered outdoor dining areas
		On-site Food Production	Establishing a school garden for growing vegetables, herbs, and edible plants
			Facility for producing animal-based products: fish, honey, eggs, etc.

5. Application

After establishing the theoretical framework through the discussion and analysis of global specialized studies, attention was directed toward the specificity of the local context concerning the health-promoting considerations and indicators. This was achieved through a two-level practical application. The first level involved conducting a focus group with two categories of experts: academic architects and consultants from the Ministry of Education responsible for project implementation. The objective was to gain a clear understanding of the design considerations for health-promoting schools. A subsequent session was then held to refine the theoretical framework, during which experts confirmed the applicability of certain global indicators within the local context while introducing new indicators and eliminating those deemed incompatible with local specificities. Given that the topic pertains to child health—a primary concern for parents and families in general—a meeting was held with parents in select local schools. The theoretical framework, along with its components and indicators, was distributed, followed by a discussion session to clarify its aspects and gather their perspectives, which were found to align with expert opinions. This process led to the development of a revised theoretical framework tailored to the local context, necessitating validation. The second level of application focused on exploring the feasibility of implementing the revised framework in two of the most common school models in Karkh and Rusafa districts in Baghdad. This aimed

to develop design plans for health-promoting schools within the Iraqi context, in addition to proposing remedial solutions for existing schools, as shown in Table (3).

Table 3 shows the modified theoretical framework for health-promoting schools (Source: Authors).

Design Considerations	Indicators	Values
Design Considerations for Environmental Health	**Thermal Comfort**	Natural shading using local trees, Artificial shading through lightweight wooden or fabric structures
		Use of reflective materials
		Implementation of permeable flooring
		Enhancing passive cooling strategies (e.g., internal courtyards, semi-enclosed corridors and schoolyards)
		Improving resistance to dust and sandstorms (e.g., vegetative barriers along outdoor spaces)
		Vertical and horizontal sun breakers
		Providing cross ventilation to enhance natural airflow
	Acoustic Comfort	Use of sound-absorbing materials
		Positioning classrooms away from external noise sources
		Utilization of sound-insulated windows and doors
		Implementation of double ceilings or suspended ceilings
Design Considerations for Social Health	**Collaboration**	Breakout areas
		Learning pods
	Community Participation	Designing a multipurpose hall
		Providing open and covered spaces for sports activities, vocational showcases, and craftsmanship demonstrations
		Designing interactive areas for extracurricular activities with integrated technology
Design Considerations for Mental Health	**Connection to Nature**	Utilization of natural materials and colors
		Maximizing natural lighting
		Incorporating water features (e.g., fountains, ponds)
		Expanding green spaces
	Enhancing Safety and Security	Providing a secure lobby with a check-in window, information dispatch system, and proactive visitor management
		Orienting entrances away from main roads
		Establishing a single, clear, and secure entry point
Design Considerations for Physical Health	**Health Services (School Nurse Office)**	Central reception office for coordinating student entry and reception
		Appropriately sized waiting room to accommodate expected users
		Dedicated screening/isolation rooms to minimize infection transmission
		Bed area with direct visibility from the nurse's office
	Encouraging Physical Activity	Providing safe pathways for walking and cycling, as well as access via public transport
		Connecting the school to parks, playgrounds, and public community facilities
		School sports fields: football field, basketball court, tennis court
		Outdoor play and recreational areas with both fixed and movable play equipment
		Indoor gymnasium
		Adoption of flexible furniture arrangements
	Promoting Healthy Nutrition	Providing a commercial and educational kitchen
		Varied indoor and outdoor dining areas
		Establishing a school garden for cultivating and harvesting crops
		Designing small school food kiosks
		Strategically placing clean drinking water stations

The Table above illustrates the modifications made by experts to the theoretical framework to adapt it to the specificity of the local context. These modifications included deletions, additions, and adjustments, in addition to retaining certain fundamental components without alteration. Safety and security, along with connection to nature, were established as essential components within the psychological health dimension. In the environmental health dimension, equal emphasis was placed on thermal and acoustic comfort. Within the social health dimension, community engagement was prioritized over collaboration.

Meanwhile, in the physical health dimension, physical activity and healthy nutrition were deemed equally important, alongside the enhancement of health services. As a result, the most critical design considerations that will guide the next phase of the research were identified. This phase necessitates validating the revised theoretical framework by examining its applicability to two of the most common

school models in the Karkh and Rusafa districts of Baghdad, marking the transition to the second level of application.

The second level of application is applying the modified theoretical framework in light of local specificity to schools in reality:

This level of application aims to explore the feasibility of implementing the revised theoretical framework within the specificity of the local context by analyzing two models that represent the most common school designs in the Karkh and Rusafa districts of Baghdad. These models were selected because they reflect the widely used traditional designs, allowing for an assessment of their compatibility with the components of the revised theoretical framework. The analysis is structured into two main phases. The first phase focuses on evaluating the current conditions by measuring the extent to which the components of the revised theoretical framework are realized in existing schools, with the objective of identifying the challenges and obstacles that hinder the achievement of health-promoting school standards. The second phase involves proposing design modifications by introducing adjustments to the two models based on the revised theoretical framework while considering the available structural and infrastructural capacities. The proposed modifications serve as examples of practical design solutions that can be integrated into traditional school designs in the local context, contributing to the enhancement of the school environment and the fulfilment of health-promoting school standards within the existing constraints.

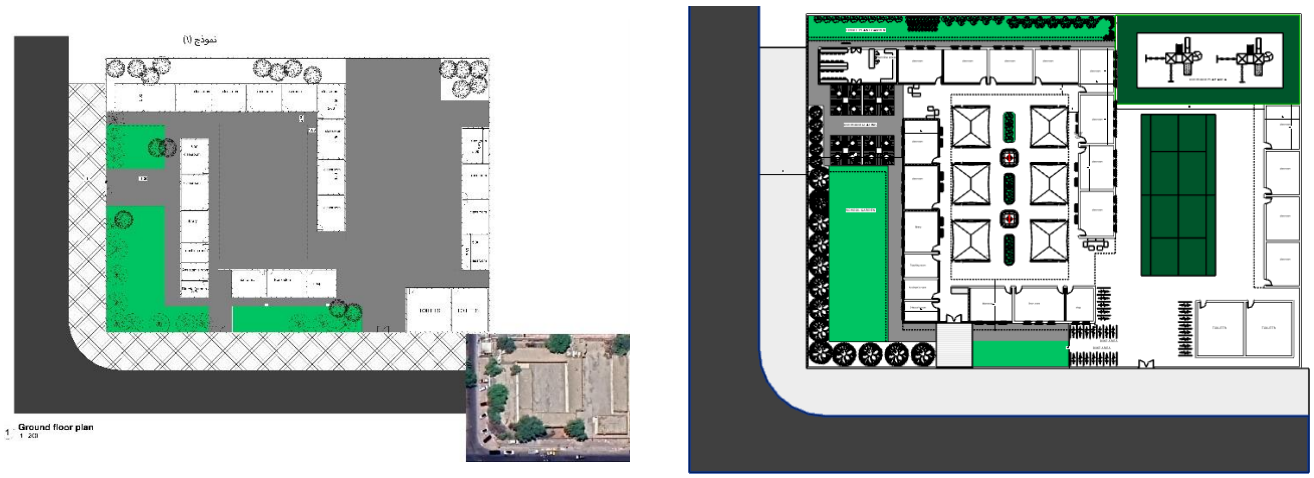

Figure 1. The Open Central Courtyard Model: Site Plan (Google Earth), Ground Floor Plan Before Modification and After Modification (Source: Authors).

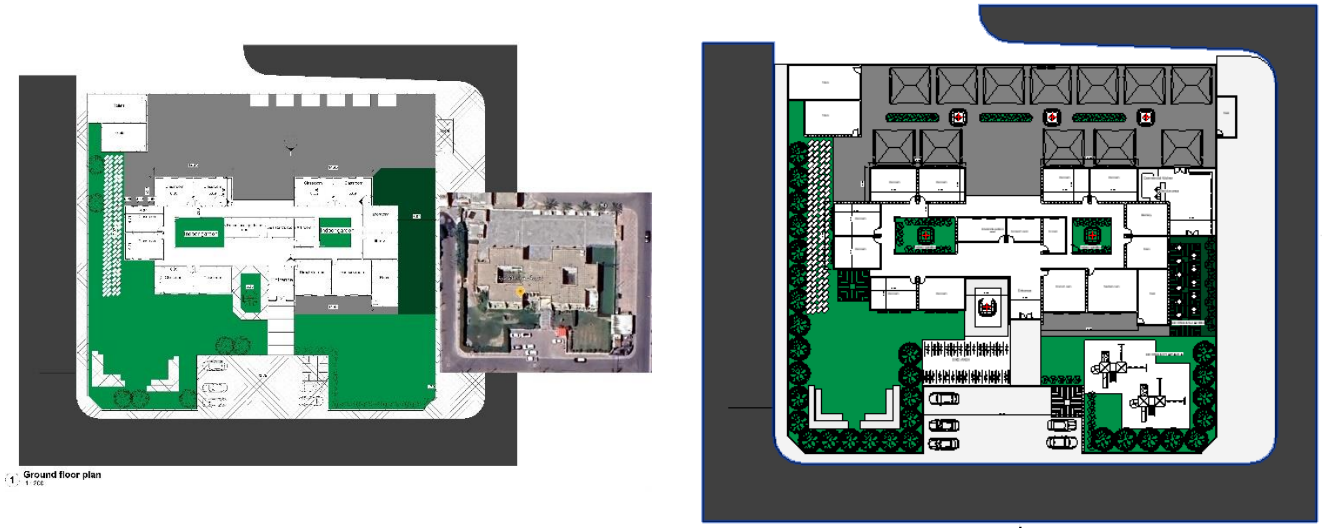

Figure 2. The Modern Enclosed Model: Site Plan (Google Earth), Ground Floor Plan Before Modification and After Modification (Source: Authors).

Measurement Method and Model Analysis: The researcher adopted a binary evaluation approach (Achieved – Not Achieved), represented by (1,0), as illustrated in Table (4).

Table 4: "Evaluation of the Achievement of the Modified Theoretical Framework Elements in Models A and B Before and After Adjustment, (Source: Authors).

Design Considerations	Indicators	Values	Model A		Model B	
			Before	After	Before	After
Design Considerations for Environmental Health	Thermal Comfort	Natural shading using local trees, Artificial shading through lightweight wooden or fabric structures	0	1	0	1
		Use of reflective materials	0	1	0	1
		Implementation of permeable flooring	0	1	0	1
		Enhancing passive cooling strategies (e.g., internal courtyards, semi-enclosed corridors and schoolyards)	0	0	1	1
		Improving resistance to dust and sandstorms (e.g., vegetative barriers along outdoor spaces)	1	1	0	1
		Vertical and horizontal sun breakers	0	1	0	1
		Providing cross ventilation to enhance natural airflow	0	1	1	1
		Percentage of achieving the thermal comfort index in the environmental health category	**14.29%**	**85.71%**	**28.57%**	**100.00%**
	Acoustic Comfort	Use of sound-absorbing materials	0	1	0	1
		Positioning classrooms away from external noise sources	0	0	1	1
		Utilization of sound-insulated windows and doors	0	1	0	1
		Implementation of double ceilings or suspended ceilings	0	1	0	1
		Percentage of achieving the acoustic comfort index in the environmental health category	**0.00%**	**75.00%**	**25.00%**	**100.00%**
Design Considerations for Social Health	Collaboration	Breakout areas	0	0	0	1
		Learning pods	0	0	0	0
		Percentage of achieving the collaboration index in the social health category	**0.00%**	**0.00%**	**0.00%**	**50.00%**
	Community Participation	Designing a multipurpose hall	0	0	0	0
		Providing open and covered spaces for sports activities, vocational showcases, and craftsmanship demonstrations	0	1	0	1
		Designing interactive areas for extracurricular activities with integrated technology	0	0	0	0
		Percentage of achieving the community engagement index in the social health category	**0.00%**	**33.33%**	**0.00%**	**33.33%**
Design Considerations for Mental Health	Connection to Nature	Utilization of natural materials and colors	0	1	0	1
		Maximizing natural lighting	1	1	1	1
		Incorporating water features (e.g., fountains, ponds)	0	1	1	1
		Expanding green spaces	0	1	1	1
		Percentage of achieving the nature connection index in the psychological health category	**25.00%**	**100.00%**	**75.00%**	**100.00%**
	Enhancing Safety and Security	Providing a secure lobby with a check-in window, information dispatch system, and proactive visitor management	0	0	1	1
		Orienting entrances away from main roads	0	1	1	1
		Establishing a single, clear, and secure entry point	**0**	**0**	**0**	**1**

Design Considerations	Indicators	Values	Model A		Model B	
			Before	After	Before	After
		Percentage of achieving the safety and security enhancement index in the psychological health category	**0.00%**	**33.33%**	**66.67%**	**100.00%**
	Health Services (School Nurse Office)	Central reception office for coordinating student entry and reception	0	0	1	1
		Appropriately sized waiting room to accommodate expected users	0	0	1	1
		Dedicated screening/isolation rooms to minimize infection transmission	0	0	1	1
		Bed area with direct visibility from the nurse's office	0	0	1	1
		Percentage of achieving the healthcare services index in the physical health category	**0.00%**	**0.00%**	**100.00%**	**100.00%**
	Encouraging Physical Activity	Providing safe pathways for walking and cycling, as well as access via public transport	0	0	0	0
		Connecting the school to parks, playgrounds, and public community facilities	0	1	1	1
		School sports fields: football field, basketball court, tennis court	0	1	0	1
		Outdoor play and recreational areas with both fixed and movable play equipment	0	0	0	0
		Indoor gymnasium	0	1	0	1
		Adoption of flexible furniture arrangements	0	0	0	0
		Percentage of achieving the physical activity stimulation index in the physical health category	**0.00%**	**60.00%**	**20.00%**	**60.00%**
	Promoting Healthy Nutrition	Providing a commercial and educational kitchen	0	0	0	0
		Varied indoor and outdoor dining areas	0	1	0	1
		Establishing a school garden for cultivating and harvesting crops	0	1	0	1
		Designing small school food kiosks	1	1	1	1
		Strategically placing clean drinking water stations	0	1	0	1
		Percentage of achieving the healthy nutrition enhancement index in the physical health category	**20.00%**	**80.00%**	**20.00%**	**80.00%**

The chart in Figure (3) shows that Model (A), in its current state, only meets two health-promoting school design criteria: light-coloured walls and natural lighting, both implemented ineffectively, leading to excessive indoor heat. In the proposed design, significant improvements were achieved through low-cost, locally adaptable solutions, such as planting native trees along the perimeter and adding wooden canopies with fabric coverings for shading, enhancing outdoor thermal comfort. Small fountains and permeable flooring materials further contributed to cooling and sustainability. Additionally, flexible spaces were introduced to support physical activity and healthy nutrition without requiring major structural modifications or high costs. However, limitations arose due to financial and structural constraints—acoustic insulation was not feasible due to high costs, and the entrance could not be repositioned due to the fixed building orientation. Learning Pods and Breakout Areas were also impractical, as the current education system prioritizes traditional lecture-based learning over interactive approaches, and classrooms are designed as closed spaces, lacking flexibility for social interaction. Furthermore, walking and public transport pathways could not be implemented due to poor urban planning and inadequate infrastructure. Ultimately, Model (A) demonstrates that some design improvements can be achieved due to local adaptability and affordability, while others remain unfeasible due to financial and structural barriers.

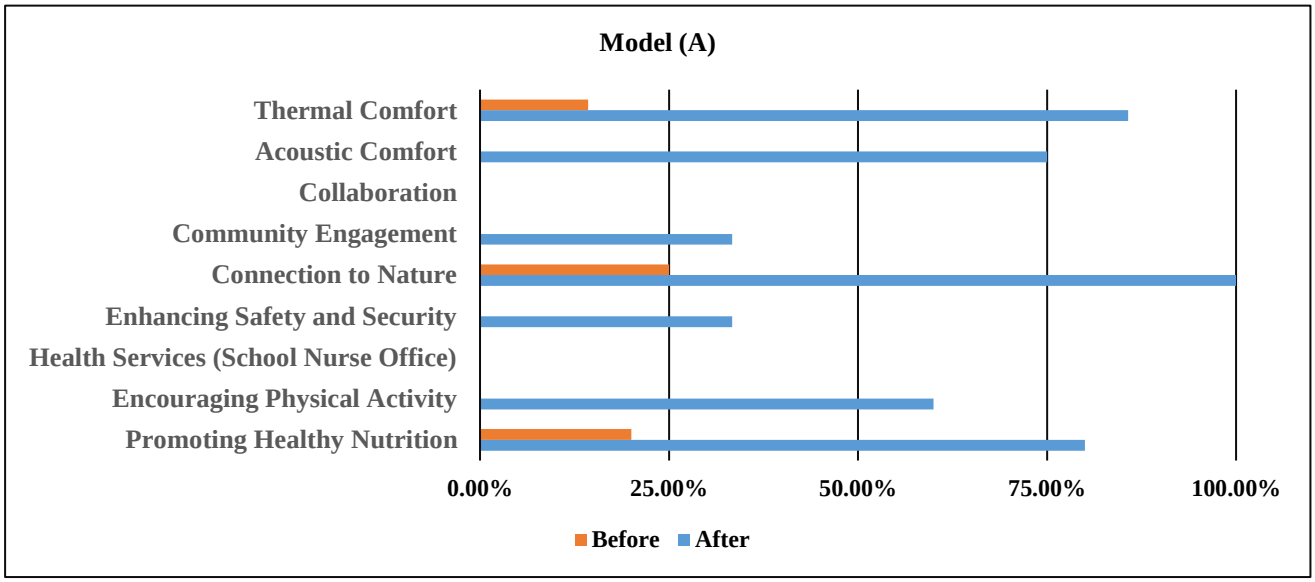

Figure 3. Chart for model (A) before amendment (current situation), after amendment (proposed amendments), (Source: Authors).

The chart in Figure (4) illustrates that Model (B) meets several design considerations for health-promoting schools, particularly in environmental health. It effectively incorporates cross-ventilation through strategic window and door placement, while green spaces, though present, can be enhanced with additional trees and shrubs. Classrooms are positioned away from noise sources, and the entrance is oriented away from main roads, eliminating the need for modifications. In the proposed design, shading was improved using wooden canopies and tall trees, and small fountains were added to courtyards for cooling. Concrete flooring was replaced with permeable local materials to reduce heat retention, and adjustable solar shading was introduced. However, pedestrian and cycling pathways could not be implemented, nor could the school be connected to community facilities due to weak infrastructure and lack of urban planning. An enclosed gymnasium was also unfeasible due to space constraints, high costs, and limited comprehensive acoustic insulation. Additionally, Learning Pods were impractical as they required significant layout modifications. While the modified framework successfully introduced shading, greenery, and recreational improvements, its impact remained constrained by spatial, infrastructural, and planning limitations.

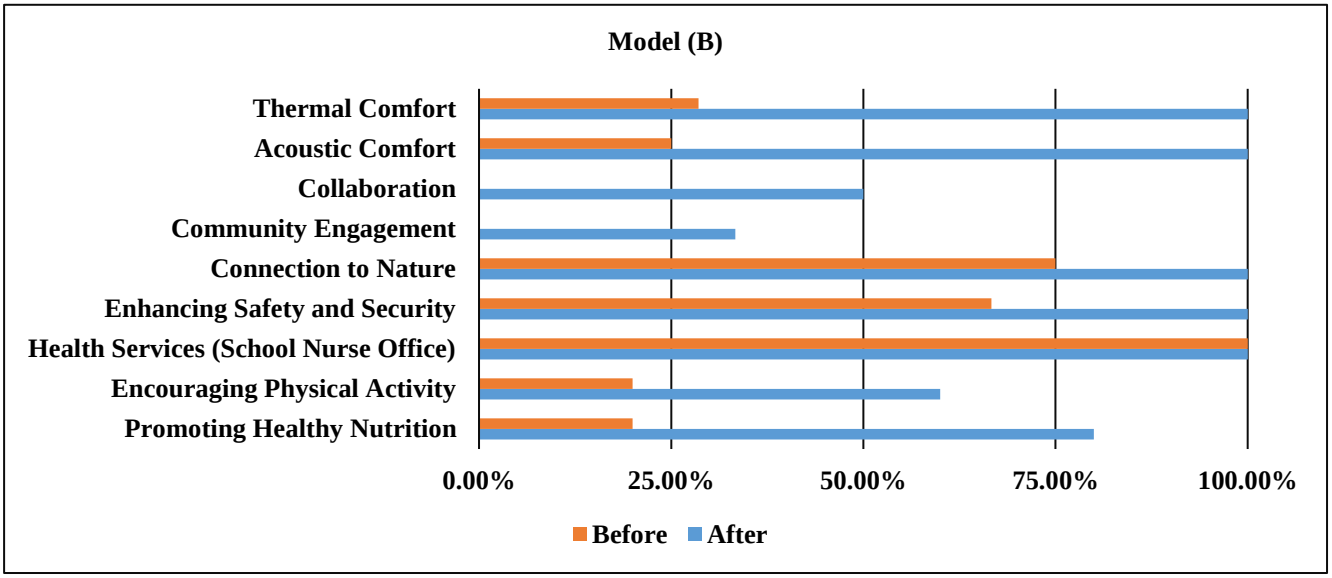

Figure 4. Chart for Model (B) before modification (current situation), after modification (proposed modifications), (Source: Authors).

6. Conclusions

- The Need for New Standards: The study identifies four key dimensions for health-promoting school design: environmental health, psychological health, physical health, and social health, each accompanied by specific design solutions.
- Deficiencies in Current School Designs: Iraqi schools suffer from traditional designs that lack essential health-promoting features. Observations reveal significant shortcomings across various design considerations. Outdoor spaces lack adequate shading and utilize non-permeable concrete flooring, while green spaces are either neglected or underutilized. Additionally, the absence of acoustic insulation creates noisy and uncomfortable learning environments. Schools also lack essential facilities such as sports fields, indoor gymnasiums, and designated recreational areas, limiting students' opportunities for physical activity. Moreover, there are no dedicated spaces for social gatherings or extracurricular activities, and hallways and gardens are not effectively utilized to enhance social or educational interaction. Administrative areas also lack entry lobbies equipped with visitor registration systems, reducing security and organizational efficiency. Due to the absence of integrated urban planning, Iraqi schools remain isolated from community facilities, with no pedestrian or cycling pathways surrounding them. This situation underscores the need for comprehensive interventions to upgrade infrastructure and educational facilities to meet health requirements.
- Differences Between Design Models: The study finds that Model B better aligns with health-promoting school standards compared to Model A. Model B includes front and side green spaces that enhance thermal comfort and psychological well-being, along with a small fountain that contributes to aesthetic and environmental quality. Its design supports cross-ventilation natural lighting and positions classrooms away from noise sources, improving acoustic comfort. Additionally, Model B enhances security and organisation through an entrance oriented away from main roads, featuring a clearly defined, secure entry point with a lobby and visitor registration system. In contrast, model A lacks many of these features, such as suitable green spaces and acoustic comfort, and its open design increases exposure to heat and noise. While Model A allows for flexible modifications, Model B remains the closest to achieving a comprehensive educational environment that meets environmental, psychological, and social health standards.
- Future Directions for Health-Promoting Schools in Iraq: Establishing health-promoting schools in Iraq requires a balanced approach that integrates both short-term and long-term solutions. Short-term improvements include enhancing ventilation, natural lighting, and using locally available, cost-effective materials. Long-term strategies involve redesigning school layouts to incorporate social and recreational spaces that address both physical and psychological health needs. Collaboration among architects, academics, and health experts is essential to ensure that school designs bridge theoretical insights with practical implementation sustainably and effectively. To achieve this, a strategic vision supported by meticulous planning and phased execution is necessary, fostering an environment that promotes holistic child development and long-term sustainability.
- The Importance of Strategic Planning: The realization of health-promoting schools requires long-term strategies that combine gradual improvements with immediate modifications to existing schools, alongside the development of comprehensive design standards for future educational facilities.

7. Recommendations

The study presents a set of recommendations to develop Iraqi schools in alignment with health-promoting school standards:

- Enhancing Environmental Health: The study recommends improving environmental health in schools by planting drought-resistant native trees and using wooden canopies covered with heat-resistant PVC fabric to reduce thermal impact. Additionally, permeable flooring materials such as clay bricks, treated gravel, or scattered stone pavements with gaps for plant growth should be utilized to enhance ventilation and minimize heat absorption. The implementation of solar shading devices, cross-ventilation through strategically placed windows and doors, and the use of light-coloured walls to mitigate heat accumulation are also advised. Furthermore, incorporating sound-absorbing materials, such as suspended ceilings and rubber flooring, is recommended to enhance acoustic comfort.

- Improving Psychological Health: The study suggests increasing green spaces within schools and equipping them with sustainable irrigation systems. Natural colours, such as green and blue, should be used in interior spaces to promote tranquillity. Additionally, safety measures should be enhanced by designing secure entrances away from main roads, incorporating clear entry points, and implementing visitor control systems to create a safer and more psychologically comfortable school environment.
- Promoting Social Health: To foster collaboration and community engagement, the study proposes transforming sections of school hallways—particularly at intersections or central areas—into flexible gathering spaces that support interactive learning and student-teacher engagement. Furthermore, social infrastructure should be improved by establishing multipurpose halls with designated stages for parent meetings and extracurricular activities, equipped with modern technologies such as display screens and interactive devices.
- Strengthening Physical Health: The study recommends providing sports fields and recreational areas within schools, along with open spaces suitable for daily movement, to support physical activity. Additionally, urban planning should integrate schools with community facilities, ensuring accessible pedestrian pathways and cycling routes. Schools should also offer diverse indoor and outdoor dining spaces to encourage healthy eating habits. Moreover, dedicated school gardens for growing edible plants should be established to promote nutritional awareness and provide an interactive learning environment.

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