Adapting Modern Iraqi School Designs to Integrate Active Learning Environments

Roa'a Zuhair Altaee [a], Dhuha A. Al-kazzaz [a]

Department of Architecture, College of Engineering, University of Mosul, Mosul, Iraq

*Corresponding author E-mail: roa'a.22enp46@student.uomosul.edu.iq
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Abstract

Many studies have addressed the challenges facing the traditional educational environment in Iraq's schools, which negatively impact the quality of education. However, these studies have not focused on the requirements of adopting active learning methods in school designs in Iraq. This paper aims to identify how active learning concepts can be incorporated into the design of future schools and provide recommendations for adapting existing schools to align with these learning methods. The study employed a two-stage methodology: (1) extracting the dominant design characteristics of active learning schools, and (2) conducting field visits and expert interviews to analyze the designs of a case study of recently constructed Chinese loan schools in Mosul. The design characteristics of the school layout, interior design, corridors, classrooms, and the exterior spaces of the active learning school were compared with four case studies of Iraqi schools to determine the possibility of adapting their features to accommodate active learning activities. The findings revealed that there is a need to enhance the design of current schools to support active learning methods. Key recommendations include avoiding linear layout and enclosed courtyards in school planning, maximizing the use of all spaces, and designing flexible, multifunctional corridors. The paper also emphasized the need to increase the informal learning spaces outside classrooms. It recommends replacing traditional classroom layouts with flexible configurations that incorporate movable partitions to provide greater functional flexibility and reorganizing outdoor spaces to support both learning and recreational activities.

Keywords: Active learning methods; Flexible school design; Local schools; Design modifications; Educational spaces.

1. Introduction

Active learning has been defined in research as both an instructional practice and an educational philosophy that supports student engagement. It offers a variety of learning strategies that allow students to collaborate effectively, nurture their innate curiosity and creativity, and achieve success through deeper learning and more meaningful educational experiences [1]. It is a pedagogical approach in which students play an active role in their learning, rather than passively receiving and absorbing information. Active learning involves various types of activities, such as classroom discussions, hands-on experiences, collaborative group work, and others [2]. Recent studies have demonstrated that active learning is a more effective method than traditional instruction-based learning in preparing students for the demands of the digital era and future labor markets. It contributes directly to the development of multiple essential skills, including critical thinking, problem-solving, and teamwork competencies that are vital for success in the 21st century, and which conventional education methods based on lecturing and rote memorization often fail to develop [1][2][3][4][5].

The importance of this pedagogical shift is underscored by the rapid changes in the labor market and technological advancements. Jobs have become increasingly unstable and diversified, requiring students to adapt to new tools and skillsets, many of which do not yet exist. This situation necessitates flexible educational approaches that promote independent learning and continuous interaction [3][5]. Studies have shown that active learning leads to measurable improvements in academic achievement, lowers failure rates, and enhances student engagement especially among lower-performing student groups. These outcomes are largely attributed to interactive learning environments specifically designed to support this type of instruction [2][4]. Furthermore, these environments encourage classroom participation and foster a more positive educational atmosphere compared to traditional settings. They create a space where students feel free to ask questions and express their ideas, thereby enhancing in-class interaction [6].

The impact of active learning also extends to the physical learning environment itself. Research indicates that traditional classroom designs with fixed seating and narrow aisles hinder movement, reduce interaction, and limit opportunities for

communication between students and instructors. In contrast, active learning environments promote flexible seating arrangements, round tables, and movable furniture, all of which positively influence student satisfaction and engagement [1][7]. Accordingly, redesigning educational spaces becomes a necessary step to make learning environments more appealing and adaptable. These redesigned spaces should be open, integrated with various educational tools, and combine physical and natural elements to provide diverse and stimulating learning experiences [8]. Contemporary developments in the understanding of active learning, the widespread availability of digital technologies, and the pressing need to prepare a generation capable of thinking, living, and working in dynamic systems all compel schools to adopt instructional strategies based on interaction, collaboration, and problem-solving. In this context, the teacher's role shifts from that of a knowledge transmitter to a facilitator and motivator, an essential transformation, given that traditional models restrict students' ability to develop these essential skills [5]. Accordingly, active learning represents a strategic educational choice to prepare students for a rapidly changing world, by offering a more authentic learning experience that is closely connected to real-life and professional contexts [1][2][3][4][5][7][8].

Based on the above, the next section of this research paper will focus on reviewing the current state of school design in Iraq. The third section presents the research problem and methodology. The fourth section presents a framework for the design characteristics necessary for active learning schools. The fifth section examines the applicability of these characteristics to existing schools in Iraq. The final section concludes with the research findings and recommendations.

2. Problems of school buildings in Iraq

Local schools in Iraq face numerous challenges that significantly impact the learning environment. A considerable body of research has addressed these issues, highlighting the various obstacles that hinder the creation of an educational setting capable of delivering the desired academic outcomes for students. A study by Al-Dabbagh and Mahmood (2022) [9] identified the problem of poor functional performance in local schools in Iraq and their inability to keep pace with developments and align with the requirements of modern learning methods. This results in weak academic performance among students and teachers. The study attributed the need for change to factors such as the increasing number of students, changes in curricula, the evolution of learning methods, and the consequences of the demolition and renovation of old building schools, which are characterized by repetitive models across Iraq. The study focused on comparing local designs with international standards and concluded that local schools suffer from a lack of educational spaces, recreational areas, and supportive activities for students spaces. Additionally, administrative spaces and circulation areas do not meet international standards.

The study by Kazem and Al-Kazzaz (2022) [10] also confirmed that school buildings in Iraq suffer from a significant shortage of educational facilities and spaces that meet students' needs, due to the absence of standardized and comprehensive criteria for school design and construction. The study compared Iraqi school design standards with those of several countries around the world. The findings revealed that Iraqi standards lack essential aspects such as sustainability, comfort, safety, and flexibility, which are necessary for adapting to future changes. Additionally, the design of Iraqi schools does not take into account the age differences among students in different educational stages, as the same design model is used for primary, middle, and secondary schools without adjustments to suit the needs of each educational level. The study also highlighted a lack of standards related to urban planning and the exterior design of educational facilities, leading to the deterioration of social and sports spaces that are crucial for students. Furthermore, Iraqi standards lack basic safety aspects, such as emergency exits and precautions against accidents. Regarding interior spaces, the study pointed out the deficiency in providing essential functions such as libraries, cafeterias, and interactive areas that contribute to enhancing the learning environment. Moreover, many aspects of external space design, such as pathways and play areas, were overlooked.

The study by Kazem and Al-Kazzaz (2023) [11] highlighted issues related to the functional performance of school designs in Iraq due to non-compliance with Iraqi standards or the absence of design standards for certain important aspects. These issues include the incompatibility of current designs with standards concerning classroom capacity, facilities, and the distribution of spaces according to different educational stages. The study concluded that the use of BIM (Building Information Modeling) was effective in improving the adaptation of current designs to Iraqi standards. The study utilized computer-aided design tools such as Revit, Grasshopper, and Plan finder to make parametric adjustments to the standardized school designs to meet global standards regarding required capacity and dimensions. The study concluded that using the BIM approach in the adaptation process of standardized designs offers flexibility in redistributing school spaces in line with functional requirements, which facilitates the improvement and expansion of spaces to address the issue of overcrowding and the misalignment of designs with the needs of different educational stages (primary, middle, and secondary).

Al-Jameel et al. (2013) [12] aimed to evaluate the extent to which Iraqi schools meet the requirements of social sustainability and to propose applicable design interventions for a standard school model adopted by the Directorate of Education in Nineveh, with the goal of improving the overall quality of these school models. The main findings of the study revealed that there is insufficient space for social activities within schools, and that such spaces are often poorly located or inadequately organized. The study emphasized that social sustainability depends on both the built environment its flexibility, diversity, integration, and design quality and the technological environment, particularly in terms of communication and social interaction. Furthermore, the study concluded that social sustainability can be achieved through:

- The adoption of compact and clustered design patterns.

- Integration of spaces, including shared areas and social zones.

- The organization of corridors to encourage interaction and student gatherings

- The provision of designated spaces for seating, gathering, and extracurricular activities.

- The use of transparent materials to allow visual monitoring without isolation and ensuring ease of access to open spaces with multiple functions.

The study by Al-Jamil and Abou Al-Yassi (2014) [13] discussed the issue of the low social quality of Iraqi schools, which stems from the continued use of outdated standardized designs that do not keep pace with global developments in the design of socially sustainable schools. These developments have been influenced by changes in the fields of education, psychology, and sociology. The study concluded that Iraqi schools suffer from a lack of designs that support social interaction, such as open spaces, wide corridors, and social facilities. Furthermore, the current designs do not take into account flexibility in spaces or adaptability to future changes in educational curricula.

It is evident from the review of previous studies that much of the existing research has focused on the challenges and issues related to the traditional design and functional performance of Iraqi school buildings. These studies have highlighted problems such as the shortage of educational and administrative spaces, overcrowded classrooms, and the lack of alignment between school designs and international standards. However, these studies have not primarily addressed the impact of curriculum modernization and the adoption of contemporary teaching methodologies on the design of local school facilities. Specifically, the integration between modern curricula and school architecture and how such integration can foster learning environments that effectively support innovative instructional methods has not been sufficiently explored. Therefore, this paper aims to investigate the potential for adapting the design of new Iraqi school buildings to incorporate modern educational curricula, with a particular focus on the implementation of active learning strategies.

3. Research problem, objectives, and methodology

The research problem concerns the impact of updating and changing traditional educational curricula to keep pace with active learning methods (as a modern educational approach adopted in many developed countries) on the design of new schools in Iraq. The aim of the research is to determine the extent to which current designs can accommodate the requirements of active learning methods, and to explore the possibility of modifying and adapting design characteristics to meet the needs of active learning methods.

The research methodology includes the following steps:
- Defining a descriptive theoretical framework to identify the prevailing design characteristics in active learning school.
- Examining a sample of newly constructed Chinese-funded schools in Mosul city - Iraq to determine their suitability for active learning design indicators. The study relied in data gathering on the following methods:
  - A descriptive analysis of a sample of school plans
  - Field visits to the investigated schools.
  - Interviews with (5) civil and architecture engineers experts responsible for designing and constructing schools in Mosul city.

The adaptability of the school design to meet each indicator is qualitatively measured across four scales: feasible, feasible with minor modifications, feasible with major modifications, and not feasible.

4. A Framework for design characteristics in active learning Schools

Gordy (2020) [6] explored the impact of active learning spaces on student learning, with a particular focus on peer interaction. The study also sought to understand how student behaviors differ in such environments compared to traditional classrooms, in order to assist educators in designing more effective instructional strategies. Furthermore, it analyzed the relationship between the design of active learning environments and the role of technology in enhancing student engagement and collaboration. The findings revealed that the non-hierarchical organization of active learning spaces contributed to a positive psychological atmosphere, which encouraged students to participate actively, ask questions, and feel more comfortable than they typically do in conventional classrooms. This, in turn, led to an increased motivation to learn. Additionally, the presence of interconnected screens positioned close to the students facilitated visual access to learning materials and enhanced collaboration by enabling effective content sharing and screen interaction. Consequently, the interactive and flexible nature of these environments, when integrated with educational technology, significantly improved students' academic performance, communication, and peer collaboration.

Cardellino and Woolner (2019) [14] aimed to analyze the role of school design in supporting active learning, identifying the architectural features that facilitate the implementation of active learning strategies. It also examined how innovative school environments influence teaching and learning methods, offering design recommendations to improve educational spaces through the integration of active learning elements in alignment with the requirements of modern schools. The study concluded that active learning necessitates open and flexible school environments. Such environments must include spaces that support interaction and collaboration both among students and between students and teachers. Additionally, the inclusion of multi-functional areas in school design is essential to support active learning by providing dynamic settings that allow students to move freely, organize both group and individual activities, and engage meaningfully with the learning process. Technology was identified as a fundamental component of active learning, highlighting the need for school environments to be equipped to support the use of digital tools in classrooms. Moreover, student motivation and interpersonal communication were emphasized as critical pillars for deeper understanding, both of which require a physical environment that encourages non-traditional and active learning experiences.

Al-Ataby and Al-Qaraghuli (2022) [15] addressed the concept of flow in educational spaces and demonstrated that the flexibility of spaces, their adaptability, and the integration of technology with the learning environment are aligned with the changes in teaching methods and the challenges faced by learners. Flow is related to the overlap and extension of spaces, achieved by reducing the boundaries between them either partially or entirely. The integration occurs either between internal spaces themselves or between internal and external spaces. The openness between spaces can be either a physical extension, meaning that the spaces are open to each other entirely or partially using flexible or fixed partitions, or by opening to the outside. Alternatively, the spaces may be placed close to one another to facilitate interaction between them. This openness or extension can be visual, either between internal spaces or between internal and external spaces, using transparent partitions between those spaces. This allows for supervision of educational spaces, as well as improving interaction through monitoring activities in classrooms and workshops by other students and visitors. Additionally, the extension can be mass-based, meaning the building's potential for vertical or horizontal expansion.

Zaitoun and Khairallah (2023) [16] focused on the internal and external spaces of school buildings in the city of Aleppo and the requirements for active learning. The study also proposed potential modifications and adjustments to the designs of existing schools to accommodate interactive learning. It presented 24 design criteria to meet the needs of modern curricula, with the most prominent being:

- A flexible design that allows spaces to be opened or closed to support various activities.
- Classroom spaces should be suitable for the students' age group.
- Provide flexible furniture appropriate for the students' age group.
- The size of windows in classrooms should be appropriate to provide proper lighting and ventilation.
- Provide a computer laboratory equipped with an internet connection.
- Provide activity rooms for subjects such as painting, music, and theater.
- Provide playgrounds and grassy courtyards for recreational activities.

The study also proposed recommendations for future schools, including ensuring clear movement paths, supporting various teaching and learning methods, dividing the educational complex into units containing a maximum of 160 students. It suggested allocating between 2.2 – 2.7 square meters of space per student. The study emphasized the importance of providing technology and internet connectivity throughout the school, regulating lighting, ventilation, temperature, and acoustics, ensuring easy supervision by teachers, offering spaces for individual learning, maintaining flexibility in space usage, and providing rooms for collaborative and individual work for teachers.

Altaee and Al-Kazzaz (2024) [17] presented a comprehensive guideline for the active learning school design, identifying the most common and dominant design characteristics in global school designs. The design characteristics were centered on four main areas: school planning, interior design, furniture, and outdoor spaces. The study concluded that the design concepts of active learning school are:

- Flexibility and Adaptability: Active learning school designs must be adjustable and expandable, using movable walls and rearrangeable furniture to meet the needs of diverse educational activities.
- Communication, Openness, and Transparency: Visual communication between spaces is enhanced by using glass walls and reducing the distance between spaces to promote interaction between students and teachers.
- Integration: This is achieved by considering all school spaces, including corridors, libraries, and outdoor areas, as part of the learning environment. These spaces are designed to include areas for both collaborative and individual work, equipped with all necessary tools and technology.
- Sustainability: Emphasis is placed on using natural lighting and ventilation, as well as incorporating natural materials into the design. Additionally, encouraging the participation of students and teachers in the design process ensures that their needs are met.

Based on the findings of previous studies, this paper induced the main characteristics of active learning school designs, as shown in Table (1), which outlines the key design features dominant in global active learning schools. These characteristics will be used as a basis for investigating Iraqi schools.

Table (1) Design Characteristics in Active Learning Schools (Source: by Authors)

Main Factors	Secondary Factors	Indicators
Building Layout Types	Preferred Layout Types in Active Learning	Use of Learning Street Layout
		Use of Courtyard Open on One or More Sides
		Use of Cluster Layout
		Use of Multi-Story Atrium Layout
		Use of Single Block Layout
		Use of Urban Form Layout
	Non-Preferred Layout Types in Active Learning	Avoid Linear Layout
		Avoid Closed Courtyard Layout Surrounded on All Sides
	Spatial Specifications in the Layout	Utilize All Spaces Functionally and Avoid Unused Spaces
Flexibility of the Layout	Adaptability to Future Changes	The ability to expand by adding floors
		The ability to expand horizontally on

		the site	
	Modifiability and Changeability	Positioning structural elements and load-bearing walls to allow modification, transformation, and resizing of spaces.	
Interior Design Specifications	The openness of internal spaces to external areas to enhance visual and environmental connectivity	The use of glass and wide openings	
	Diversity of informal learning spaces	Creating individual study corners	
		Creating collaborative spaces	
		Providing unconventional and comfortable seating areas in corridors, libraries, and other spaces	
	Specifications for gathering spaces (not relying on a single gathering space).	Design of multiple spaces throughout the school	Wide corridors
			Courtyards
			Multifunctional areas
	Specifications of Individual Study Spaces	Creating designated areas and corners for individual work and focus to enhance individual study, ensuring they are clear, multiple, visually isolated, and furnished with comfortable furniture	
	Specifications for Non-Educational Spaces	Functionally integrating different spaces to extend learning by equipping them with the necessary tools and devices for learning	Library
			Hallways
			Outdoor areas
	The relationship between internal spaces	Achieving visual openness and connecting spaces visually with each other, using glass walls to avoid unmonitored spaces and isolated areas	
		Achieving smooth movement between them	
	Specifications of colors	Achieving color balance in interior design, using refreshing and calming colors, with the possibility of using colors to define space activities, such as selecting specific colors for a space based on the activity.	
	Specifications of Materials Achieving visual stimulation in both interior and exterior design	Using diverse materials such as wood, glass, various coatings, and surfaces with different textures to enhance an attractive and stimulating environment	
Interior design flexibility	The ability to easily change the shape and size of the space	Providing folding walls, movable partitions, and linking adjacent spaces to expand or reduce the area based on the activity	
	Use of school spaces by the community	Designating multifunctional spaces that are easily accessible for use outside of regular working hours	
Specifications of Corridors	The corridors should be clear and direct	Avoid complicated corridors, and ensure the sightlines are extended without visual obstructions	
	Must be concise and not long	To reduce the length of corridors by placing nodes, gathering areas, and distributing classrooms around them	
	The corridors should have an appropriate width	Designing corridors with a suitable width to accommodate movement	
	They should be multifunctional	Equipping them with suitable seating,	

		furniture for collaborative and individual work, and other educational tools
	They should be visually monitored and under the supervision of teachers	Equipping them with glass walls and open sightlines from teachers or administrative rooms
Classroom Specifications	Avoid designing classrooms according to traditional closed-plan layouts	Using glass partitions that can open to corridors or adjacent classrooms
	Determining the number of students in a classroom	The number of students in a classroom should be 30, with design conditions ensuring that this number is not exceeded
		Design the classroom space to be spacious enough for the number of students and accommodate active learning activities.
	The relationship between the classroom and adjacent spaces	Opening up to adjacent spaces by connecting classrooms with flexible spaces or educational corridors using sliding doors or foldable walls
		The presence of adjacent spaces to the classroom to serve as focus rooms
	Classroom shape	Adopting regular geometric shapes such as square, rectangular, or circular depending on the need
	Class Orientation	Orienting the rectangular classroom towards its long facade (placing the blackboard on one of the long walls)
	Types of Classrooms	Designing flexible, reconfigurable classrooms
		Design specialized classrooms equipped with fixed tools and equipment according to the activity, such as laboratories and music classes
outdoor spaces	Outdoor space functions	The presence of various rest areas such as (garden, seating areas, social interaction areas and events)
		Using outdoor spaces to support learning by organizing outdoor spaces to include a school garden, planting beds, and other
		Organizing school activities and events that cannot be implemented inside the school, and creating playgrounds, outdoor platforms, celebration areas, simple games, and others
		Support physical health by designing dedicated walking and jogging paths with safe flooring, shaded by trees or canopies, and providing simple exercise equipment

5. Practical Study

The designs of the Chinese loan schools were selected for investigation due to the ongoing and future construction of hundreds of their design models across all Iraqi governorates. The selected samples are among the first buildings that have been completed and handed over to the Nineveh Directorate of Education.

By the end of 2024, four different design models of the Chinese loan schools will have been implemented in the city of Mosul, each differing in its architectural layout. One sample was investigated from each design model.

Four sites were visited, three of them are occupied, while the fourth model is awaiting handover by the Nineveh Education Directorate for occupancy. The models are as follows:

Model A12, 12 classrooms, located in Al-Shaimaa neighborhood, occupied by Bashayer Al-Khair Primary School for Girls and Bashayer Al-Amal Primary School for Girls.

Model B18, 18 classrooms, located in Al-Samah neighborhood, occupied by Al-Kuwait Seventh Primary School for Girls and Boys.

Model B24, 24 classrooms, located in Al-Sinaa neighborhood, occupied by Um Al-Rubayyin Industrial Secondary School.

Model A24, 24 classrooms, located in Al-Ikhaa neighborhood, and the school is currently unoccupied.

5.1 Description of School Designs

-            Layout Patterns

There are three models of schools with a layout of the type "courtyard enclosed on all sides," as shown in the figure (1) below. This layout is not preferred in active learning schools due to the arrangement of classrooms around a narrow corridor, which leads to wasted space that could otherwise be used for interaction.
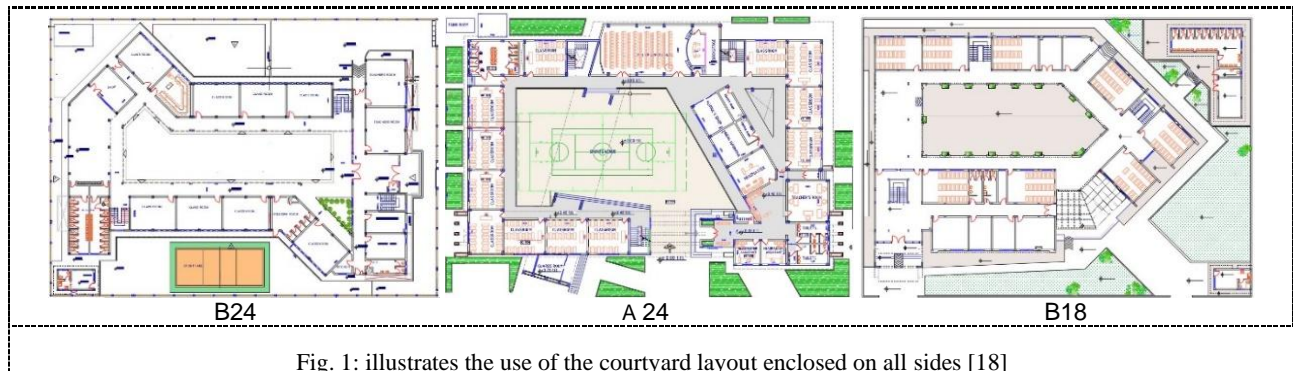

Fig. 1: illustrates the use of the courtyard layout enclosed on all sides [18]

As for Model B12, the open courtyard layout from both sides has been used, as shown in Figure (2) below. This layout is one of the patterns that can be used to provide flexible communication between classrooms and shared spaces, and to create open corridors that allow for social interaction.
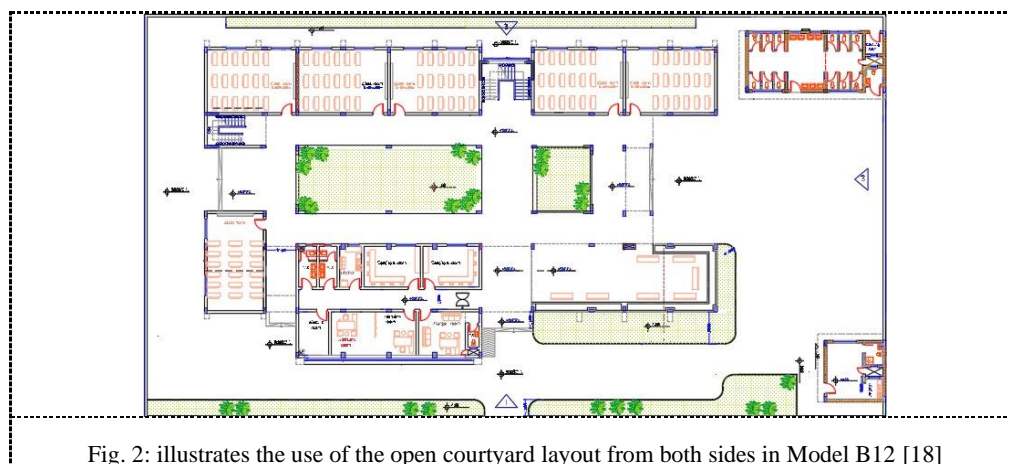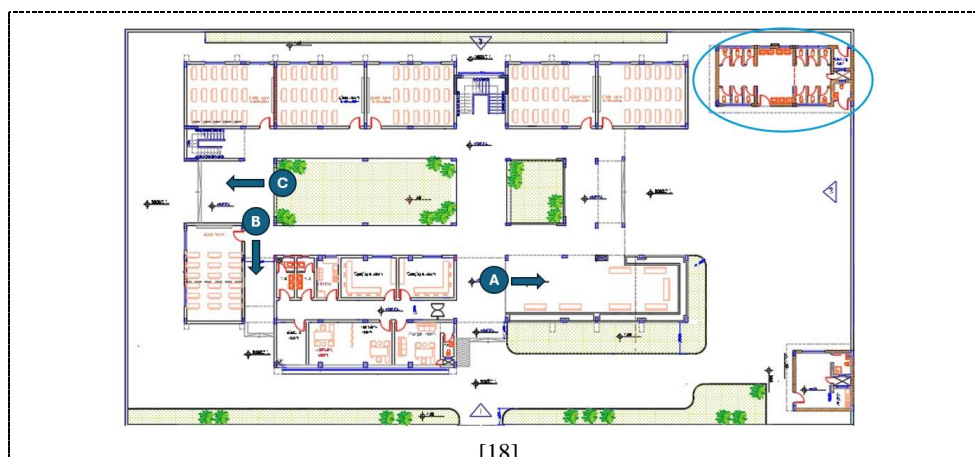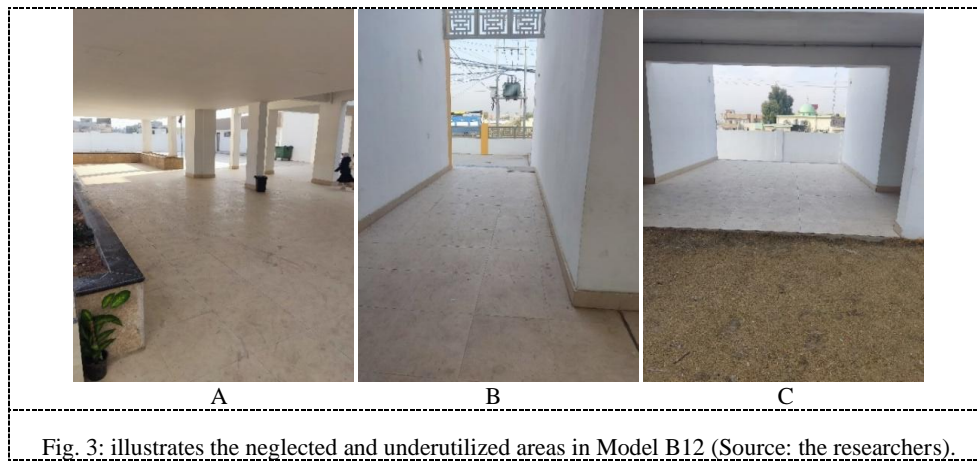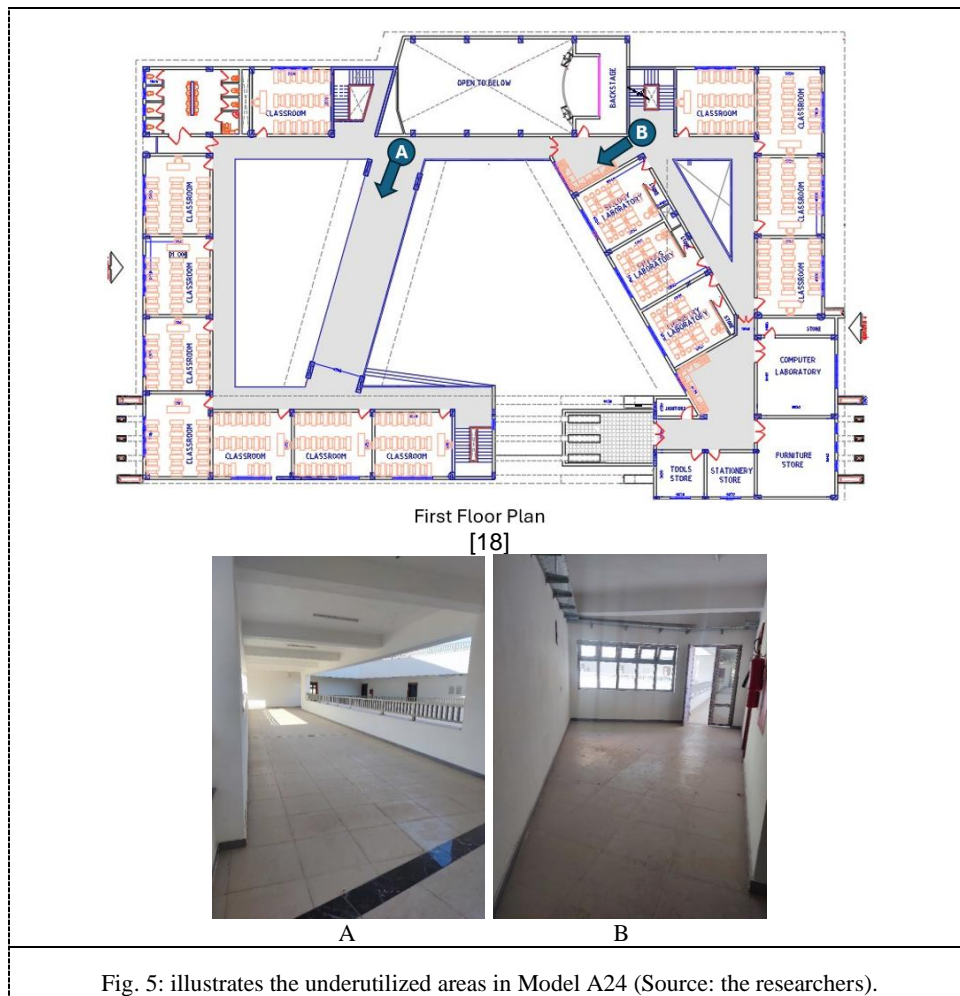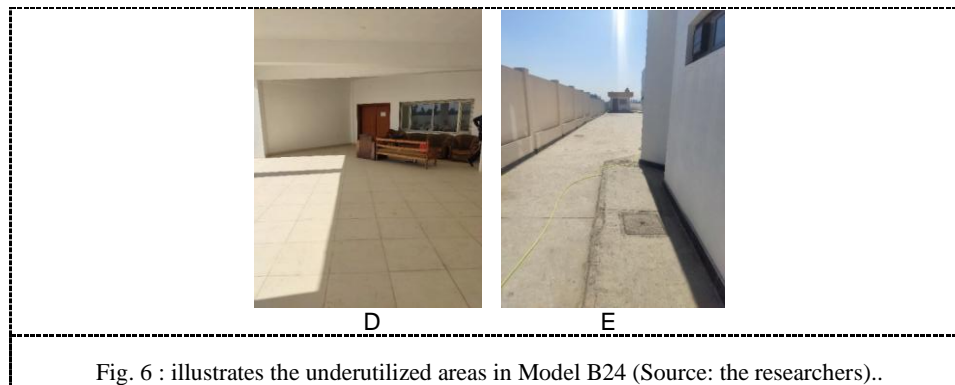

Fig. 2: illustrates the use of the open courtyard layout from both sides in Model B12 [18]

The schools contain neglected and functionally underutilized areas, as shown in Figures (3)(4), (5) and (6) below. This contradicts the principles of active learning, which require that all spaces be utilized effectively.

[18]

Fig. 3: illustrates the neglected and underutilized areas in Model B12 (Source: the researchers).

GROUND FLOOR PLAN

[18]

Fig. 4: illustrates the underutilized areas in Model B18 (Source: the researchers).

First Floor Plan
[18]

Fig. 5: illustrates the underutilized areas in Model A24 (Source: the researchers).

GROUND FLOOR PLAN
[18]

Fig. 6 : illustrates the underutilized areas in Model B24 (Source: the researchers)..
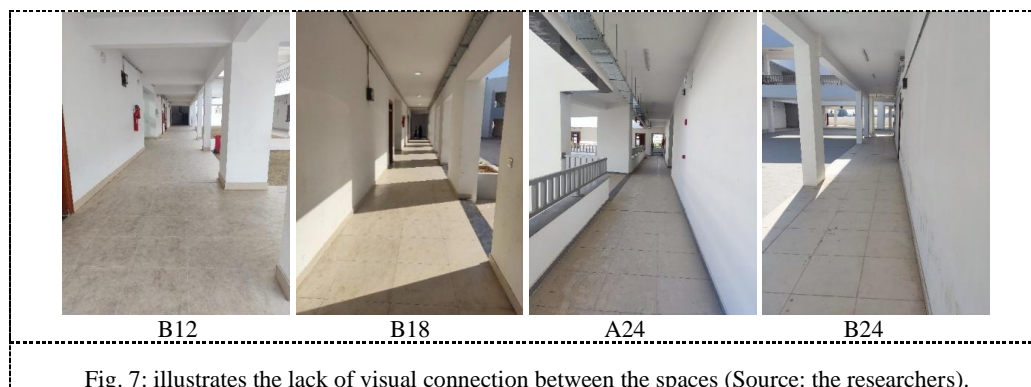
The spaces in the four models of the schools lack visual connection due to the solid walls that are devoid of openings, as shown in Figure (7) below. This contradicts the requirements of active learning, which necessitates an open and visually connected school environment.

Fig. 7: illustrates the lack of visual connection between the spaces (Source: the researchers).

-   The interior design of learning spaces

In terms of interior design, the window openings facing the outside in the designs of the four schools do not provide the required connection between the interior and exterior spaces, nor do they allow for the adequate amount of natural light required for the spaces. In contrast, the design of active learning schools requires large window openings that allow natural light to flow and provide proper ventilation for the school spaces, improving the learning environment. As shown in Figure (8) below.

Fig. 8: illustrates the inadequate window opening sizes (Source: the researchers).

The four schools lack diversity in their informal spaces, as they do not contain areas for individual learning or for collaborative work among students, with no supportive learning spaces in the corridors, library, or outdoor areas. The availability of these spaces is essential for implementing active learning methods, as they support learning outside the classrooms.

The student gathering areas in the schools are limited to the internal courtyard only, which does not align with active learning methods that require providing multiple gathering spaces, such as small areas or wide corridors, to support student interaction.

In addition, there are spaces in the four schools that are not under supervision and are far from sightlines, as shown in Figure (9) below. This contradicts the principles of active learning, which require continuous supervision and clear visibility throughout all areas of the school.

B18   B24
Fig. 9: illustrates the inadequate window opening sizes (Source: the researchers).

The designs of the four schools' spaces lack diversity in the use of colors and materials, as the same color and material have been applied across all school spaces. This has resulted in a loss of visual stimulation and richness, which are essential for enhancing the learning environment. Active learning space design principles emphasize the creation of a stimulating educational environment that encourages student interaction and engagement.

- Interior Design Flexibility

The four school models lack the necessary flexibility required for active learning environments. The walls are fixed, preventing any changes to the shape and size of the spaces, and there are no areas that can be expanded into the learning spaces when needed. Additionally, the spaces within these schools are not accessible for community use. These issues contradict the principles of active learning environment design, which require flexible furniture capable of supporting various educational activities. Furthermore, they hinder the encouragement of community use of specific areas within the school. Active learning environments emphasize the importance of adaptable spaces that cater to changing educational needs and foster interaction with the wider community outside school hours.

- Corridors

The corridors of the four school models are characterized by being long, with a length of approximately 45 meters, and their function is limited to movement only. The width of the corridors in three of the models ranges from 2 meters to 2.10 meters, making them insufficient to create educational areas or host other activities. However, in model B12, the width of the corridors is about 3 meters, but they remain underutilized functionally, as shown in the figure (10) below. Therefore, the corridors in these schools do not align with the design of corridors in active learning schools, where they are considered vital spaces for social, recreational, and educational purposes. They should contain multiple areas for informal learning.

B12   B18   A24   B24
Fig. 10: illustrates the inadequate window opening sizes (Source: the researchers).

Additionally, the corridors in the schools are enclosed by fixed walls that cannot be opened to the classrooms, which also does not align with the requirements of active learning, which necessitates the possibility of opening the corridors with movable partitions or walls. The corridors lack teacher supervision, except in the B12 and B18 models, which contain teacher rooms equipped with windows overlooking the corridors. This is emphasized in the designs of schools adopting active learning to create a safe learning environment and activate the role of teachers in guiding students.

- Classroom

The classrooms in the four school models are characterized by a traditional layout, with classrooms arranged around a corridor space and enclosed by fixed walls, preventing them from opening up to adjacent classrooms or the corridor. This design contradicts the principles of active learning school design, which emphasize that classrooms should have the flexibility to open up to adjacent spaces and incorporate other spaces when needed using movable partitions.

The classroom orientation and student arrangement in the sample schools are towards the short direction, whereas active learning classrooms emphasize the importance of orienting the classroom along the long axis to ensure visual communication between students, the teacher, and the educational content.

Moreover, the number of students in each classroom exceeds 50, which contradicts the principles of active learning. This approach considers that having more than 30 students per classroom limits the flexibility needed for diverse learning activities and interactions.

- Outdoor spaces

The outdoor spaces in the four school models are not utilized for learning purposes, lacking organization and essential features such as seating areas or shaded zones for students to sit or read. The green areas are very limited in three models: B12, B18, and A24. In the B24 model, there are green spaces, but they are neither organized nor utilized effectively, as shown in the figure (11) below. In contrast, outdoor spaces in active learning schools serve as valuable educational tools, used for playing and various activities.

Fig. 11: illustrates the outdoor spaces in the four school models (Source: Researchers)

5.2 The possibilities of applying active learning in the case study of Iraqi schools

Beside the field visit of the four school sites, open interviews were conducted with the supervising engineers and officials responsible for the construction of the Chinese Loan Schools in Nineveh Governorate, including the Schools Division/Directorate of Education in Nineveh, and the supervising engineers from the Directorate of Buildings/Ministry of Housing and Construction. To determine the feasibility of applying active learning methods in the Iraqi schools under study, the research relied on the opinions of expert engineers, as well as the researcher's perspective, which is based on analyzing the building floor plans to investigate whether a particular feature is already applied, can be implemented with minor adjustments, or requires design modifications. This is illustrated in Table (2)

Table (2) Feasibility of Applying Active Learning Characteristics in the Iraqi Schools Under Study
(✓: Cases of the four schools, *✓: Some cases)
(Source: by Authors)

Main Factors	Secondary Factors	Indicators	A feature applied in some or all cases	A feature applicable with minor modifications	A feature applicable with major modifications	A feature not implemented	Notes
Building Layout Types	**Preferred Layout Types in Active Learning**	Use of Learning Street Layout				✓	
		Use of Courtyard Open on One or More Sides	✓*				The open courtyard layout was used in only one model (B12)
		Use of Cluster Layout				✓	
		Use of Multi-Story Atrium Layout				✓	
		Use of Single Block Layout				✓	
		Use of Urban Form Layout				✓	
	Non-Preferred Layout Types in Active Learning	Avoid Linear Layout	✓				This layout was not used in the design of the four school models
		Avoid Closed Courtyard Layout Surrounded on All Sides				✓*	The enclosed courtyard layout was used in three models
	Spatial Specifications in the Layout	Utilize All Spaces Functionally and Avoid Unused Spaces		✓			**Modification techniques from the researcher's perspective:** Transforming neglected areas and corners into learning spaces or display areas by reorganizing these spaces and adding flexible partitions and adaptable furniture for their use. This includes utilizing external spaces and converting them into interactive educational and recreational areas
Flexibility of the Layout	**Adaptability to Future Changes**	The ability to expand by adding floors			✓		**Modification techniques from the researcher's perspective:** The building design allows for the addition of upper floors or horizontal expansion in specific areas. **Modification techniques from the experts' perspective:** Vertical expansion is possible in all models and should be considered when designing the foundations
		The ability to expand horizontally on the site			✓		Horizontal expansion is structurally feasible, but it depends on the availability of adjacent space at the school site
	Modifiability and Changeability	Positioning structural elements and load-bearing walls to allow modification, transformation, and resizing of spaces.			✓		**Modification techniques from the researcher's perspective:** Replacing fixed walls in all educational spaces with movable partitions to allow for flexibility in the configuration of

Category	Criterion	Sub-specification						Notes
								space. **Modification techniques from the experts' perspective:** There is a possibility to modify and alter spatial configurations since the building is based on a structural frame system; however, such changes must be made in accordance with the established structural system.
Interior Design Specifications	**The openness of internal spaces to external areas to enhance visual and environmental connectivity.**	The use of glass and wide openings				✓		**Modification techniques from the researcher's perspective:** Enlarging the size of existing windows or adding new ones. **Modification techniques from the experts' perspective:** It is possible to modify and enlarge window openings.
	Diversity of informal learning spaces	Creating individual study corners				✓		**Modification techniques from the re-searcher's perspective:** Reorganizing existing spaces and creating new flexible spaces equipped with adapta-ble furniture. **Modification techniques from the ex-perts' perspective:** This is possible, but to a limited extent, by utilizing unused areas such as corners and adequately wide corridors.
		Creating collaborative spaces						
		Providing unconventional and comfortable seating areas in corridors, libraries, and other spaces						
	Specifications for gathering spaces (not relying on a single gathering space).	Design of multiple spaces throughout the school, such as: Wide corridors Courtyards Multifunctional areas					✓	
	Specifications of Individual Study Spaces	Creating designated areas and corners for individual work and focus to enhance individual study, ensuring they are clear, multiple, visually isolated, and furnished with comfortable furniture				✓		**Modification techniques from the re-searcher's perspective:** Designating quiet zones or corners by defining them with flexible and transpar-ent partitions to achieve isolation and calm. For example, in models B12 and B18, areas labeled (C) can be used for this purpose, while in model B24, area (D) can be utilized. **Modification techniques from the ex-perts' perspective:** This is possible, but to a limited extent, by utilizing existing corners and allocating them for this function.
	Specifications for Non-Educational Spaces	Functionally integrating different spaces to extend learning For classroom learning (preparing and equipping the library, hallways, and even outdoor areas with the necessary tools and devices for learning)		✓				**Modification techniques from the re-searcher's perspective:** Utilizing the library and corridors with adequate width, as in model B12 and the corridor on the first floor of model 24A, to serve as learning areas, equipped with the necessary furniture and technology. **Modification techniques from the ex-perts' perspective:** The library can accommodate educational functions, but the corridors are narrow and cannot have their width increased.
	The relationship between internal spaces	Achieving visual openness and connecting spaces visually with each other, using glass walls to avoid unmonitored spaces and isolated areas				✓		**Modification techniques from the re-searcher's perspective:** Ensuring openness in all spaces of the four models by using transparent glass parti-tions and utilizing and furnishing them functionally. **Modification techniques from the ex-perts' perspective:** Solid partition walls between school spac-es can be replaced with transparent glass walls to achieve visual connectivity.
		Achieving smooth movement	✓					

Category	Criterion	Description					Notes / Modification
		between them					
	Specifications of colors	Achieving color balance in interior design, using refreshing and calming colors, with the possibility of using colors to define space activities, such as selecting specific colors for a space based on the activity.		✓			**Modification techniques from the researcher's perspective:** Adding calming colors such as blue and green to classrooms and libraries in all models, along with incorporating stimulating colors in activity, interaction, circulation, and gathering areas.
	Specifications of Materials Achieving visual stimulation in both interior and exterior design	Using diverse materials such as wood, glass, various coatings, and surfaces with different textures to enhance an attractive and stimulating environment		✓			**Modification techniques from the researcher's perspective:** The use of diverse materials, such as wood and fabric for furniture, and glass for walls in interior spaces.
Interior design flexibility	The ability to easily change the shape and size of the space	Providing folding walls, movable partitions, and linking adjacent spaces to expand or reduce the area based on the activity			✓		**Modification techniques from the researcher's perspective:** Using movable partitions between spaces to provide flexibility in adjusting their size and improving their efficiency based on the activity. **Modification techniques from the experts' perspective:** The possibility of removing fixed walls and replacing them with flexible partitions.
	Use of school spaces by the community	Designating multifunctional spaces that are easily accessible for use outside of regular working hours				✓	Spaces typically used by the community include the library, flexible and multi-purpose spaces, and the sports hall. However, the presence of these spaces in schools is very limited
Specifications of Corridors	The corridors should be clear and direct	Avoid complicated corridors, and ensure sightlines are extended without visual obstructions	✓				
	Must be concise and not long	To reduce the length of corridors by placing nodes, gathering areas, and distributing classrooms around them			✓		
	The corridors should have an appropriate width	Designing corridors with a suitable width to accommodate movement	✓				The width of the corridors is suitable only for movement
	They should be multifunctional	Equipping them with suitable seating, furniture for collaborative and individual work, and other educational tools				✓	The width of the corridors is insufficient for activities, except for model 12B, where the corridor width is 3 meters, allowing it to be utilized for other functions
	They should be visually monitored and under the supervision of teachers	Equipping them with glass walls and open sightlines from teachers or administrative rooms			✓*		**Modification techniques from the researcher's perspective:** Providing rooms with glass walls overlooking the corridors and intersections in models A24 and B24, along with the addition of display screens and surveillance cameras in all models. **Modification techniques from the experts' perspective:** The possibility of removing solid walls and replacing them with glass walls, equipped with cameras and the necessary technology
Classroom Specifications	Avoid designing classrooms according to traditional closed-plan layouts	Using glass partitions that can open to corridors or adjacent classrooms				✓	Classroom layouts are traditional, with fixed walls defining the spaces
	Determining the number of students in a classroom	The number of students in a classroom should be 30, with design conditions ensuring that this number is not exceeded		✓			Modification techniques from the researcher's perspective: Working to reduce the number of students in the classroom to an acceptable level.
		Design the classroom space to be spacious enough for the number of students and accommodate active learning activities.	✓				The classroom space is sufficient, provided the number of students is reduced
	The relationship between the classroom and adjacent spaces	Opening up to adjacent spaces by connecting classrooms with flexible spaces or educational corridors using sliding doors or				✓	There are no adjacent or nearby spaces that can be opened into the classrooms

Category	Subcategory	Item	1	2	3	4	5	Modification techniques
		foldable walls						
		The presence of adjacent spaces to the classroom to serve as focus rooms			✓			Modification techniques from the researcher's perspective: Working on separating part of every two adjacent classrooms with a movable partition and designating it as a shared focus space between them
	Classroom shape	Adopting regular geometric shapes such as square, rectangular, or circular depending on the need	✓					
	Class Orientation	Orienting the rectangular classroom towards its long facade (placing the blackboard on one of the long walls)		✓				Modification techniques from the researcher's perspective: Changing the orientation of the classroom to the longer direction and arranging it accordingly
	Types of Classrooms	Designing flexible, reconfigurable classrooms		✓				Modification techniques from the researcher's perspective: Designating classrooms for fixed subjects and others with flexible furniture and arrangements for multiple subjects in each school model
		Design specialized classrooms equipped with fixed tools and equipment according to the activity, such as laboratories and music classes						
outdoor spaces	**Outdoor space functions**	The presence of various rest areas such as (garden, seating areas, social interaction areas and events)		✓				Modification techniques from the researcher's perspective: Organizing and designing outdoor spaces to create areas with seating, shaded zones, and other features that encourage student interaction and learning, particularly in model A12, which has ample spaces that can be utilized for various activities. In contrast, model A24 has limited outdoor spaces compared to the other models
		Using outdoor spaces to support learning by organizing outdoor spaces to include a school garden, planting beds, and other		✓*				Modification techniques from the researcher's perspective: A vegetable garden can be created in models B18 and B24 for students to cultivate, or other real-world educational tools can be implemented. As for model A12, establishing a garden would require removing part of the concrete flooring in the side area to utilize it for such functions and add other educational tools. In model A24, the outdoor spaces are limited to the internal courtyard, and their potential for use is somewhat restricted.
		Organizing school activities and events that cannot be implemented inside the school, and creating playgrounds, outdoor platforms, celebration areas, simple games, and others			✓*			Modification techniques from the researcher's perspective: Redesigning and organizing the outdoor spaces, particularly in the three previously mentioned models (A12, B18, and B24), to provide diverse areas that can be utilized for various activities
		Support physical health by designing dedicated walking and jogging paths with safe flooring, shaded by trees or canopies, and providing simple exercise equipment			✓			Modification techniques from the researcher's perspective: Creating safe running paths by replacing the asphalt surface with a safer material for students in case of falls, planting trees to shade those areas, and providing space for simple exercises to support physical activity for students. Modification techniques from the experts' perspective: The playground surfaces can be replaced with safer materials.

6. Discussion

The results of investigating the features of building layout patterns revealed that the feature of using the open courtyard pattern was implemented in only one of the models, which is considered a preferred pattern. Additionally, the feature of avoiding the use of the linear pattern, as an unfavorable type in active learning schools, was also considered. The feature that is applicable with minor modifications was the functional use of all spaces and avoiding unused areas by reorganizing them, adding flexible partitions, and equipping them with adaptable furniture, in addition to utilizing outdoor areas and converting them into interactive educational and recreational spaces. The remaining features were not applied. It is observed that most design features of active learning school patterns are not adopted in modern schools in Iraq. Figure (12) illustrates the percentage of features applicability.
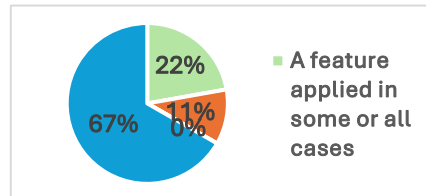
Fig. 12: The percentage of adoption of active learning school layout indicators in modern Iraqi schools

The results of applying the features of layout flexibility, indicated that the features related to vertical expansion (adding floors) and horizontal expansion on-site are applicable in all four school models, provided that major modifications can be made, as expansion was considered during foundation design. Similarly, the feature of spatial adaptability and modification is also applicable with major modifications, given that the structural system allows for changes in spatial configuration while maintaining the locations of the structural elements. Figure (13) illustrates the percentage of features applicability.
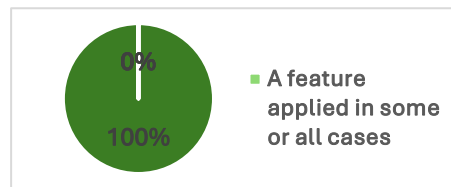

Fig. 13: The percentage of adoption of layout flexibility indicators for active learning schools in modern Iraqi schools

The results of feature implementation of interior design specifications for active learning schools showed that the feature of enabling smooth circulation between school spaces was implemented in all four models. The feature of functional integration between various spaces to serve as an extension of learning is applicable with minor modifications, such as utilizing and equipping the library space and adequately wide corridors in models B12 and A24 with flexible furniture, tools, and technological devices to support learning. Additionally, the feature of achieving color balance in the interior design is also applicable with minor adjustments, such as introducing calming colors like blue and green into classrooms and libraries and using stimulating colors in transitional areas and activity spaces like workshops to foster creativity. Moreover, the feature of using diverse materials to enhance visual stimulation was implemented using materials like wood and fabric for furniture, and glass partitions within interior spaces.

The feature of opening interior spaces to outdoor areas to enhance visual connection is applicable with major modifications, such as enlarging existing windows or adding new ones. The feature of having a variety of informal learning spaces is also applicable with major modifications, including reorganizing functionally underutilized spaces such as junctions, corners, and sufficiently wide corridors, and creating new flexible areas equipped with adaptable furniture. The feature of establishing dedicated zones or corners for individual work and focus is applicable with major modifications as well, involving the use of underutilized areas and defining them with flexible and transparent partitions to ensure acoustic isolation. Likewise, the feature of achieving visual openness and interconnection between spaces is applicable with major modifications through replacing solid walls with transparent and flexible glass partitions, ensuring that all school spaces are activated and equipped with necessary furnishings for learning activities. Finally, the feature of designing multiple distinct

spaces throughout the school is not applicable due to the absence of such areas in the four study models. Figure (14) illustrates the percentage of features applicability.
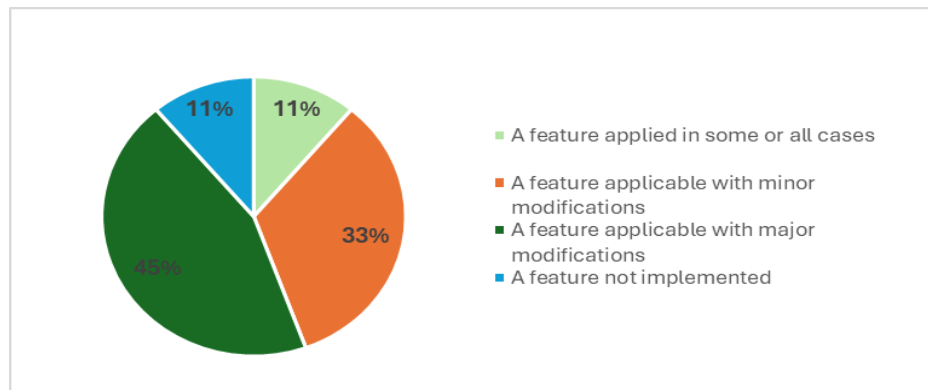

Fig. 14: The percentage of adoption of interior design specification indicators for active learning schools in modern Iraqi schools

The results of applying the features of interior design flexibility such as the ability to modify the shape and size of spaces to accommodate changing activities were found to be applicable with major modifications, through replacing fixed walls with movable partitions to allow flexibility in resizing spaces and improving their functional efficiency. However, the feature concerning the possibility of using school spaces by the is not applicable in the four school models, due to the limited presence of spaces typically used by the community such as libraries, music rooms, and multi-purpose halls. Figure (15) illustrates the percentage of features applicability.
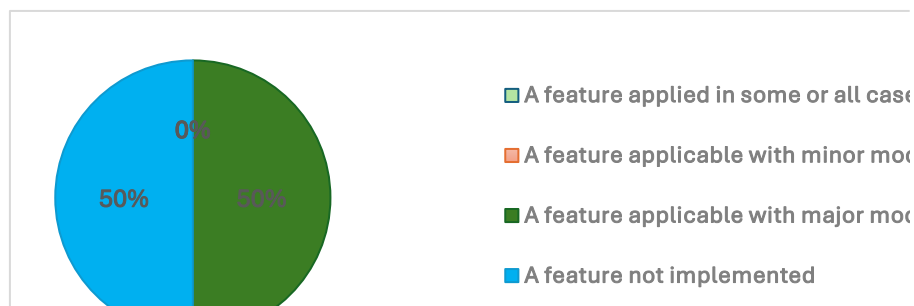

Fig. 15: The percentage of adoption of interior design flexibility indicators for active learning schools in modern Iraqi schools

The results of applying the features of corridor specifications revealed that the feature of avoiding complex layouts and maintaining clear lines of sight was implemented, as corridors are clear and direct in all models. The feature of designing corridors with adequate width to accommodate movement was also achieved, as their width is suitable for circulation purposes. The feature of corridors being monitored and supervised by teachers was implemented in models B12 and B18 due to the presence of teacher rooms with glass walls overlooking the corridors. In contrast, in models A24 and B24, this feature is applicable with major modifications, such as replacing solid walls with glass partitions overlooking the corridors and intersections and installing surveillance cameras. However, the feature of having short, non-elongated corridors was not implemented, nor was the feature of multi-functional corridors, as the width does not support additional activities—except in model B12, where the 3-meter-wide corridors allow for other functional uses. Figure (16) illustrates the percentage of features applicability.
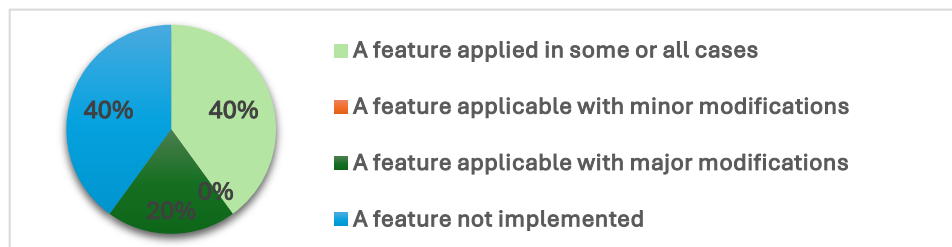

Fig. 16: The percentage of adoption of corridor specifications indicators for active learning schools in modern Iraqi schools

The results of applying the features of classroom specifications showed that the classroom space has a sufficient area for the number of students and their active educational activities. Additionally, the property of using regular geometric shapes was also implemented. However, limiting the number of students in the classroom to 30 can be applied with minor adjustments by reducing the number of students to an acceptable limit. The property of directing the classroom towards its long side can also be applied by changing the orientation of the classroom and organizing it accordingly. Regarding the property of preferring two types of classrooms, one flexible and the other dedicated to a single subject or type of activity—it can be

applied with minor modifications, such as dedicating certain classrooms to teaching one subject, which can be used across all stages, while others remain flexible with movable furniture to accommodate different activities. The property of having adjacent spaces to the classroom for use as focus rooms is applicable after major modifications, including removing the wall between two classrooms and dedicating a shared room that is isolated by flexible partitions, which can be used for this purpose. Both properties, avoiding the design of classrooms according to traditional closed layouts and ensuring openness between the classroom and adjacent spaces through flexible partitions, were not applied. Figure (17) illustrates the ratios of features applicability.
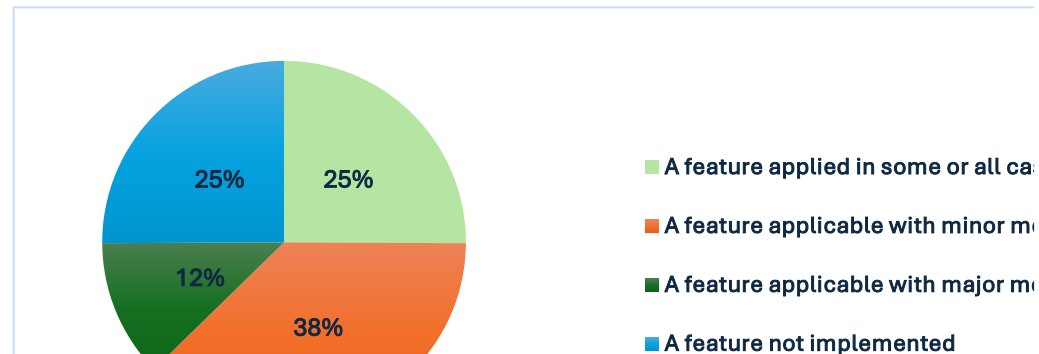

Fig. 17: shows the percentage of adoption of indicators for classroom specifications in modern active learning schools in Iraq

The results of applying the features of the external spaces category, it was found that the feature requiring external spaces to include diverse areas is applicable after making minor adjustments. This includes organizing and designing the available spaces in the four models and utilizing them to create shaded areas, vegetable gardens, plant beds, etc. Specifically, in model A12, there are sufficient spaces that can be exploited for various activities. However, in model A24, the external spaces are limited compared to the other models.

Additionally, the feature of using external spaces to support the learning process is applicable after making minor adjustments in models B18 and B24. In these models, a vegetable garden could be created for students to plant, or real-world educational tools could be incorporated. As for model A12, this would require removing a portion of the concrete floor in the side garden to utilize the space for these functions. In model A24, the external spaces are limited to the internal courtyard, and the potential for exploitation is somewhat restricted.

As for the feature of the possibility of conducting school activities and events in external spaces, it was found to be applicable after making major adjustments through designing and organizing those spaces, especially in the three previously mentioned models (A12, B18, and B24). As for the feature that external spaces should support physical and mental health, it is also applicable after making major adjustments. These adjustments include creating safe running paths, replacing the asphalt floor with a safe surface to prevent injury to students when they fall, and planting trees to provide shade over these areas, allowing for simple exercises to support students' physical activity. The graph in Figure (18) illustrates the ratios of features applicability.
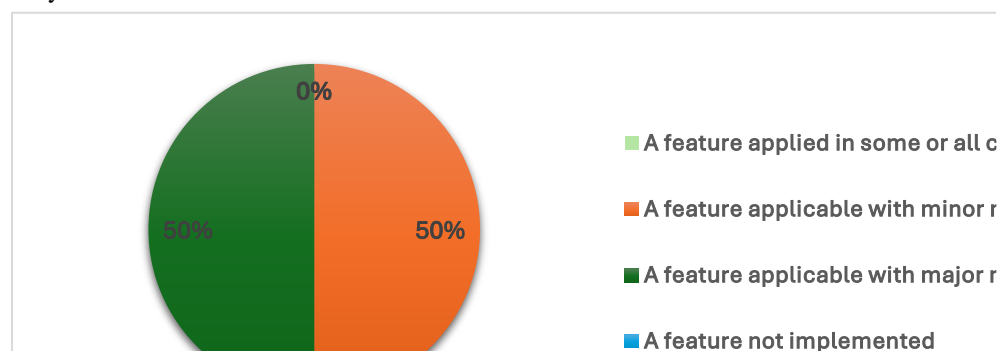

Fig. 18: Percentage of Adoption of Active Learning School Design Indicators for Outdoor Spaces in Modern Iraqi Schools

7. Conclusions

The paper explored the feasibility of applying active learning in modern Iraqi schools. A case study of four models of Chinese loan schools were investigated which revealed different adaptation possibilities. Regarding the architectural layout of the schools, it can be found that the courtyard type surrounded on all sides was adopted in three models, which is not preferred in active learning schools. However, the fourth model followed an open courtyard layout on two sides, which is more suitable for active learning schools. All four models contained neglected spaces and corners that can be slightly modified and transformed into flexible, interactive educational areas. Regarding the flexibility of the layout and its expansion capability, it is found that all four school models are characterized by their ability to be modified and altered in terms of the shape and size of their spaces, as the structure is modular. Additionally, there is potential for both vertical and horizontal future expansion.

The investigation of interior design revealed that the four school models offer the potential to expand window sizes, enhancing the connection between interior and exterior spaces, which is a key feature in active learning schools. Additionally,

there is the possibility to design diverse spaces that represent informal learning areas, such as individual and collaborative zones, by utilizing underused spaces, the library area, and corridors with appropriate widths. These can be furnished and equipped with the necessary tools, technology, and power outlets for learning. However, the provision of supporting areas for various activities required by active learning methods outside the classrooms is limited, with small spaces restricted to the neglected areas in the designs of the four models. This is insufficient when compared to what was observed in the analysis of global examples of active learning schools. The designs of the four school models feature the possibility of replacing solid walls with glass walls or partitions to achieve open sightlines between the school spaces, creating an open and visually connected learning environment without isolated areas. Additionally, stimulating colors can be incorporated into interaction zones, corridors, and stairs, while using diverse materials in the interior design such as wood, metal, colorful fabrics in the furniture, and glass partitions to achieve visual stimulation for students. Carpets can also be used for the same purpose, in addition to providing the necessary sound insulation in some areas of the school.

The design characteristics of corridors in the four schools are characterized by their appropriate width for smooth movement only, and they are clear, with very limited capacity to accommodate activities other than movement. Their use is confined to exploiting and furnishing the neglected and unused areas at the ends of corridors and intersections. In the B12 model, the corridor width is approximately 3 meters, which allows for displaying student works and utilizing the space for placing cabinets or even including seating along one side. Supervision of the corridors can be achieved in the A24 and B24 models, where the corridors do not connect with the spaces they face, by replacing the walls of those spaces with transparent glass partitions.

The classrooms in the four models are characterized by their ability to achieve openness with each other only by replacing the fixed walls separating them with flexible, movable partitions, allowing them to be combined when required by the activity. It is also possible to allocate space from every two classrooms to increase the classroom area and create a shared focus and project workroom, isolated by flexible partitions. The classrooms in the four models consider the geometric shape required for active learning classrooms, but it is necessary to change the orientation of the classrooms so that their arrangement and facades face the longer direction, rather than the shorter direction, which is avoided in active learning classrooms. Additionally, the number of students in each classroom should be reduced to 30 students to maintain flexibility. Regarding classroom activities, some classrooms in each model can be designated as spaces for specific activities or subjects that can be used across multiple grade levels. Other classrooms can be flexible, accommodating various activities, and can be assigned to a specific class when needed.

Regarding the outdoor spaces, there is potential to design and organize the outdoor spaces to include various educational areas and social interaction zones by providing shading canopies, placing seating areas, and allocating part of the space for a school garden, involving students in planting and taking responsibility for it. This is particularly feasible for models A12, B18, and B24. However, the fourth model (A24) only contains an internal courtyard, which is not suitable for all the activities required in active learning schools. Additionally, running paths can be organized with safe flooring materials, shaded with trees to support the students' mental and physical health, and equipped with simple age-appropriate playground equipment.

Recommendations

The research recommends adopting active learning concepts in the design of future schools to enable the integration of these educational methods. It also recommends modifying the unexecuted Chinese loan schools by making alterations and adjustments to their designs to allow the application of active learning methods, particularly the following features:

- Avoid using a courtyard design surrounded on all sides.
- Design multiple gathering spaces for students instead of restricting them to one area, and host diverse activities within them.
- Implement several adjacent spaces to educational areas that provide flexibility, allowing them to be combined when needed.
- Ensure the design of hallways with appropriate width so they can serve multiple purposes, including educational, social, and recreational uses.
- Avoid using the traditional classroom design with fixed walls, and instead create flexible spaces with movable partitions to enable the opening of classrooms and integration with neighboring spaces if needed for educational activities.
- Design outdoor areas to be used for educational, recreational, and sports activities.
- Allow the community to use school spaces after school hours and during holidays by designing multifunctional spaces, as well as allowing the use of outdoor areas.

To sum up, the implementation of these recommendations is expected to significantly contribute to improving the learning environment in Iraqi schools, enhancing the effectiveness of active learning methods, which will have a positive impact on the overall educational system in the country.

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