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The Impact of Modern Educational Transformations on the Design of Learning Spaces

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Abstract

This study explores the impact of modern educational transformations on the architectural design of learning spaces. Over the past century, shifts from teacher-centered to student-centered pedagogies—rooted in Behaviorism, Cognitivism, and Constructivism—have redefined spatial requirements and instructional practices. By conducting a comprehensive literature review and analyzing 59 award-winning international schools, Kim Dovey & Kenn Fisher identify six typologies of learning environments (traditional classrooms, learning commons, street spaces, meeting areas, fixed-function rooms, and outdoor learning zones). Our findings reveal that adaptive layouts, flexible furniture, and seamless integration of indoor and outdoor areas support active learning, collaboration, and personalized instruction. Critical sensory factors—natural lighting, acoustics, and spatial complexity—emerged as key drivers of student engagement and educational outcomes. We propose a framework linking pedagogical strategies with spatial design principles—complexity, adaptability, and assemblage—to guide architects and educators in co-creating future-ready learning environments. Ultimately, this research underscores the necessity of reimagining school architecture to enhance student-centered experiences and offers directions for future empirical studies on spatial-pedagogical efficacy.

Keywords: Learning space – Pedagogy – classroom – Teaching – Student.

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1. Introduction

The Organization for Economic Co-operation and Development (OECD) defines a learning space as a physical environment that supports diverse curricula and teaching methods, respects and harmonizes with its environment, encourages social interaction, and provides a healthy, comfortable, safe, and stimulating setting for learners (Gorkiewicz et al., 2016). Over the past century, architectural design for learning environments has slowly evolved as a result to shifts in pedagogical theories and strategies. With the transition from teacher-centered to learner-centered paradigms, design embraced more open plans, new spatial typologies, and adaptive configurations. (Dovey & Fisher, 2014)

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2. The Modern Learning System

The modern educational system is characterized by its emphasis on flexibility, inclusivity, and the enhancement of critical thinking skills to meet the demands of an increasingly complex and globalized world. It moves beyond traditional, teacher-centered approaches by integrating technology, promoting collaborative learning environments, and focusing on the development of both cognitive and social-emotional competencies. Curricula are often designed to be interdisciplinary and adaptive, encouraging students to apply knowledge creatively across various contexts. Moreover, there is a growing recognition of diverse learning needs and cultural backgrounds, leading to more personalized and equitable educational practices. The development of modern learning systems has been profoundly shaped by the evolution of pedagogical theories, particularly behaviorism, cognitivism, and constructivism.

2.1. Evolution of Educational Theory

Although traditional teaching methods played a certain role in educational practice, they have inherent limitations. With advances in educational theory and innovations in pedagogies, modern teaching approaches emerged in three main stages: Behaviorism, Cognitivism, and Constructivism, which form the basis of contemporary education system. And several other theories have emerged following the same idea of student-centered learning such as sociocultural theory, situational learning theory, and personalized learning theory. (Yue,2024)

2.1.1. Behaviorism

The behavioral approach—is Grounded in the stimulus–response approach developed by Pavlov and Skinner — which emphasizes teacher-centered instruction and uses a strict “bells & cells” model for classroom design, clearly segmenting time and space. Behaviorism is a theory that suggests that learning is the product of the interaction between a stimulus (an event that triggers a response) and a response (the behavior that results from the stimulus). According to behaviorists, the stimulus-response (S-R) relationship forms the basis of all learning and behavior.

Behavior shaping is central to behavioral teaching. It involves reinforcing successive approximations of a target behavior until it is fully acquired. For example, when teaching a student to read, a teacher might praise the student first for selecting a book, then for opening it, and finally for reading a word or sentence. These gradual reinforcement steps develop complex behaviors and skills.

Despite the deep impact of behaviorism and its applicability, this theory is criticized for overemphasizing observable behavior while neglecting cognitive processes like thoughts, emotions, and expectations. Critics argue that it may overvalue rote memorization and underplay critical thinking and creativity. (edumaged.com, 2023)

2.1.2. Cognitivism

Cognitivism developed through the work of scholars such as Bruner and Piaget, who promoted progressing from basic to advanced cognitive skills through tasks involving recall, comprehension, application, analyzing and evaluation. Each phase corresponds to different spatial and physical requirements in learning environments. (Burner, 1972)

2.1.3. Constructivism

Constructivism, that took shape in the 1970s, principally built upon Vygotsky’s initial studies, who maintained that recalling and utilizing knowledge must take place Within the learner’s everyday experiences so that it transforms into authentic learning, that students build their personal meanings through personal and social experiences. Learning environments, therefore, function simultaneously in terms of social, spatial, and informational dimensions that link Current abilities and understanding alongside new learning opportunities. (Vygotsky, 1978)

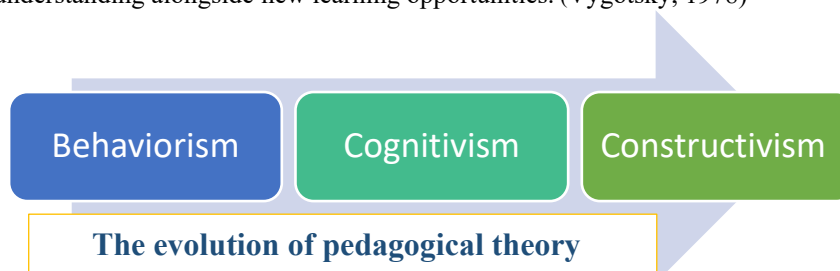


Figure 1: The evolution of pedagogical theory
Source: The researchers.

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2.2. Modern Educational Transformations

The shift from traditional to modern teaching methods is the entry point for several key theories. Traditional teacher-centered approaches typically rely on knowledge transmission and indoctrination learning, with the teacher as the primary information source and students as passive recipients. These methods often depend on paper-based materials and repetition, neglecting practical application and critical thinking.

With rapid advances in science, technology, and pedagogical reform, modern methods have gradually replaced traditional ones. Modern teaching emphasizes active student participation, personalized instruction, and experiential learning. Teachers now serve as guides and mentors, fostering greater student engagement and exploration. (Yue,2024)

2.2.1 Teacher-centred Learning

This mode of learning is mainly based on indoctrination, students sit in rows facing a teacher at the front by the blackboard. Movement is restricted to maintain silence, making students passive recipients who often memorize content without critical engagement, and because of this they not encouraged to think and not to show any development. (Byers, Imms & Hartnell-Young, 2014)

2.2.2 Student-centred Learning

Student-centered pedagogy encourages collaboration, enhancing students' abilities to cooperate and apply knowledge in practice. Here, the teacher acts as a mentor rather than the focal point, that's because independent study helps the students to develop their personal interests. (Hille, 2011)

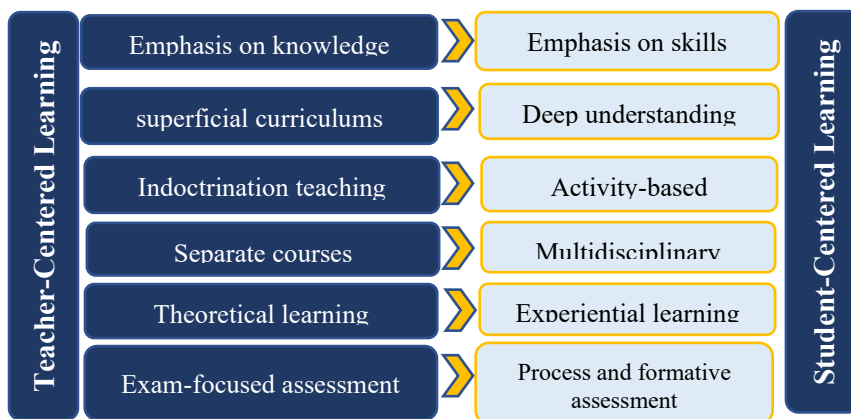


Figure 3: The main educational transformations

Source: The researchers.

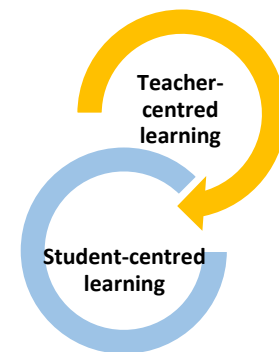


Figure 2: transformation from teacher-centered learning to student-centered learning

Source: the researchers

3. Learning Space and Modern Pedagogies Sciences

The learning environment and pedagogy can be seen as twin dynamics that should work in concert. If the evaluation of these two interacting forces is informed by philosophy, the learning environment is categorized as content or essence, while pedagogy acting as an idea. From the perspective of Plato, the Greek philosopher, the idea refers to the cause and beginning of everything and is an unchangeable force, while essence is a force that is highly indicated by its ability to change. When idea and essence interact, form is formed, i.e. the physical manifestation of the learning environment. (Bruksute, 2019).

At the beginning of the twentieth century, the renowned educationalist John Dewey realized that the quality of learning can be offered intentionally by adapting the learning spaces to the learning process, and emphasized the importance of student-centered learning, which highlights the essential role of social context, peer interaction, and playful learning. Woolner & Thomas emphasized that learning is a complex and the interactive connection between the educational spaces and the activities conducted within it, and that the student's outcomes are related to the effectiveness of the learning space. (Woolner & Thomas, 2016). Barrett et al. argued that sensory features of the classroom contribute to improved learning achievements and a more fulfilling life experience. (Dovey & Fisher, 2014)

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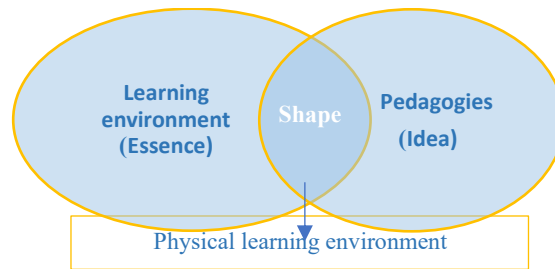


Figure 4: interaction between pedagogies & learning environment
Source: G.Brukstute, 2019

3.1 Classification of Educational Activities

In order to analyze the relationship between pedagogical strategies and spatial configurations, a set of six core instructional practices grounded in constructivist teaching methods were identified. This classification addresses a variety of group sizes involved in learning extending from large-scale presentations to four varieties of small-group work, to single-student reflective activities, (Dovey & Fisher, 2014) and in the following table (1) this classification is illustrated in detail.

Table 1. Typology of student-centered pedagogies

Activity Type	Description
Presentation (25–150 students)	Teacher or students make a presentation in front of a large group. The size of the group varies, it can be one class or more. These activities facilitate the effective delivery of knowledge.
Large Interactive (25–75 students)	Learning activities designed to shift effectively from large-scale to small-scale group work and vice versa, often arranged into groups of 4–6 students, but can be later split in groups of 2-3 students. supporting peer-to-peer and team teaching.
Medium Interactive (10–25 students)	Learning activities exhibiting a comparable flow of motion as large interactive but with smaller groups and often one instructor.
Creative Interactive (10–25 students)	Engaging activities with a strong focus on practical, hands-on experiences activities using resources like art supplies, wet areas, science labs, or outdoor spaces.
Small Interactive (2–5 students)	Problem-based learning and informal peer tutoring in breakout model, in which small groups of students are able to accept responsibility for directing their own learning.
Self-Reflection (1 student)	Individual Learning activities centered on reading, writing, or experiential research to fulfill educational objectives

Source: Kim Dovey & Kenn Fisher, 2014.

Based on De Souza & Kowaltowski (Negriz & Kowaltowski, 2017) along with Merrienboer et al. (2017), three core groups of learning activities can be categorized as: shared (collective) learning, team-based (group) learning, and independent learning Nair, who studied architecture and school education presented a more detailed typology of learning activities that he recommended for every modern school (2006), illustrated in detail in figure (5).

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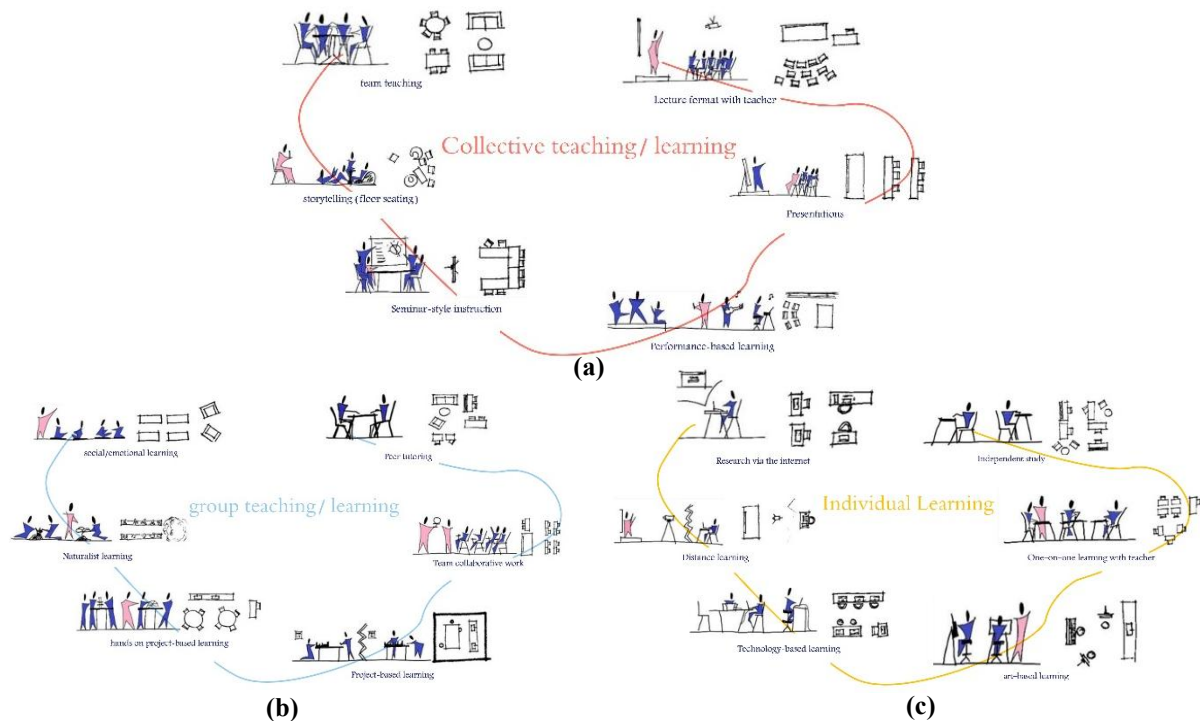


Figure 5: Nair classification for modern learning activities a) collective teaching learning b) group teaching/ learning c) individual learning

Source: the researchers based on Negris & Kowaltowski, 2017

3.2 Evolution of Learning Spaces

a. Around 1910, with no artificial light available in schools, classroom layouts were developed in such a way as to provide the maximum flow of natural lighting and enable the largest count of children to be taught at the same time. In the same year Hamlin proposed two models of classrooms, indicating a defined proportion of windows, the classrooms' dimensions and the height of the window sashes. He asserted that these measurements secured maximum natural light for the classroom. The width of the classroom was based on the number of pupils, so if the capacity of the classroom was 48 students, the width should be 7.5 meters and the length 10 meters, while if the capacity was for a class of 40 pupils, the width should be decreased to 6.56 m. For furniture, desks are arranged in rows so that the sun shines on the pupil's left side when they are writing, or the natural light will be blocked from the pupil (Hamlin, 1910). According to Baker (1900), in order to maximize the natural lighting of the classroom, there was a need to avoid large distances separating windows from one another and from surrounding walls. The instructor stands at the head of the class, and the black board is also hung there, to give the teacher control of the classroom and monitor the students, so that they can concentrate as much as possible, aim to keep noise in the classroom to a minimum, and don't allow students to move around. The down side is that students become passive recipients of information and knowledge, so this method does not encourage students to think or to show any progress.

b. During the period 1918-1939, open-air schools began to be established, on the premise that it was better for children's health. In 1935, the architects Eugene Beaudoin and Marcel Lods designed one of France's most notable open-air schools. The building comprised eight classrooms linked by a glazed corridor, each featuring three sliding glass walls that could be opened when required. The furnishings consisted of lightweight tables and chairs, enabling them to be easily moved outdoors if necessary. Within the classrooms, the furniture was arranged in rows, with the teacher's desk and blackboard positioned at the front. (Gislason, 2009)

The growing interest in unconventional practice has Motivated architects to produce many experimental designs of classroom. Richard Neutra, the Austrian architect create a classroom, based on the belief that school is meant to be an environment where learning turns into a distinctive experience for children, and is not limited to the passive intake of information or to reading and writing activities. Neutra's classroom was characterized by its flexibility and adaptability to practicality. (Neutra, 1935)

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However, only a few schools have developed based on creative educational concepts. Yet, most schools continuing to follow the traditional classroom layout proposed in 1938 by the American Horace Mann. Tables and chairs are arranged in rows, blackboard and teacher's desk are located at the front, with windows line both sides of the space. This classroom could accommodate 49 students, as the number of learners was growing exponentially influenced by the Industrial Revolution in the United States. (Baker, 2012)

- c. Between 1960 and 1965, the concept of the open classroom model was revived as a reaction to the restrictive and authoritarian educational spaces of the industrial period according to Alterator & Deed, who linked classrooms to Varied approaches to learning, namely: flexible educational space, pupil choice of learning activities, diversity of instructional materials, merging of different learning domains, small and large group teaching, and individual learning spaces. Alterator & Deed indicate that students are more easily observed in an open learning environment, where the flexible configuration of seating encourages communication and collaboration, but noise is one of the main drawbacks of these classrooms. (Bruksute, 2019)

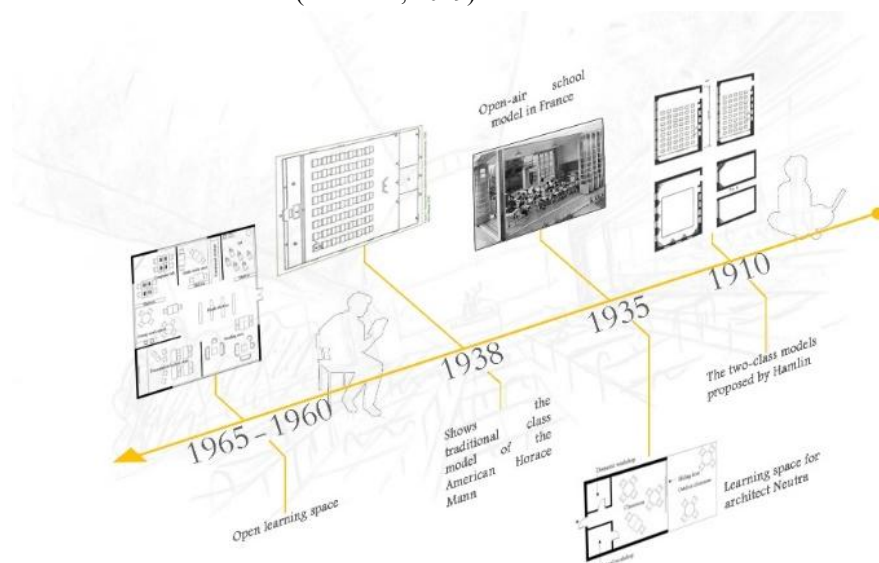


Figure 6: evolution of learning space
Source: the researchers based on Bruksute, 2019

To date, the most popular classroom space is a box-shaped space where furniture is organized in rows, with the teacher's desk and blackboard positioned at the front, but learning is not limited to classrooms, other learning spaces such as corridors, lobbies, reading rooms,etc. We can summarize that the progression of classroom design and furniture was guided by various essential considerations: (Bruksute, 2019)

- ensure maximum natural lighting in classrooms.
- Emergence of open-air schools
- Designing classrooms to hold large student populations.
- Introducing innovative scientific materials to curricula.
- Innovative pedagogical ideas and strategies.
- Growth of open-plan classrooms

3.3 Types of Learning Spaces

Based on the analysis of a sample of international sources from 59 outstanding and prize-winning schools sourced from three organizations designed to address pedagogical change and modern teaching methods, namely: designing for the future of learning, CEEPI's Australian Awards Program, and the British Council for school environments, the learning spaces were divided into types according to the teaching methods used by student-centered pedagogies, namely: traditional classroom, learning commons, street space, meeting area, specialized fixed-function spaces, and outdoor learning spaces. (Dovey & Fisher, 2014)

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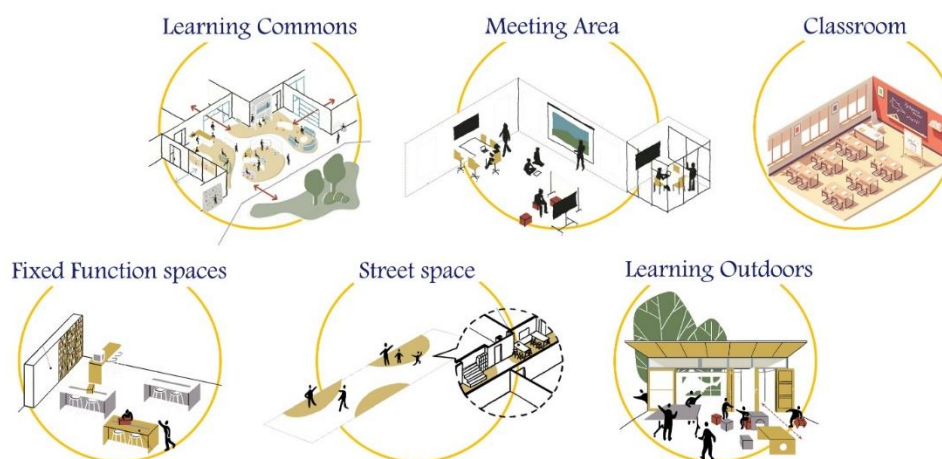


Figure7: types of learning spaces according to student-centered pedagogies

Source: the researchers based on <https://fieldingintl.com/design-patterns/show-all/>

This categorization simplifies a complex range of spaces, that Rarely occur in complete separation and frequently overlap. For example, meeting spaces can form an essential component of common areas, street spaces and Classrooms, or they may be distinct spaces, with some areas adaptable for conversion from one type to another, but the spaces that must be distinguished are commons and street spaces, because the prominent difference between them is the Presence or absence of traffic, which can restrict a variety of learning activities influenced by privacy, group identity and acoustic environment. (Dovey & Fisher, 2014) The following table illustrates the nature of each space and the pedagogical practices that take place in it.

Table 2. typology of learning spaces

Space Type	Description
Traditional Classroom	A traditional enclosed learning space of approximately 40-60 m ² and accommodating 20-30 students. If learning spaces of this size can be fully enclosed with movable walls, these are classed as a classroom.
Learning Commons	A space that is usually larger than 40 m ² , cannot be fully enclosed and Is not the primary connection to any other common spaces or classrooms, i.e. separate from the main traffic flow.
Street Space	An open learning space that is 3 meters or more wide (allows for activities + traffic) and cannot be closed off to form a classroom, as it can be the space from which other educational spaces are accessed.
Meeting Area	A small learning space of less than 40 m ² , accommodating groups of 5 to 20 people. These spaces can hold seminars and other activities but the main difference is that they cannot accommodate the size of a traditional classroom.
Fixed-Function Spaces	These are learning spaces dedicated to specific subjects or disciplines as Art, Science, IT, Computer, Wet area, Music, Drama, and spheres.
Outdoor Learning	Any outdoor space with a horizontal projection is an integral part of a learning community and is usually labelled as outdoor room, or learning courtyard.

Source: Kim Dovey & Kenn Fisher, 2014.

3.4 Aligning different learning activities to spatial configurations

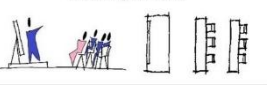
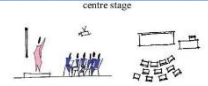
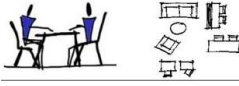
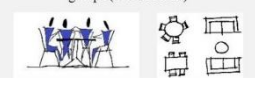
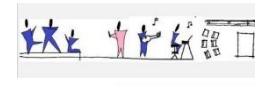
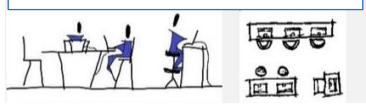
Based on the preceding discussion, it can be concluded that each type of educational activity can take place in one or more types of learning spaces. This depends on some factors such as the number of students, the nature of the educational

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practices, and its spatial requirements. The following table illustrates the suitability of learning spaces for different educational activities.

Table 3. The spatial adaptability required to support different learning practices

Core learning practices	Detailed learning activities			Appropriate spatial configurations
Presentation (25–150 students)	Seminar style instruction 	Student presentation 	Lecture 	- Classroom (up to 30 students). - Common.
Large Interactive (25–75 students)	Interdisciplinary learning 	Peer tutoring 	Story telling 	- Flexible Classroom (up to 30 students). - Common. - Outdoor learning area.
Medium Interactive (10–25 students)	Team collaborative work in mid-size groups 	Performance based learning 	Story telling 	- Flexible Classroom (up to 30 students). - Common. - Outdoor learning area.
Creative Interactive (10–25 students)	Art-based learning 	Naturalist learning 	Hands on-based learning 	- Flexible Classroom. - Fixed-function spaces. - Common. - Street space. - Outdoor learning area.
Small Interactive (2–5 students)	Team collaborative work in small groups 	Social / emotional learning 	Peer tutoring 	- Common. - Street space. - Outdoor learning area. - Meeting space.
Self-Reflection (1 student)	Independent study 	Distance learning 	Technology-based education 	- Common. - Fixed-function spaces. - Street space. - Outdoor learning area.
	One-to-one learning with the teacher 	Research using internet 		

Source: the researchers.

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3.5 New Learning Clusters

Due to the previous typology of learning spaces new learning clusters appeared, which combine multiple learning space types and their interconnections. For a learning cluster to be a complex adaptive one must have three characteristics: complexity, adaptability, and assemblage. To analyze the plans of schools, a methodology was developed for mapping learning clusters illustrating the spatial categories alongside their overlaps, links, and flexibility, in the form of a cluster diagram for the floor plans of schools

After analyzing several floor plans of schools, the learning clusters were narrowed down to five types: Traditional Classroom Cluster, Traditional Classrooms + Street Space Cluster, Convertible Classrooms Cluster, Convertible Street Space Cluster, Dedicated Commons Cluster. (Dovey & Fisher, 2014)

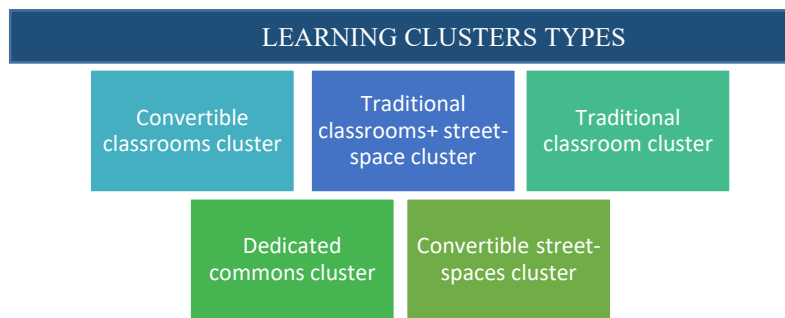


Figure 9: Learning Clusters

Source: the researchers.

The following table illustrates in detail the learning cluster types with examples for each type.

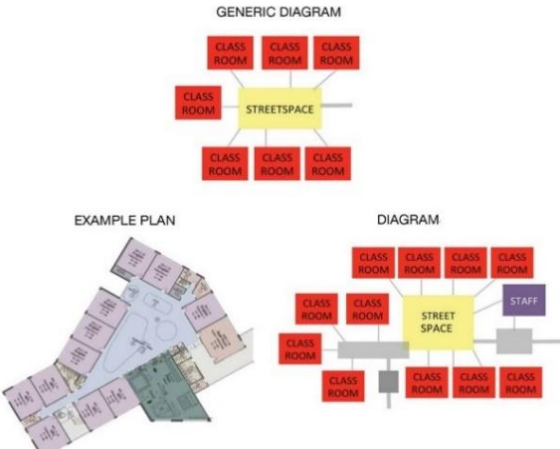
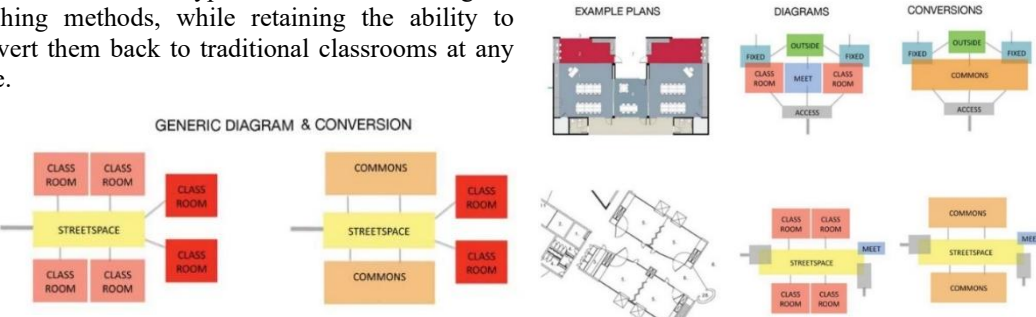
Table 4. The types of learning clusters

Learning cluster type	Description

Key	SPATIAL TYPES الأنواع المكانية				CONNECTIONS روابط (علاقات)
	فراغ مفتوح أو قابل للتحويل لفراغ مفتوح OPEN OR OPENABLE	↔	CLOSED	فراغ مغلق	
	فصل دراسي CLASSROOM		CLASSROOM	فصل دراسي	DOORWAYS مداخل
	مشاع COMMONS				
	ممر STREET				OPENABLE WALLS حوائط قابلة للفتح
	اجتماعات MEET		MEET	اجتماعات	
	ثابت (مخصص) FIXED		FIXED	ثابت (مخصص)	INTERPENETRATING SPACES فراغات متداخلة
	خارجي OUTSIDE				
	منفذ ACCESS				MAIN ENTRY مدخل رئيسي
	هيئة التدريس STAFF		STAFF	هيئة تدريس	

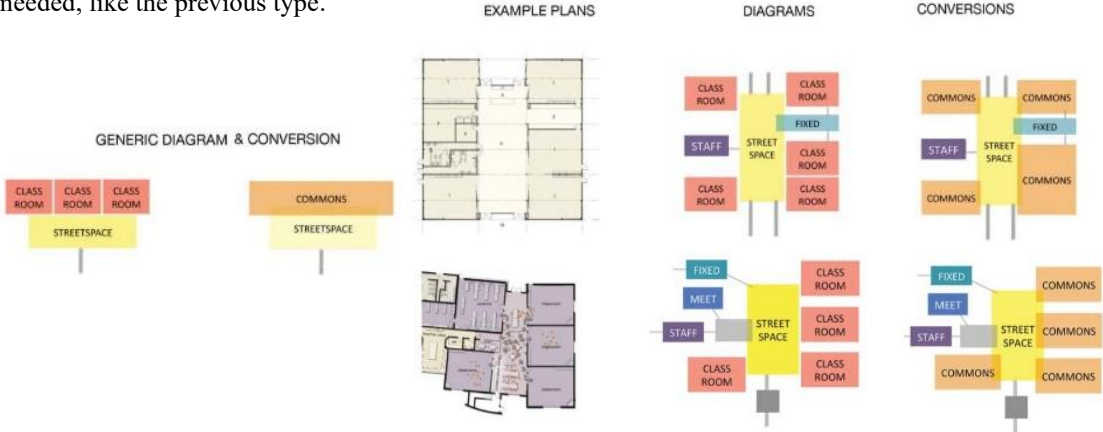
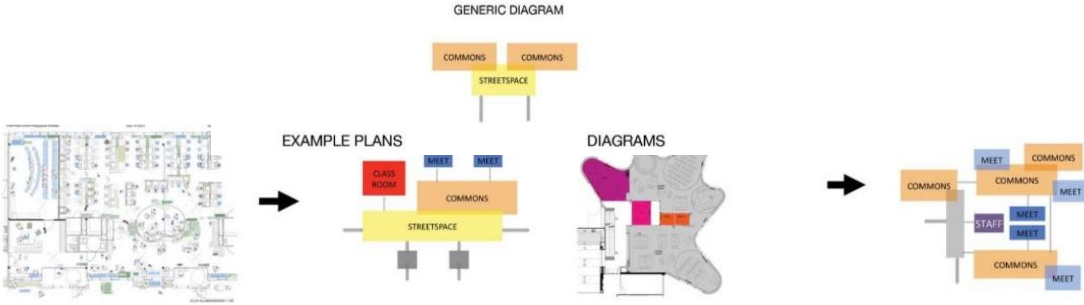
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Traditional classroom cluster	The first type of learning clusters, which are accessed through corridors without any outlet or space directly connected to other teaching spaces, and without the possibility of opening between the classrooms themselves, and in the following figure example for it.  Figure 11: Traditional classroom cluster. Source: Kim Dovey & Kenn Fisher, 2014.
Learning cluster type	Description
Traditional Classrooms + street space Clusters	- The second type is identical to the first, except that the classroom access corridor is expanded to become street space without any other changes. This type is somewhat adaptable by connecting the teaching and learning group through the street space, but without any commons or convertibility. A break-out space is created, an open space where less formal classroom activities or informal activities take place. - This type and the first type are largely traditional in spatial structure.  Figure 12: Traditional classrooms + street space cluster. Source: Kim Dovey & Kenn Fisher, 2014.
Convertible classrooms clusters	These are learning clusters where flexible walls enable two or more classrooms to be converted into a single common. This type allows for a wide range of teaching methods, while retaining the ability to convert them back to traditional classrooms at any time.  Figure 13: convertible classrooms cluster. Source: Kim Dovey & Kenn Fisher, 2014.

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Convertible street spaces clusters	• This type includes plans in which a group of classrooms can be opened onto a street space, as well as to each other to become larger commons, with the possibility of returning to traditional classrooms when needed, like the previous type.  Figure 14: convertible street spaces cluster. Source: Kim Dovey & Kenn Fisher, 2014.
Learning cluster type	Description • This category encompasses a diverse range of open-plan configurations that cannot be transformed into conventional classrooms. Rather than representing a rigid spatial format, it embodies a set of spatial innovations. • In this one, the relationship with traditional pedagogy is intentionally dissolved, and the use of doors is largely forsaken.
Dedicated commons	 Figure 14: Dedicated commons cluster. Source: Kim Dovey & Kenn Fisher, 2014.

Source: the researchers based on Kim Dovey & Kenn Fisher, 2014.

4. Conclusion

In conclusion, modern educational transformations have a profound effect on the design of learning spaces, shifting the focus from passive reception of information to active student-centered learning experiences. The adoption of theories such as Constructivism and Cognitivism has driven the need for more flexible, adaptive environments that encourage creativity, collaboration, and personalized learning. So, the traditional classroom can no longer be considered the only learning space. But, most areas within the school can be effectively utilized as learning spaces, depending on the nature of the educational activities and the needs of the students.

By integrating modern pedagogical principles with the physical design of educational spaces, institutions can better support the diverse learning needs of students and facilitate effective teaching. As technology continues to advance and educational practices evolve, the design of learning environments will need to be continuously re-evaluated and updated to reflect these changes. In light of the ongoing educational reforms, it is essential to prioritize the creation of spaces that not only meet the practical needs of learning but also inspire innovation and engagement in the educational process.

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